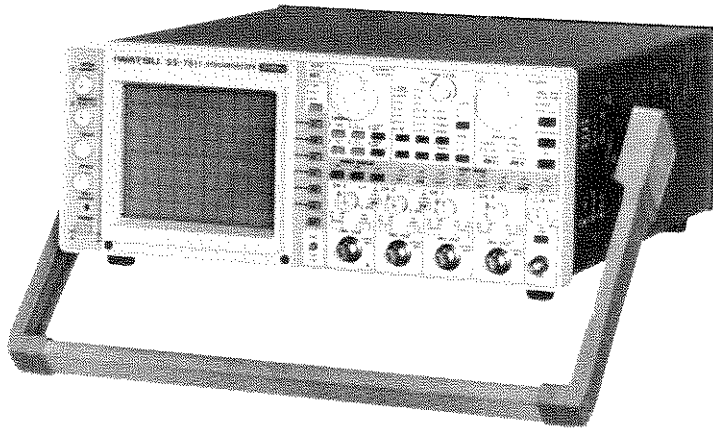


OPERATION MANUAL




OSCILLOSCOPE
SS-7611 (100 MHz)
SS-7607 (60 MHz)


Introduction

Thank you for purchasing the IWATSU product.
Your satisfaction by using the
IWATSU product is our eternal goal.

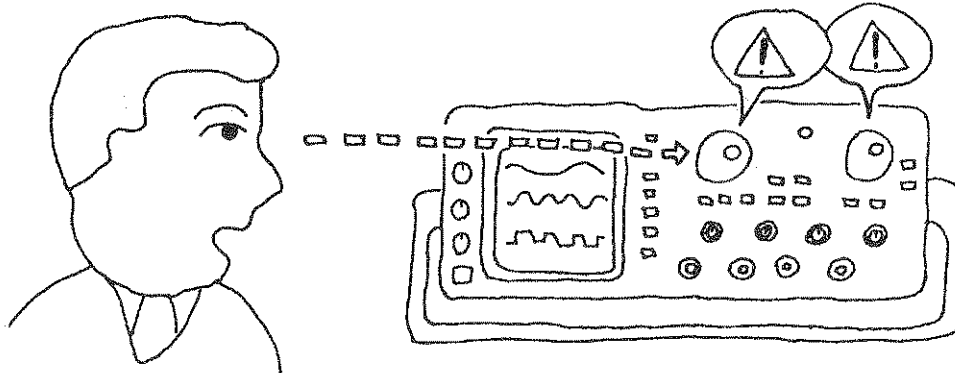
- ◇ In the future, you may not find the manual and the product itself may tell you how to operate.
- ◇ However, today, the product needs the manual for you to learn the operation.
- ◇ This manual is written for the first-time users as well as the experienced users. If you are a first-time user, you will learn easily the full capability of the product step by step.
If you are an experienced user, you will be able to find instantly what you want to know.
- ◇ In order to improve our products, we have been keep listening and we will

Precautions in Handling

- ◇ The  mark on the panel is the caution mark.

In the manual, you will learn the details of the caution at the  mark on the panel.

- ◇ The  mark is used so that the marked knob is to be pushed for the function.

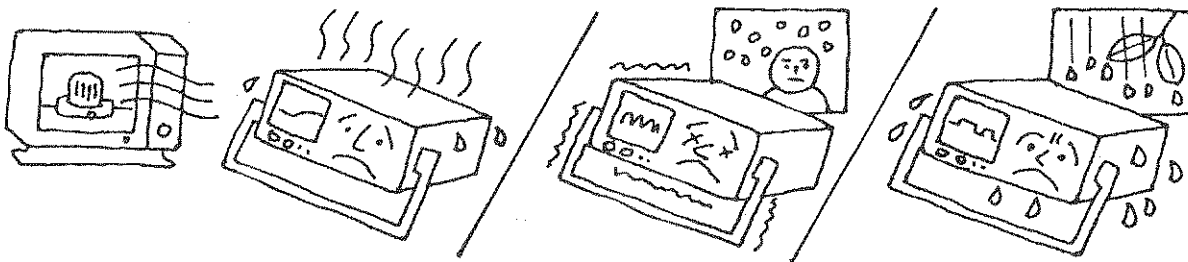


- ◇ Do not use the oscilloscope in the harsh environment.

The environmental characteristics are:

- Operating temperature : -10°C to $+50^{\circ}\text{C}$
- Operating relative humidity : 90%RH at 40°C

- ◇ Avoid using the oscilloscope in the poor ventilation circumstances.



- ◇ Check the line voltage before turning the power on.

- Operational line voltage range : AC 90 V to AC 250 V

- ◇ Use the right power cord which is supplied with the instrument and suitable for your power line.

- Do not use the instrument without ground connection of the power line.

- ◇ Use the fuse only specified.

Location	Rating
Fuse holder on rear panel (See Page 113)	2 A, 250 V slow blow

Disconnect the power plug from the power outlet before replacing the fuse.

Precautions in Handling

- ◇ Never apply an excessive voltage into the inputs.

Input	Maximum input voltage
CH1, CH2, CH3, CH4	± 400 V (DC + AC peak) without probe ± 600 V (DC + AC peak) with SS-080R probe $\pm 1,000$ V (DC + AC peak) with SS-081R probe
Z AXIS	± 30 V (DC + AC peak)

- ◇ Call your dealer when the internal battery has been drained, since the battery is not commercially available.

With the drained battery, the instrument still functions, and you will only lose the real time clock and the data in the setup memories at turning the power off.

- ◇ Start measuring after 30 minutes of warm-up time.

The specifications are assured after 30 minutes of warm-up time.

- ◇ Use the appropriate cleaner.

Clean the covers and panels gently with soft cloths dipped in the water or the mild detergent. Using the prohibited cleaner in the list may change the coloring or cause the unexpected damage.

Recommended cleaner	Prohibited cleaner
Water, mild detergent	Acetone, gasoline, ether, alcohol, lacquer, thinner, methyl-ethyl-ketone, detergent containing ketone



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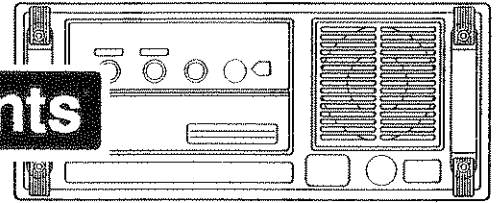
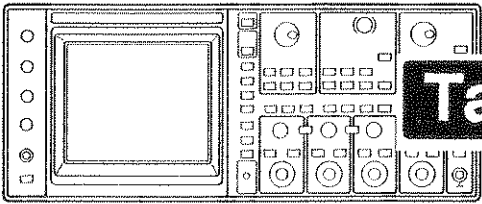
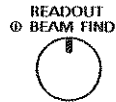


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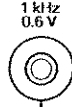



















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

















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Background of the Oscilloscope

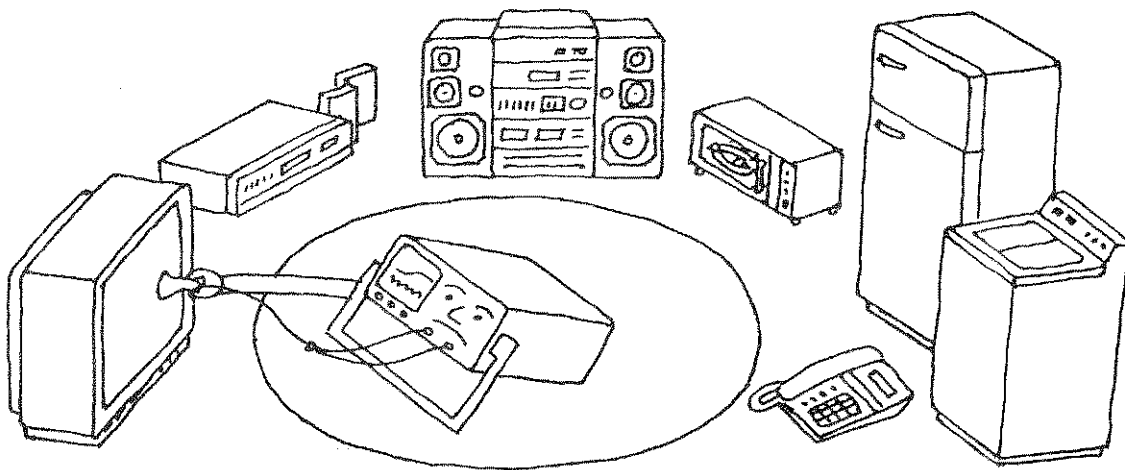
Old days :

- ◆ There may be some engineers who would be surprised to hear the oscilloscope, which is today normally used, was a teaching tool developed by Dr. Braun to show students the electric current waveform. Before that, he had invented the cathode-ray tube in 1897 as well.
- ◆ The first commercial CRT oscilloscope was introduced to the world by a U.S.A. manufacturer in 1946.
- ◆ In Japan, it was the then-president of Iwatsu who found the triggering oscilloscope of today's de facto standard in his trip to the U.S.A. in early fifties, and recognized quickly its capability, and started developing the oscilloscope as soon as he returned to Japan. From Iwatsu, the first Japanese oscilloscope was delivered in 1954.
- ◆ The oscilloscope has been improved its performance and functions towards higher-speed, more sophistication and digitization. The oscilloscope has been widened its product line including storage oscilloscope, sampling oscilloscope, and digital storage oscilloscope. These improvements have contributed greatly to the world's electronic technology development, and have been due to the large scale integration of the components as well as the circuit technology development.

Now today:

The oscilloscope is an important mother tool in many industries including the electronic industry firstly.

- ◆ As familiar examples of its applications, the oscilloscope is often used as the development and repair tools for TV, VCR, stereo, microwave oven, communication equipment, and electric washing machine. Further more, many measurements for the material and chemical analysis, biological research, and the structural analysis of the building depend on the oscilloscope performance.



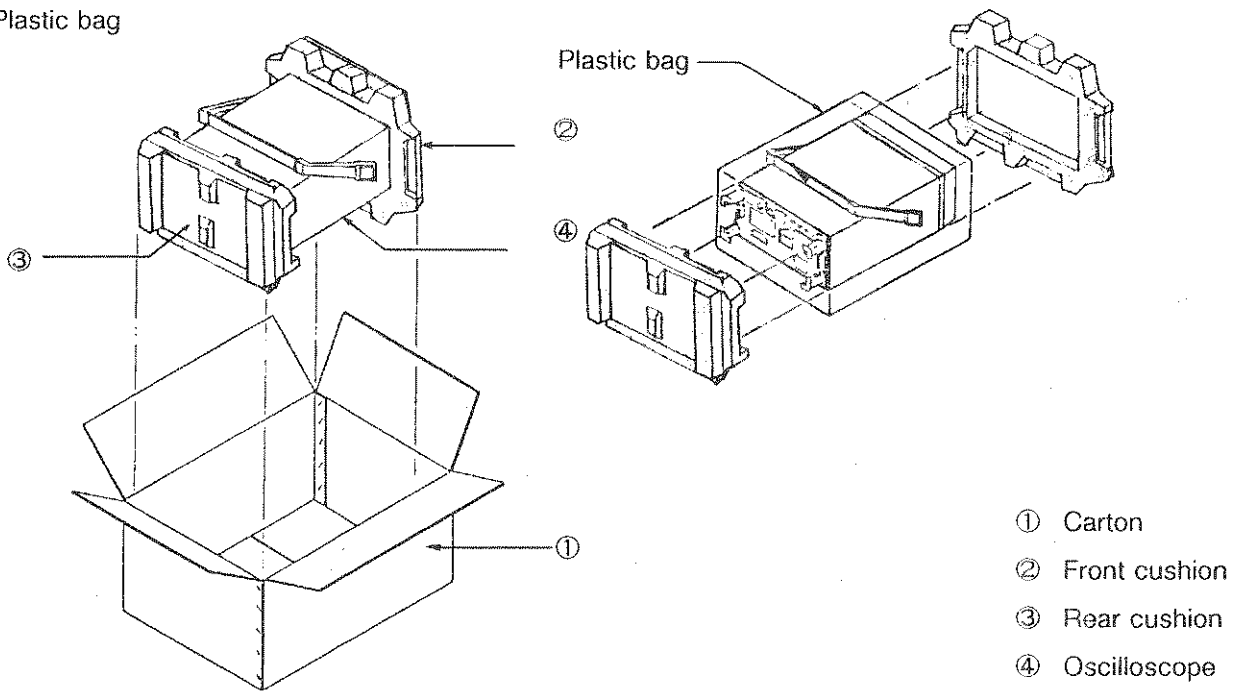
- ◆ Not only the electric signal but sound, light, chemical change and mechanical movement are measured by the oscilloscope with the transducer, which converts energy from one form to the electric energy.

Accessories and Packing

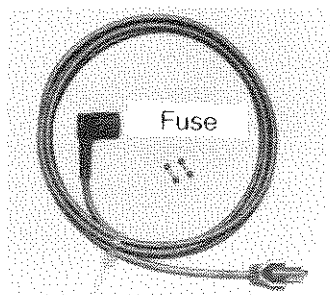
◆ Packing List

Open the carton and carefully unpack the oscilloscope and accessories.

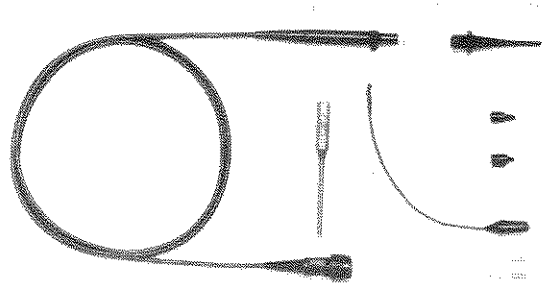
- Plastic bag



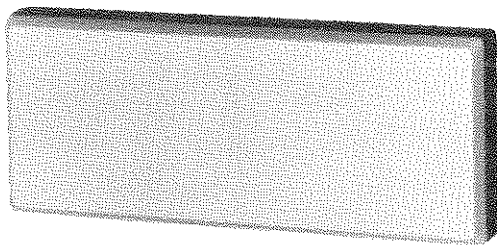
◆ Accessories



Power cord



Probe



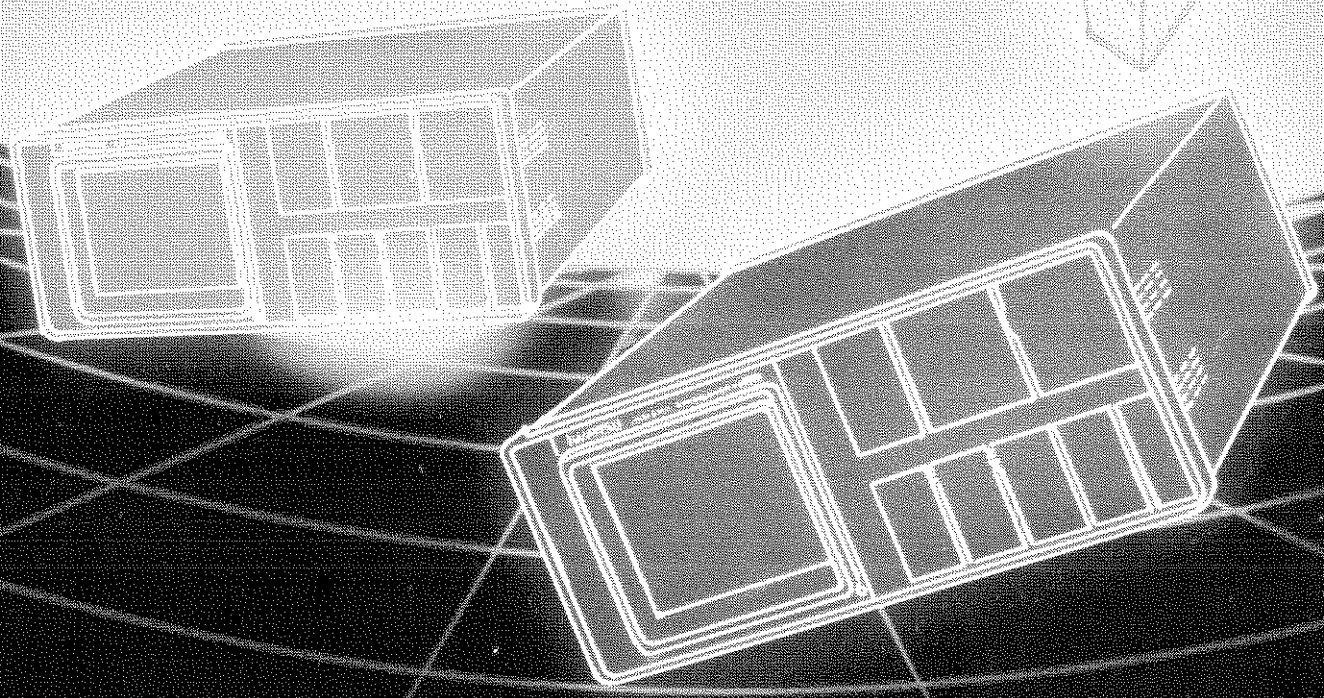
Panel cover

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Accessory list	1	Probe	2
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1

2 3 4 5 6 7

Getting to Know This Manual



MEMO

1

Getting to Know This Manual

The introduction and operation manuals cover the followings.

If you are a first-time user, start from the beginning in the following list.

Before use

"Precautions in Handling" (page IV) describes what to do and what not to do.

"Accessories and Packing" (page 2) describes all your items for your initial inspection.

For a first-time user

SS-7611/SS-7607 Introduction manual describes how to display the CAL signal.

Basic operation

"Basic Operations" (page 9) describes the primary information for the operations.

Learning operations

"Functions and Operations" (page 15) describes how to use the oscilloscope from the beginning step by step.

"Applications" (page 83) describes the important measurement methods of the oscilloscope.

Maintenance

"Daily check" (page 91) describes how to keep the oscilloscope in good conditions over the long period.

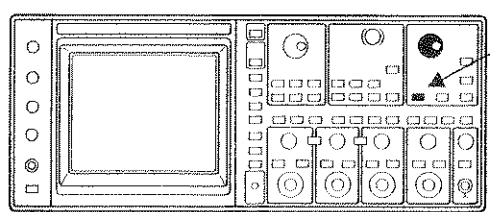
Getting to Know This Manual

◆ Each function and operation is described in the following order:

- Purpose : is the outlines what you obtain from the operation.
- Warning : describes what may cause some hazard, accordingly prevents any accident.
- Caution : describes what you must or must not do, accordingly prevents any instrument damage.
- Preliminary setup : describes necessary signal connections and other setup before start.
- Key operation : describes key operation sequence.
- Operating procedure : describes the details of the operation.
- One point advice : describes some useful tips to know.

◆ Notations and Conventions





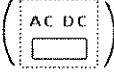




This manual uses the following notations and conventions.




◇ Panel illustration

The panel illustration in the top and right of the each page shows the locations of the keys used for the operation as the painted keys.

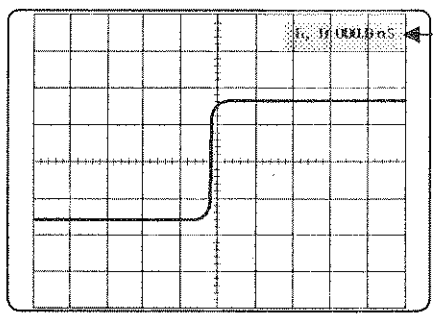
◇ Key notations


-   is used to indicate the actual key or switch.
-  is used to indicate the actual knob.
-  /  is used to indicate the bistable key. Pressing the key shifts to the another state. The key notation in the parentheses may be omitted.
-  ,  is used to indicate all the necessary keys for the operation. You can push the keys in any order and may need to push the key several times.
-  →  is used to indicate the key operation sequence.

◆ Notations in the operation procedure

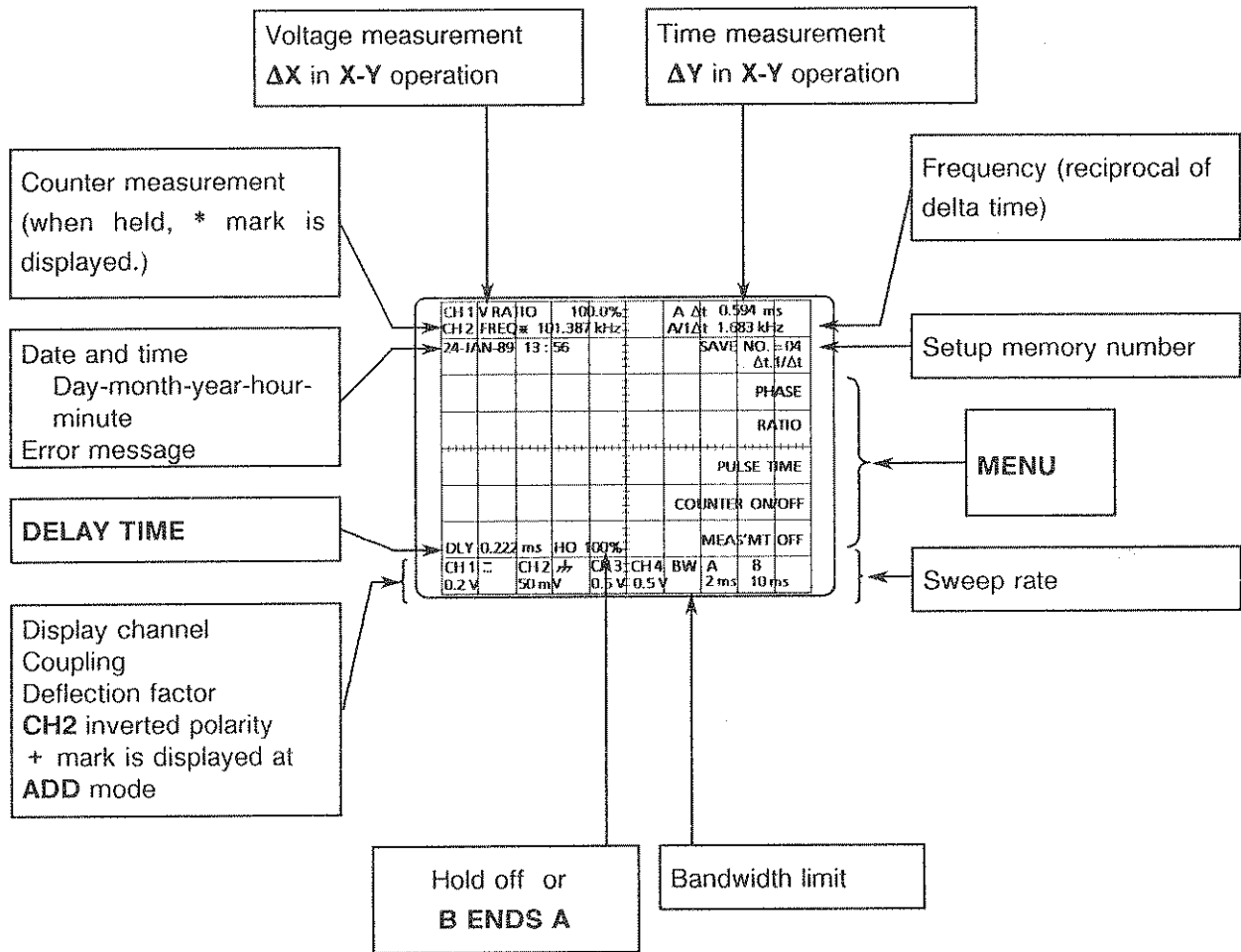
- ①, ②, ③ ... is used to indicate the operation procedure.
- SWEEP is used to indicate the function to be selected.
-  connects the description and the illustration.

◆ Marks in the screen display illustration



The ← and  marks are used to indicate the functions or operations selected. Certainly these marks are not shown on the actual screen.

Viewing Area and Messages on the Screen



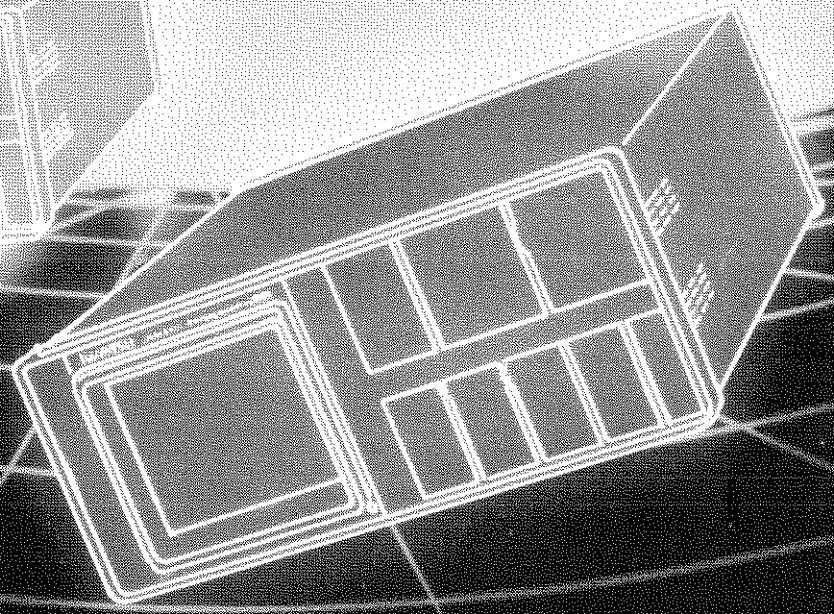
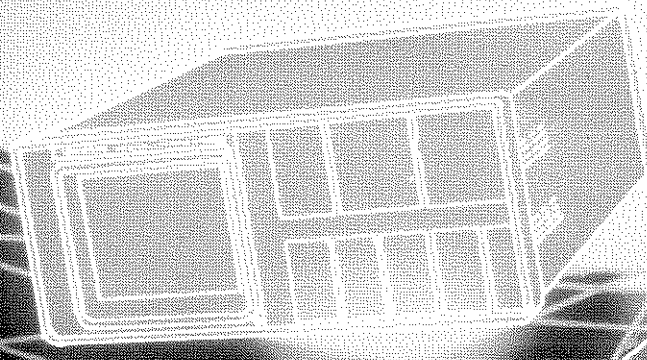


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1 3 4 5 6 7

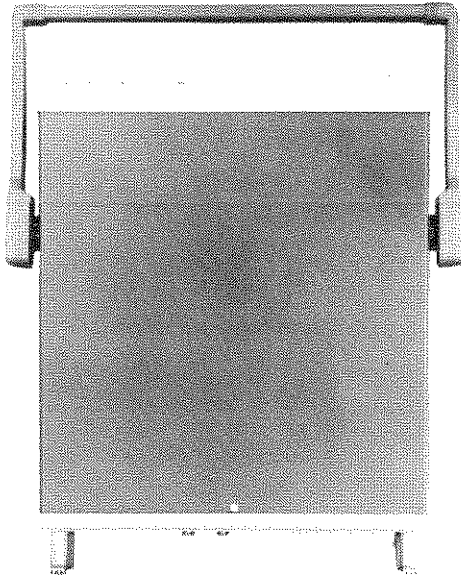
Basic Operation



Using the Handle

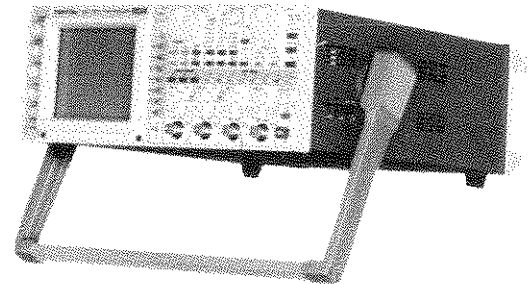
◆ Setting the handle position

2



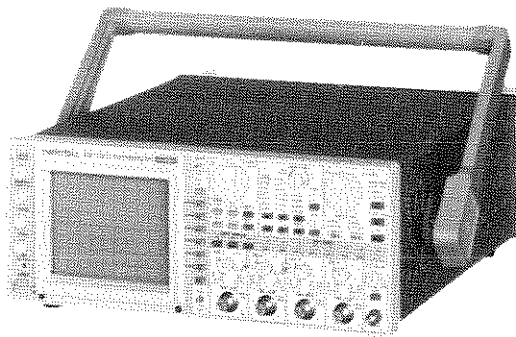
The handle is used as a carrying handle and as a stand. Pressing the both bases (rotating joints) of the handle simultaneously inward will release the lock. Rotate the handle while pressing to obtain the desired position. When you take your hands off of the rotating joints, the handle is automatically locked.

Set the handle position to the right angle so that you can easily observe signals on the screen.



Propped up condition

◆ Leaving unused



When you leave the oscilloscope unused, you had better set the handle position to the upper deep position.

2. BASIC OPERATIONS

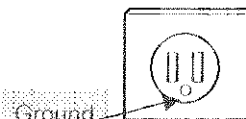
Turning the Power On and Off

WARNING

- ◆ Follow the next rules for the safety operation when connecting the power cord.

Check the line voltage and use the proper power cord suiting to the line voltage.
Never use the wrong power cord.

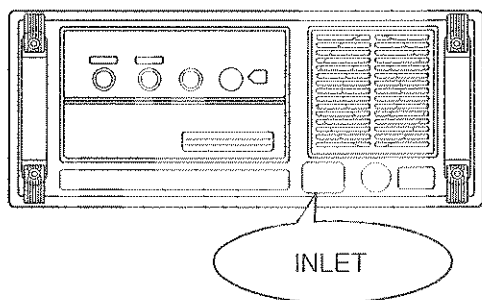
Three core type source
AC100V



- ◆ Turning the power on



Names on rear panel



- ① Push out the power switch and turn the power off position



- ② Insert the power cord plug into the oscilloscope inlet.

- ③ Insert the power cord plug into the outlet in the wall.

- ④ Push the power switch and turn the power on position

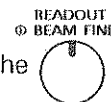


- In a short time, the trace and/or the character readouts are displayed.

If not, turn the



knob and/or the



clockwise.

(These knobs are set fully counterclockwise at the factory shipment.)

- ◆ Turning the power off

No special procedure is required for turning the power off.

- ⑤ Start the measurement.

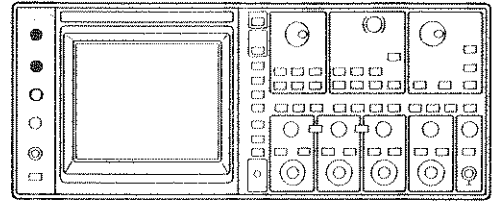
One point advice



- The last setup before the power off is backed up by the internal fixed lithium battery. When the oscilloscope is turned on, the last setup before the power off is recalled.

Adjusting the Display

**INTEN
ENHANCE
READOUT
BEAM FIND**



To obtain the best measurement circumstances, adjust the display before starting the measurement.

CAUTION

Do not increase the CRT intensity too highly. Highly increased intensity may result in eye irritation. When the instrument is left under high intensity condition for a long time, this may burn the phosphor on the CRT face plate.

◆ Intensity of the trace

- **INTEN**

Rotating the **INTEN** control clockwise increases the trace intensity.



- **ENHANCE**

Pushing the **INTEN** control increases the intensity further. The **ENHANCE** mode is available at the sweep rate between 20nS/div and 2mS/div on the both of the A and B time base.

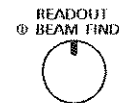
◆ Intensity of the character readout

- **READOUT**

Rotating the **READOUT** control clockwise increases the character readout intensity.

- **BEAM FIND**

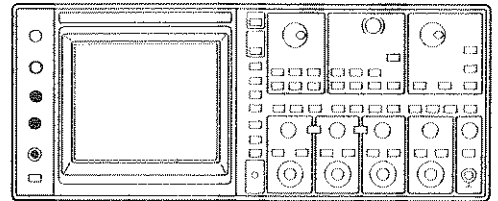
Pushing the **READOUT** control locates the trace position.



When you cannot find the trace by **BEAM FIND** function, turn the **INTEN** control clockwise and increase the intensity.

Adjusting the Display

FOCUS
SCALE
TRACE ROTATION



◆ Focus of the trace and character readout

- FOCUS



Adjust the **FOCUS** control to optimize the trace and character readout display.

◆ SCALE illumination

- SCALE (SCALE ILLUMINATION)



At the case such as taking a picture, adjust the **SCALE** illumination to optimize the contrast between the display and scale.

◆ Display alignment

- TRACE ROTATION



The earth magnetism may cause the display tilted.

Using the small screw driver, adjust the **TRACE ROTATION** control to align the tilted display.

2. BASIC OPERATIONS

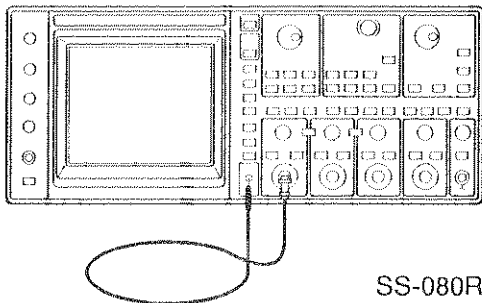
Displaying the CAL waveform

(The CAL signal is used for the vertical sensitivity and sweep rate calibration and probe phase compensation.)

Displaying the signal on the screen is the first step for the oscilloscope users. For a first time user, the following steps describe how to display the signal on the screen.

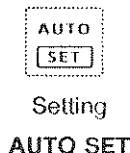
2

◆ Preliminary setup



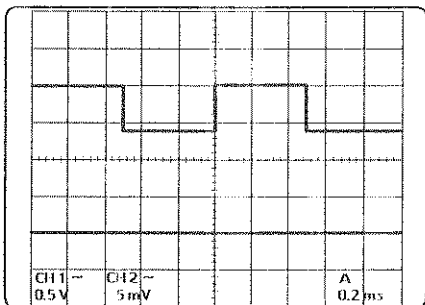
Using the accessory probe (SS-080R), apply the CAL signal into the CH1 input.


◆ Key operation



Setting
AUTO SET

◆ Operating procedure



① Press the  key.

- The setups are automatically selected to display the appropriate size of the waveform such as:

CH1 CAL signal

Amplitude : 1.2 division at 0.5V/div attenuator range

Cycle : about 2 cycles at 0.2ms/div sweep rate

Automatic setup conditions

Function	Selection made
Vertical system	
VERT MODE	Dual trace of CH1 and CH2
CH2 INV	OFF
20MHz BW	OFF
VOLT/DIV	1 to 4 div screen amplitude
UNCAL	OFF
COUPLING	AC
X5 MAG	OFF

Function	Selection made
Horizontal system	
HORIZ DISPLAY	A
A SEC/DIV	1 to 4 cycles of the signal
X10 MAG	OFF
Triggering	
A TRIG SOURCE	CH1 or CH2, whichever lower frequency
A TRIG COUPLING	AC
A TRIG SLOPE	+
A TRIG LEVEL	Optimum level

One point advice



- The **AUTO SET** function has no effect to the menu measurement conditions.
- When the **AUTO SET** function is selected, the oscilloscope is set to the appropriate setups after the input signal amplitude and frequency are checked. No **AUTO SET** function is available for the CH3 and CH4 inputs.

3

12 4 5 6 7

Functions and Operation

◆ Summary

The functions and operations are described in detail in this section.

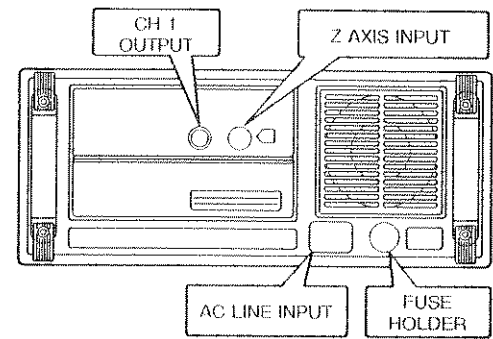
◆ Test signal used in this section

Unless specified, CAL (calibration) signal is used for the test signal.

To apply the CAL signal, see "2. BASIC OPERATIONS Displaying the CAL waveform."

3.1 Inputting and Outputting the Signal

INPUT and OUTPUT (on the rear panel)



◆ AC LINE INPUT

Provides inlet connector for the power cord.

◆ FUSE HOLDER

Set the fuse for the instrument safety.

Use the 2A/250V slow-blow fuse only as specified.

◆ Z AXIS INPUT

A connector for the external intensity modulation. Positive going signal decreases the intensity and the negative going signal increases the intensity.

Maximum input voltage : $\pm 30\text{V}(\text{DC} + \text{ACpeak})$

Minimum modulation voltage : 0.5Vp-p

Frequency range : DC to 5MHz

Input impedance : 4.6 K Ω approx.

◆ CH1 OUTPUT

An output connector for the signal applied into CH1 INPUT connector on the front panel.

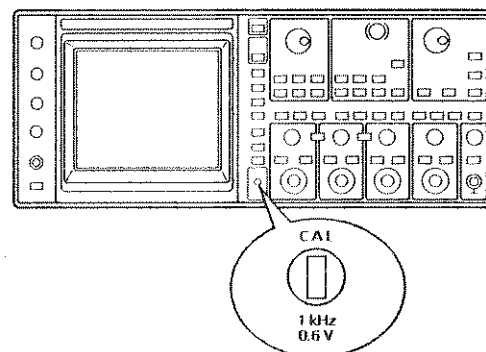
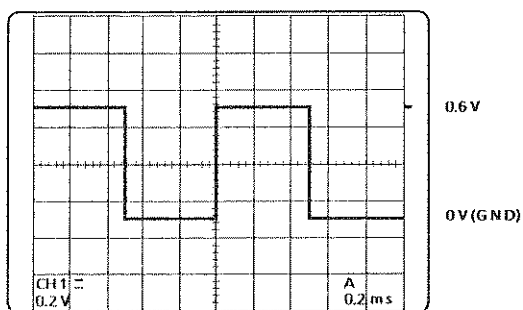
	Output voltage (at 50 Ω load)	Bandwidth (-3db)	Output R
SS - 7611	20mV / div $\pm 20\%$	50MHz	50 $\Omega \pm 20\%$
SS - 7607	20mV / div $\pm 20\%$	30MHz	50 $\Omega \pm 20\%$

3.2 Simple accuracy checking

CAL 1kHz 0.6V

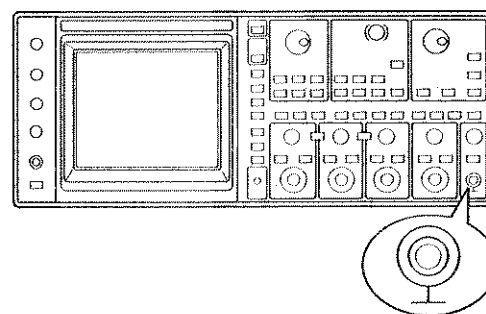
The CAL signal output is used for the simple accuracy checking and calibration for the vertical sensitivity and the horizontal sweep rate. The CAL signal output is used for the probe phase compensation as well.

◆ CAL (Calibration signal)



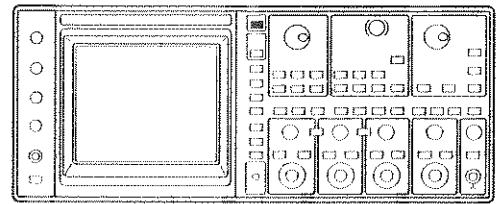
3.3 Grounding

Measuring ground terminal connects the ground between the oscilloscope and the signal source under test.



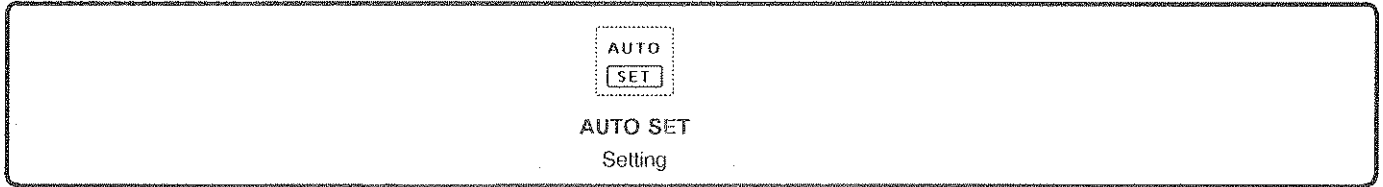
3.4 AUTO SET

AUTO SET




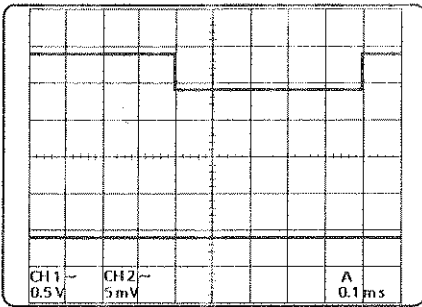
Allows you to display the waveform on the screen automatically in the appropriate conditions.

◆ Key operation



◆ Operating procedure

- ① Press the  key and activate the **AUTO SET** function.



◇ Vertical system

Function	Selection made
VERT MODE	Dual trace of CH1 and CH2
CH 2 INV	OFF
20MHz BW	OFF
VOLTS/DIV	1 to 4 div screen amplitude
UNCAL	OFF
COUPLING	AC
X5 MAG	CH1 CH2 OFF
GND	OFF

◇ Horizontal system

Function	Selection made
HORIZ DISPLAY	A
A SEC/DIV	1 to 4 cycles of the signal
X10 MAG	OFF
FINE	OFF

◇ Triggering

Function	Selection made
A TRIG SOURCE	CH1 or CH2 of lower input frequency
A TRIG COUPLING	AC
A TRIG SLOPE	+
A TRIG LEVEL	Optimum level

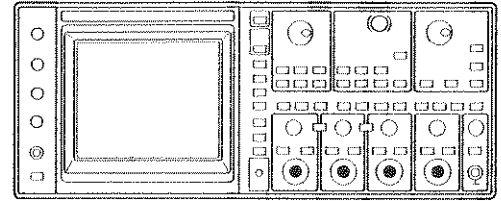
One point advice



- No auto setup is available for the **CH3** and **CH4** inputs.
- For positioning waveform after **AUTO SET**, see “3.7 Positioning the Signal”. (Page 21)

3.5 Inputting the Signal

INPUT



Receives the signal. Use the standard probe or the coaxial cable for applying the signal.

Caution

Never apply an excessive voltage into the inputs.

Input	Maximum input voltage
CH1, CH2, CH3, CH4	± 400 (DC + acpeak) without probe ± 600 (DC + acpeak) with SS-080R probe ± 1000 (DC + acpeak) with SS-081R probe

3

◆ Connecting the probe

- The attenuation factors displayed on the screen for the each channel are automatically corrected by using the standard probe SS-080R or the optional SS-081R.

One point advice



◆ Grounding

- Connect the oscilloscope ground and the device ground under test.
- Connect the signal ground as short as possible with the probe ground.

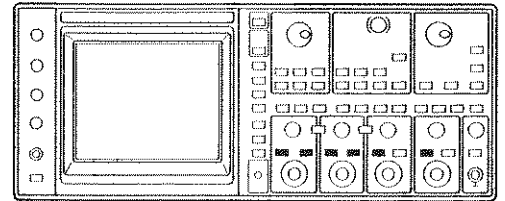
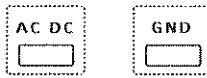
◆ Loading effect

For the accurate measurement, it is important to minimize the loading effect. Using the standard probe SS-080R is generally the best solution for this.

Input RC without probe: $1\text{M}\Omega 25\text{pF} \pm 2\text{pF}$
Input RC with probe: $10\text{M}\Omega 14.5\text{pF}$ approx.

3.6 Coupling the Signal

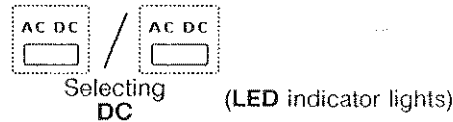
DC-AC-GND



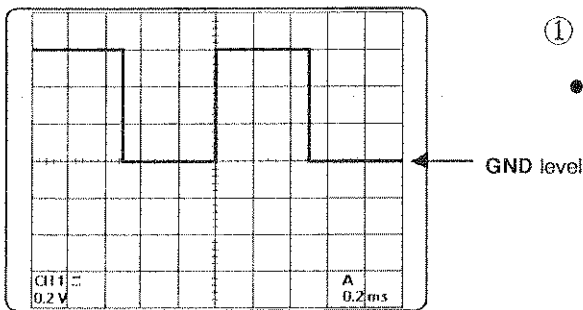
Couples the input signal. In many cases, the **DC** coupling is the best choice, since the **DC** coupling eliminates no signal component. When you measure a small signal amplitude having a large **DC** offset, use the **AC** coupling to eliminate the **DC** level. You will obtain the ground reference level by using the **GND** coupling.


DC coupling CH1, CH2, CH3, CH4

◆ Key operation



◆ Operating procedure

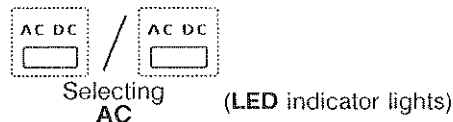


① Press the  key and select the **DC** coupling.

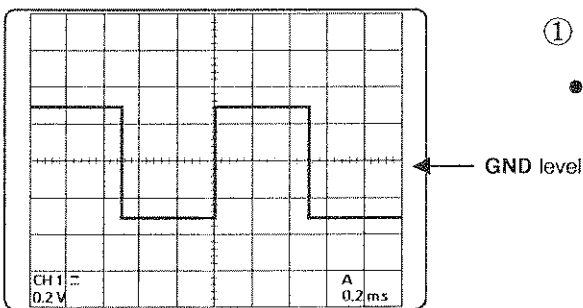
- The **CAL** signal on the screen is displayed above the ground level.


AC coupling CH1, CH2, CH3, CH4

◆ Key operation



◆ Operating procedure

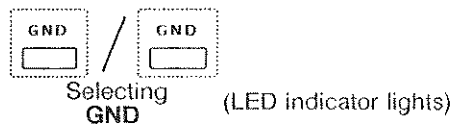


① Press the  key and select the **AC** coupling.


- The **CAL** signal on the screen is displayed symmetrically over the ground level.

GND coupling CH1, CH2

◆ Key operation



◆ Operating procedure

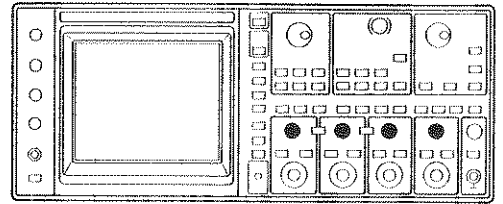
① Press the  key and select the **GND** coupling.

- The **GND** coupling shows the ground reference level on the screen. Knowing the ground level, you can measure the **DC** offset level of the signal.

3

3.7 Positioning the Signal

POSITION



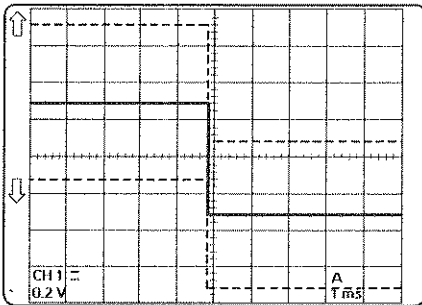
Moves the signal up and down on the screen to obtain the desired waveform position.


◆ Key operation



Positioning
Signal





◆ Operating procedure



- ① Using the  knob, position the signal.

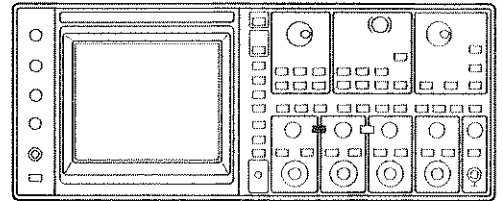
One point advice



- When you activate the **AUTO SETUP** function by pressing the **AUTO SETUP** key, you may not move the signal in some range of the  control knob. In this case, rotate the  control knob further until it will be in action again.
- Pushing the  knob of the **CH1** or the **CH2** increases the vertical sensitivity five times, and the **LED** indicator lights. Pushing the  knob again turns to the normal sensitivity.

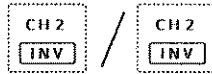
3.8 Inverting the signal

CH2 INV



Inverts the CH2 signal polarity to the negative polarity. When you use the CH2 INV polarity in conjunction with ADD vertical mode of the CH1, the differential signal between CH1 and CH2 is displayed on the screen.

◆ Key operation

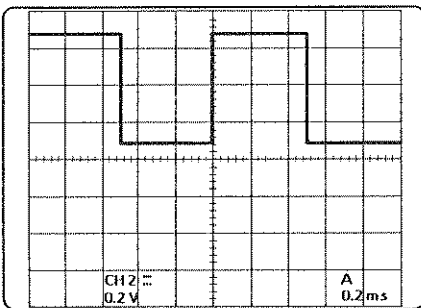


Selecting Polarity
(LED indicator lights at INV mode)

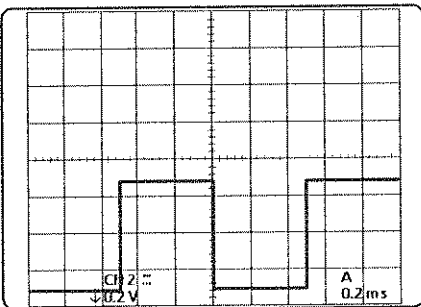
3


◆ Operating procedure

CH2 normal display



CH2 inverted display



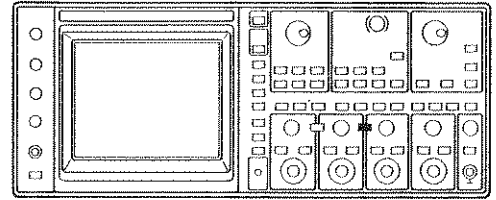
- ① Press the  key and the signal display is inverted against the center horizontal screen.

The LED indicator lights and the message on the screen is displayed at the INV mode.

- No trigger polarity changes at the CH2 INV or normal polarity.
- The "↓" mark alongside the CH2 sensitivity shows the CH2 signal is inverted.

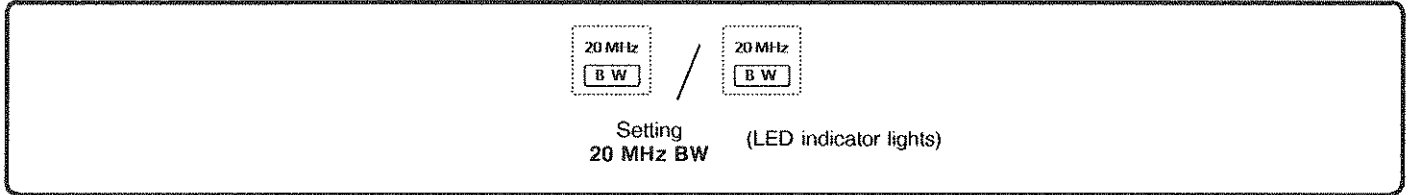
3.9 Limiting the Bandwidth

20MHz BW




Limits the bandwidth to the 20MHz and reduces the high frequency noise accordingly.

◆ Key operation



◆ Operating procedure

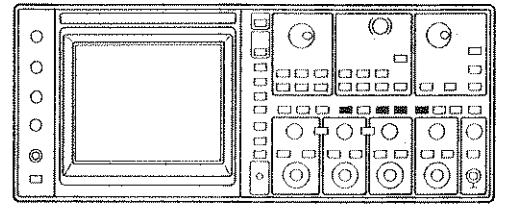
- ① Press the  key and set the 20MHz BW mode.
 - The bandwidth is limited to the 20MHz.



3.10 Selecting the signal VERT MODE

**CH1-CH2-
CH3-CH4**

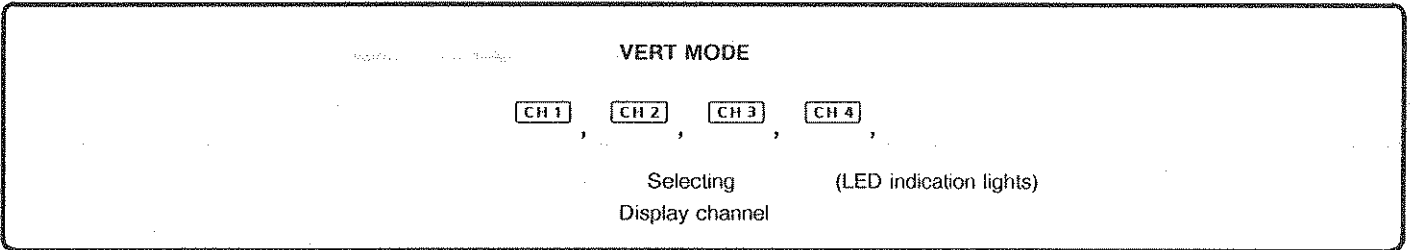
CH 1 CH 2 CH 3 CH 4



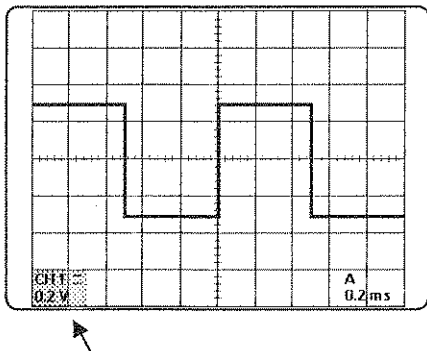
Selects the signal channel to be displayed.

◆ Key operation

3



◆ Operating procedure



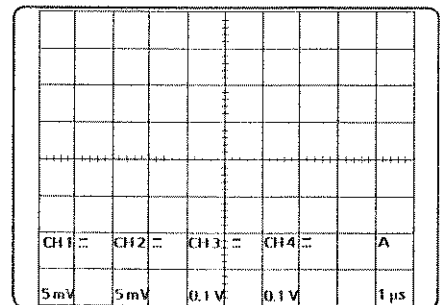
① Press the appropriate key to display the desired channel.

- The active channel is indicated by the lit LED indicator.
Pressing the each key again turns the specified channel off.

One point advice



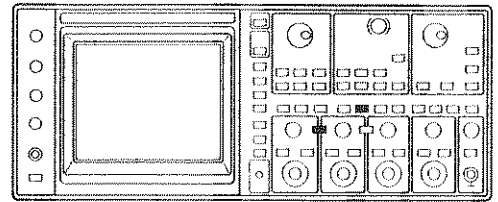
- The selected channel are shown by the channel number displayed at the bottom of the screen.
At least one trace is always displayed on the screen.



3.10 Selecting the signal VERT MODE

ADD

ADD

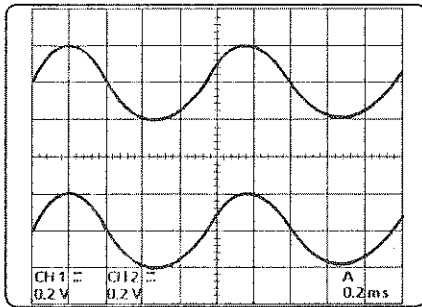
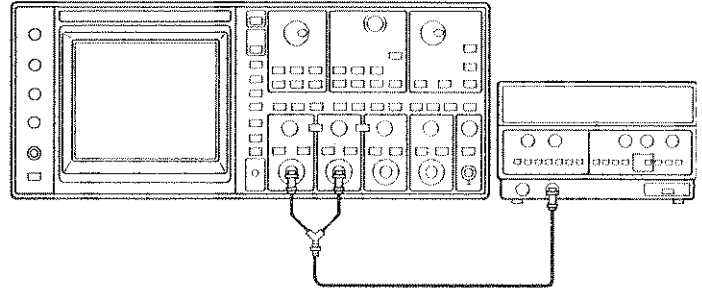


Displays the algebraic added or subtracted signal between the CH1 and CH2 signals.

◆ Preliminary setup

Apply the signal from the generator (e.g. Iwatsu SG-4111) to the CH1 and CH2 inputs.

- Signal frequency : 1kHz
- amplitude : 0.4V_{P-P}



◆ Key operation

VERT MODE

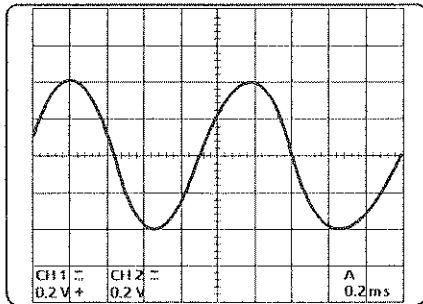
ADD

Selecting (LED indicator lights)

ADD

◆ Operating procedure

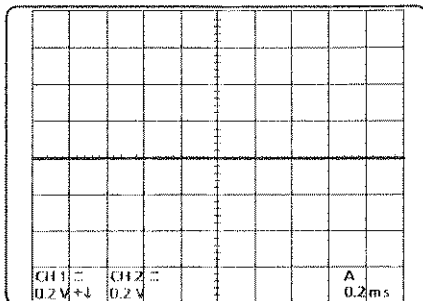
ADD : Sum display with the CH2 INV off



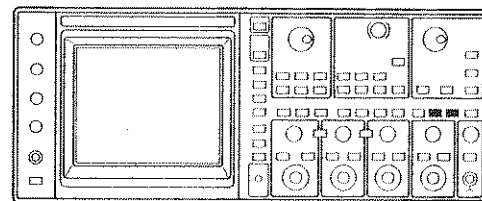
① Press the ADD key and select the ADD mode.

- The added signal is displayed on the screen.
- When you press the CH2 CH2 INV key, you can make the differential measurement at the ADD mode.

ADD, CH2 INV : Differential display with the CH2 INV on



3.10 Selecting the Signal VERT MODE



ALT-CHOP

ALT CHOP

Selects how to display the multi-channel signals on the screen.

◆ Preliminary setup

Set the oscilloscope to the multi-channel display mode by pressing the **VERT MODE** key whose channel you want to display.

ALT display mode

◆ Key operation

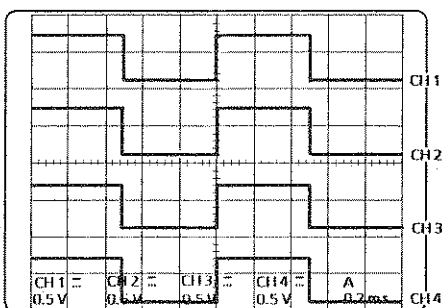
3

VERT MODE

ALT

Selecting (LED indicator lights)
ALT

◆ Operating procedure



- ① Press the **ALT** key and select the **ALT** display mode.

CHOP display mode

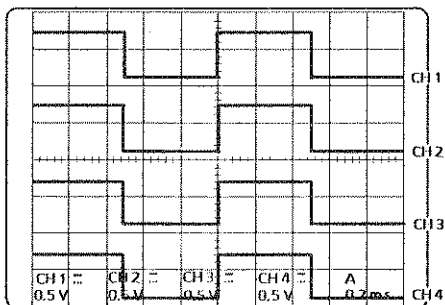
◆ Key operation

VERT MODE

CHOP

Selecting (LED indicator lights)
CHOP

◆ Operating procedure



- ① Press the **CHOP** key and select the **CHOP** display mode.

One point advice

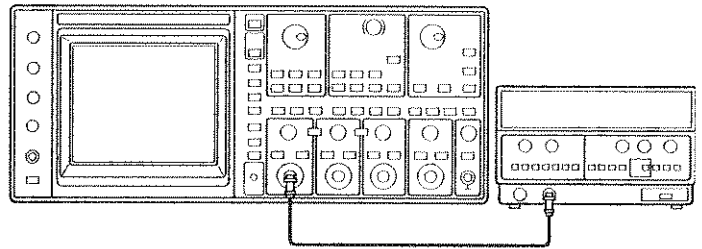
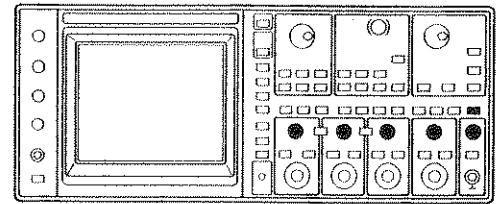


- The **CHOP** multi-display mode is advantageous for displaying the slow speed signal.

3.10 Selecting the Signal VERT MODE

X-Y

X-Y



Allows you to display the signal in the X-Y format. The X-Y display mode is useful to display the Lissajous pattern or voltage-current curve of the semiconductor characteristic.

◆ Preliminary setup

Apply the sine wave signal from the generator (e.g. Iwatsu SG-4111) to the CH1(X) and CH2(Y) inputs.

- Signal frequency : 1kHz
- amplitude : 3Vp-p

◆ Key operation

VERT MODE

X-Y

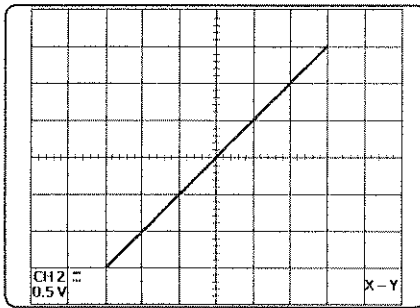
Selecting (LED indicator lights)

X-Y

◆ Operating procedure

① Press the X-Y key and select the X-Y display mode.

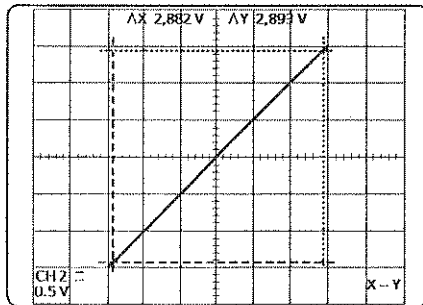
The controls for the X-Y mode is:



Sensitivity : 0.5V/div
Input signal : Sine wave

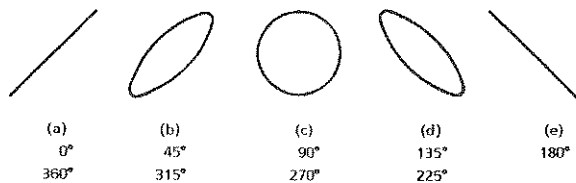
	X axis	Y axis
Input	CH1	CH1, 2, 3, 4, ADD
Deflection factor	CH1 VOLTS/DIV CH1	CH1 VOLTS/DIV CH1 CH4 0.1V 0.5V CH2 VOLTS/DIV CH2 ADD VOLTS/DIV CH1 CH3 0.1V 0.5V CH2
Position	↔ ○	CH1 CH3 CH2 CH4 ↑↓ ○

One point advice



- The cursor voltage measurements for X and Y axes are available in the X-Y mode as well.
- Different waveform with same frequency

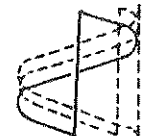
● Examples of the Lissajous pattern



(a) Sine vs. triangle waveform



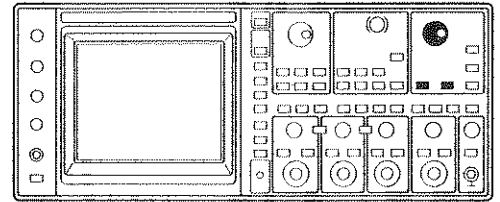
(b) Sine vs. square waveform



(c) Sine vs. ramp waveform

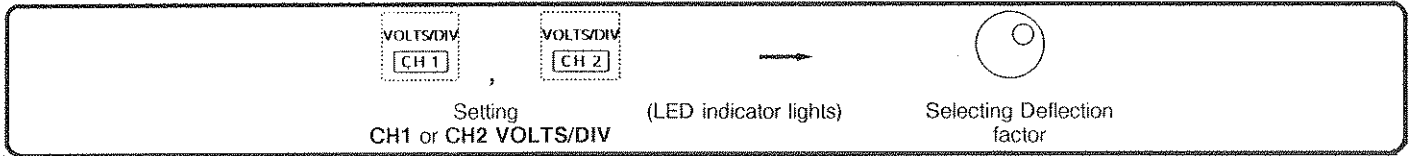
3.11 Changing the Signal Amplitude CH1 CH2

VOLTS/DIV UNCAL



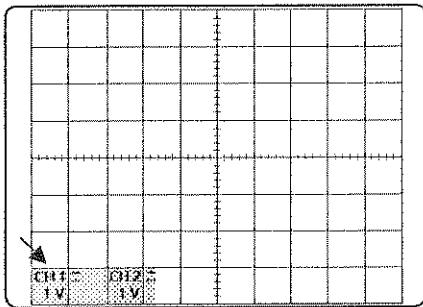
Changes the signal amplitude to obtain the appropriate size. The deflection factor is displayed on the screen. You can change the amplitude continuously by using the variable function (**UNCAL**).

◆ Key operation



3

◆ Operating procedure



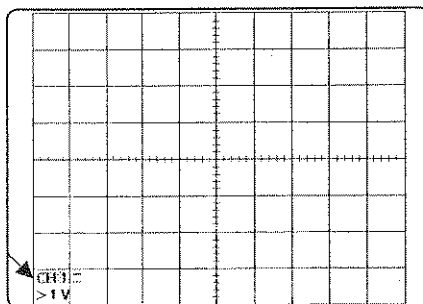
◇ VOLTS/DIV

- ① Press the **VOLTS/DIV CH1** key or the **VOLTS/DIV CH2** key and set the **CH1** or the **CH2 VOLTS/DIV**.
 - The selected **LED** indicator lights.
- ② Using the **RANGE** knob, select the deflection factor.

◇ UNCAL (variable function)

- ① Pressing the **VOLTS/DIV CH1** key or the **VOLTS/DIV CH2** key sets the variable function.
 - The **UNCAL LED** indicator lights.
- ② Using the **RANGE** knob, changes the amplitude continuously.
- ③ Pushing the **RANGE** knob sets the amplitude change by step for coarse adjustment.
 - Counterclockwise turn of the **RANGE** knob before pushing sets the step variable for amplitude reduction, and the clockwise turn sets the amplitude increase step variable.
 - The maximum variable range is 2.5 times or more of the deflection factor.

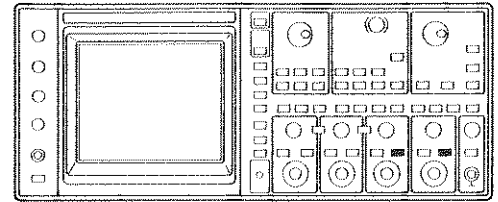
One point advice



- In the **UNCAL** mode, the ">" mark is displayed on the screen alongside the deflection factor.
- Pressing the **VOLTS/DIV CH1** key or the **VOLTS/DIV CH2** key in the **UNCAL** mode, release the **UNCAL** mode.
- Setting the **UNCAL** mode, the signal amplitude is changed by the variable ratio set at last time.


3.11 Changing the Signal Amplitude CH3 CH4

0.1V 0.5V



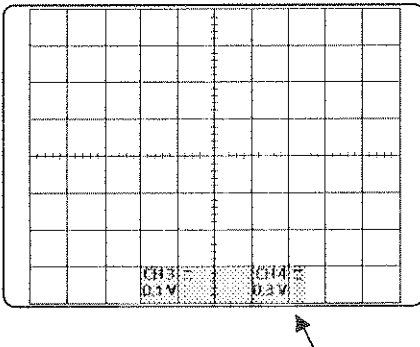
Allows you to display the signal in the appropriate amplitude.


◆ Key operation



Selecting (LED indicator lights)
0.1V/div or 0.5V/div

◆ Key operation



- ① Press the  key and select the 0.1V/div or the 0.5V/div deflection factor.
 - The selected LED indicator lights.

One point advice

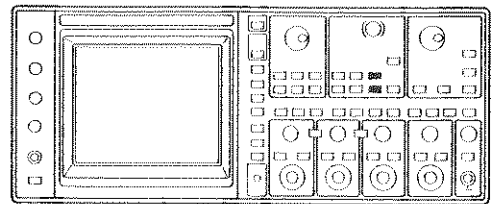
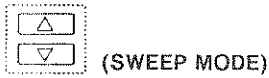


- No variable function is available for the CH3 and CH4.

3

3.12 Selecting the Seep Mode

AUTO



Generates the sawtooth signal in either case the oscilloscope is triggered or not. Triggering the oscilloscope provides the stable display, and not triggering the oscilloscope provides the free-running sweep. The **AUTO** sweep mode is advantageous in the normal measurement. Use the **NORM** sweep mode, when your signal frequency is below 50 Hz or you do not want display the trace at the lack of triggering.

◆ Key operation

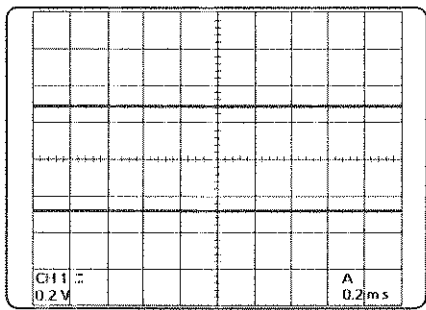
3


(SWEEP MODE)

Selecting (LED indicator lights)
AUTO

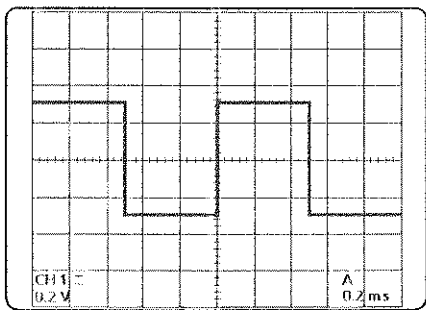
◆ Operating procedure

Free -running sweep display of the **CAL** signal



- ① Press the  (SWEEP MODE) key and set the **AUTO** mode.

Triggered sweep display of the **CAL** signal



One point advice



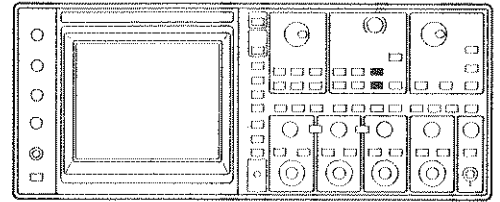
- It is necessary to adjust the trigger level to trigger the oscilloscope.
Use the **NORM** sweep mode when your signal frequency is below 50 Hz.
Use the **AUTO** sweep mode when you want to check the ground level.

3.12 Selecting the Sweep Mode

NORM



(SWEEP MODE)



Allows to display the signal only when the oscilloscope is triggered. The **AUTO** sweep mode is advantageous in the normal measurement. Use the **NORM** sweep mode, when your signal frequency is below 50 Hz or you do not want to display the trace at the lack of triggering.

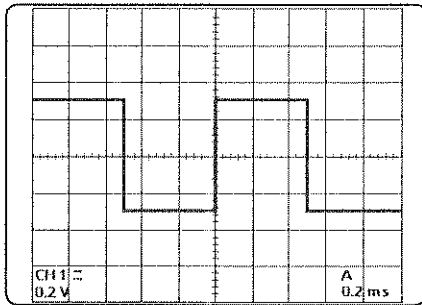
◆ Key operation


(SWEEP MODE)



Selecting (LED indicator lights)
NORM

◆ Operating procedure



- ① Press the  (SWEEP MODE) key and set the **NORM** mode.
 - No trace is available on the screen at the lack of triggering.

One point advice



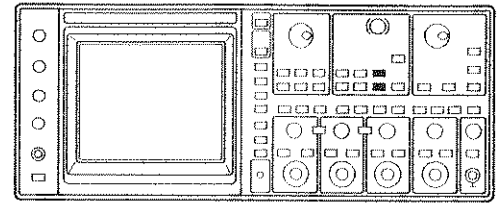
- Use the **NORE** sweep mode when your signal frequency is below 50 Hz.
- Use the **AUTO** sweep mode you want to check the ground level.

3.12 Selecting the Sweep Mode

SINGLE



(SWEEP MODE)



In the **SINGLE** sweep mode, the signal is captured once by the triggering at the oscilloscope ready. Until you set the oscilloscope ready again, the oscilloscope will not be triggered. Therefore, the **SINGLE** sweep mode is advantageous for capturing the single shot event and taking the picture of the signal.

◆ Preliminary setup

Let's suppose the **CAL** signal as the single shot signal. Do not apply the **CAL** signal until the instruction for applying the signal.

◆ Key operation

(SWEEP MODE)

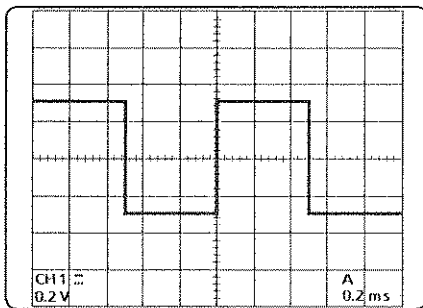




Selecting (LED indicator lights)
SINGLE




Selecting (LED indicator lights)
READY

◆ Operating procedure



- ① Press the  (SWEEP MODE) key and set the **SINGLE**.
- ② Press the  key and set the oscilloscope ready. The **READY** LED indicator lights.
 - Apply the **CAL** signal.The trace sweeps once with the **TRIG'D** indicator on, and the **READY** indicator goes off.

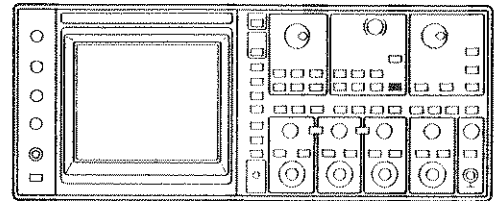
One point advice

- Press the  key to set the oscilloscope ready.



3.13 Enabling the Trigger Selection

A / B



Enables the **A** or **B** trigger mode selection. After enabling the trigger mode selection, you can change the **A** or **B** trigger conditions enabled by this selection. See the following pages to change the individual **A** trigger condition. The **B** trigger selection procedure for the source and coupling is described in this page.

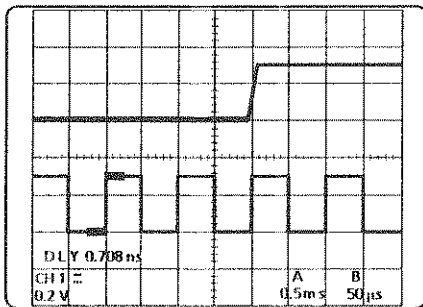
◆ Key operation



Selecting

A or B trigger mode (LED indicator lights)

◆ Operating procedure



B trigger selecting menu

F1:		F2:	
B SOURCE		B COUPL	
→ RUNS AFTER		FIX	
CH1	DC	HF REJ	
CH2	LF REJ	TV-HI	
CH3			
CH4			

◆ Selecting the A trigger mode

- Press the **MODE** key and set the **A** trigger mode. The selected LED indicator lights.
- Set the **A** trigger conditions according to the instructions in the following pages.
 - Trigger conditions : Trigger source, coupling, slope, level

◆ Selecting the B trigger mode

- Press the **MODE** key and set the **B** trigger mode.
- Press the key and select the **B** trigger source.

The → mark alongside the trigger source shows the selected trigger source.

Pressing the key each time sets the next trigger source in the screen menu.
- Press the key and select the **B** trigger coupling.

The → mark alongside the trigger coupling shows the selected trigger coupling.

Pressing the key each time sets the next trigger coupling in the screen menu.

To exit the **B** trigger selection menu, press the key.

The procedure for setting the **B** trigger slope and level are the same as for the **A** trigger selection.

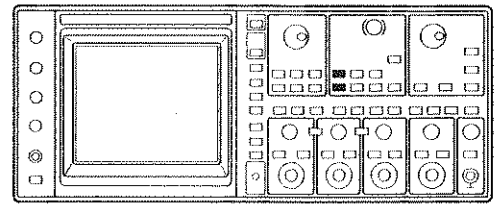
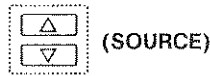
One point advice



- Selecting the **A** or **B** trigger mode does not change the **A** and **B** trigger conditions.
- The trigger source and coupling LED indicators are off during the **B** trigger selection.

3.14 Selecting the Trigger Source

VERT



With the **VERT** trigger source, the trigger signal is selected from the vertical channel assigned by the **VERT MODE**.

Therefore when you display the signal trace on the display, it is not necessary to select trigger signal to obtain the stable display, since the trigger signal automatically set to the vertical signal on the screen.

The **A** trigger source selection procedure is described in this page. The **B** trigger source selection procedure is described in the “3.13 Enabling the Trigger Selection.”

3

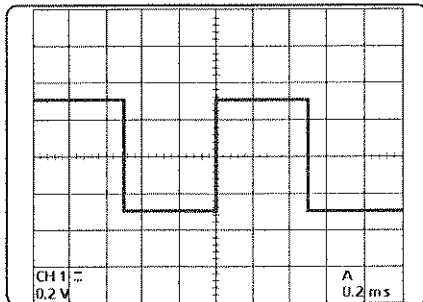
◆ Key operation


(SOURCE)



Selecting (LED indicator lights)
VERT

◆ Operating procedure



- ① Press the  (**SOURCE**) key and select the **VERT** mode.

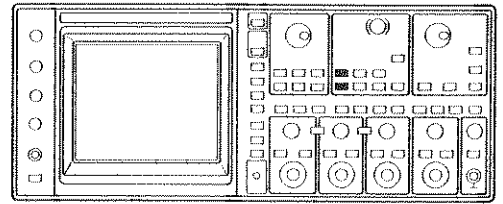
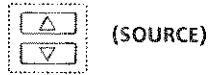
One point advice



- Avoid to use the **VERT** trigger source in the multi-display mode of **CHOP** and **ALT**.

3.14 Selecting the Trigger Source

CH1-CH2
CH3-CH4




It is necessary to trigger the oscilloscope to obtain the stable display on the screen.

The trigger source can be selected from the four signals of the **CH1**, **CH2**, **CH3**, and **CH4** vertical input.

The **A** trigger source selection procedure is described in this page. The **B** trigger source selection procedure is described in the “3.13 Enabling the Trigger Selection.”

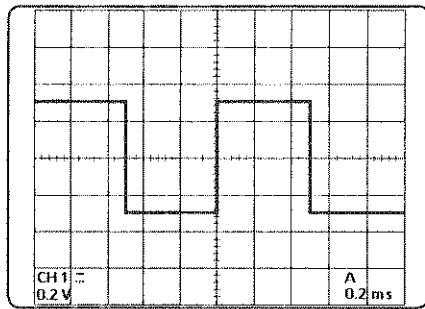
◆ Key operation


(SOURCE)



Selecting (LED indicator lights)
CH1, CH2, CH3, CH4

◆ Operating procedure



- ① Press the  (SOURCE) key and select the trigger source.

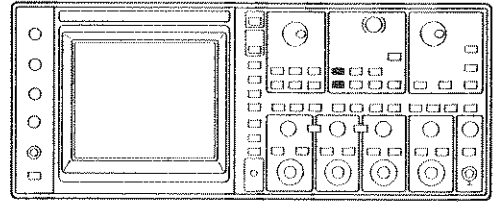
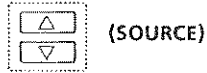
One point advice



- You can select any trigger source regardless of the display channel.

3.14 Selecting the Trigger Source

LINE



Triggers the oscilloscope with the line frequency. The **LINE** trigger source is advantageous for checking the line voltage, ripple voltage, and other voltages relating line frequency. The **LINE** trigger source is only available for the **A** trigger source.

◆ Key operation


3

(SOURCE)



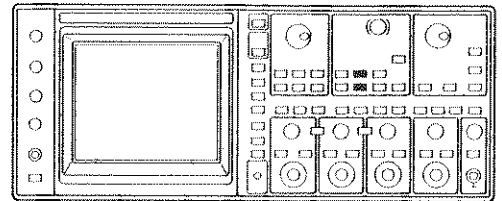
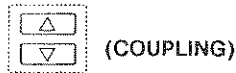
Selecting (LED indicator lights)
LINE

◆ Operating procedure

- ① Press the  **SOURCE** key and select **LINE** source.

3.15 Selecting the Trigger Coupling

FIX, AC, DC




Allows to select the suitable trigger coupling for the measurement.

The **A** trigger coupling selection procedure is described in this page. The **B** trigger coupling selection procedure is described in the “3.13 Enabling the Trigger Selection.”

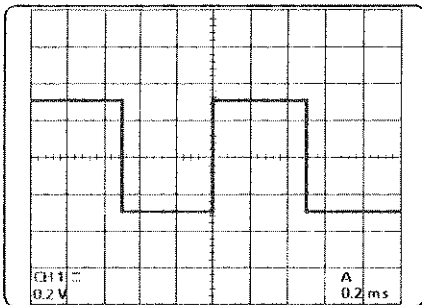
◆ Key operation


(COUPLING)



Selecting (LED indicator lights)
FIX, AC, DC

◆ Operating procedure

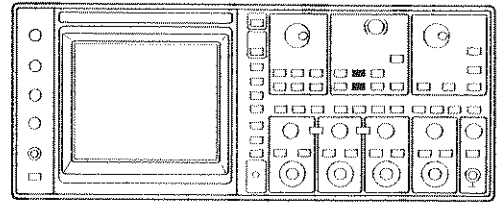
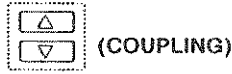


① Press the  (COUPLING) key and select the **FIX**, **AC**, or **DC** coupling.

- **FIX** : automatically sets the **AC** coupling and the **TRIG LEVEL** to the near ground level.
This function is hands-free mode for the triggering.
- **AC** : rejects the dc offset level from the trigger signal. Below the 100Hz frequency triggering may be difficult since the trigger signal amplitude will be attenuated.
- **DC** : passes all the signal components.

3.15 Selecting the Trigger Coupling

HF REJ, LF REJ



Occasionally the trigger signal noise may cause the triggering difficult to obtain the stable display. Use the frequency rejection coupling to reject noise.

The **A** trigger coupling selection procedure is described in this page. The **B** trigger selection procedure is described in the “3.13 Enabling the Trigger Selection.”

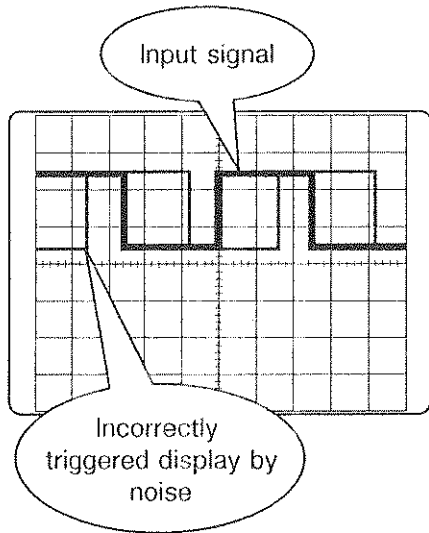
◆ Key operation


3

(COUPLING)

Selecting (LED indicator lights)
HF REJ, LF REJ

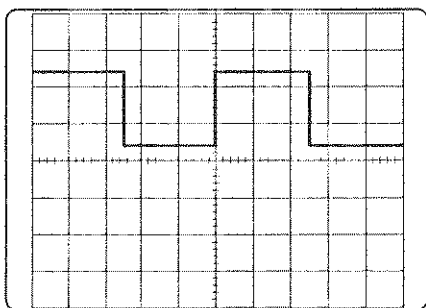
◆ Operating procedure



- ① Press the  (COUPLING) key and select the **HF REJ** or the **LF REJ** coupling.

- **HF REJ** : attenuates the signal components above the 10kHz frequency.
- **LF REJ** : attenuates the signal components below the 10kHz frequency.

Stable triggered display

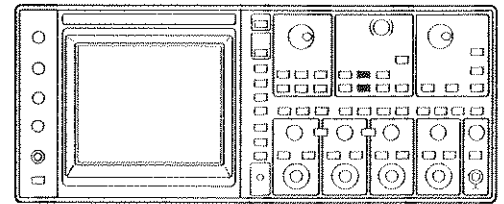


3.15 Selecting the Trigger Coupling

TV-V, TV-H



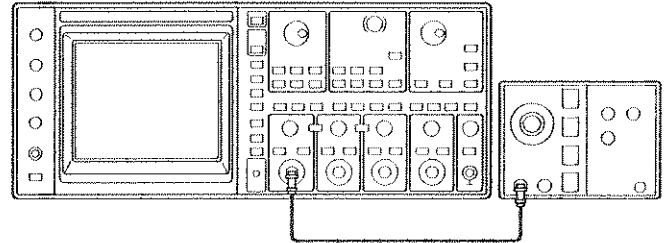
(COUPLING)



Allows to trigger the composite video signal easily.

◆ Preliminary setup

Apply the signal from the video signal generator into the CH1 input.



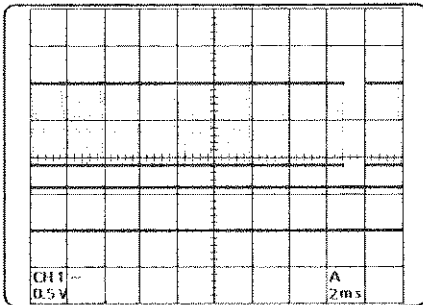
◆ Key operation


(COUPLING)



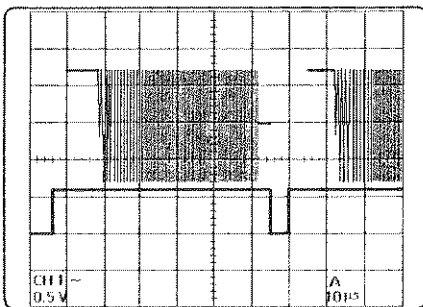
Selecting (LED indicator lights)
TV-V, TV-H

◆ Operating Procedure



- ① Press the  (COUPLING) key and set the TV-V or the TV-H coupling.

- TV-V : allows to trigger with the vertical sync pulse of the video signal.



- TV-H : allows to trigger with the horizontal sync pulse of the video signal.

One point advice



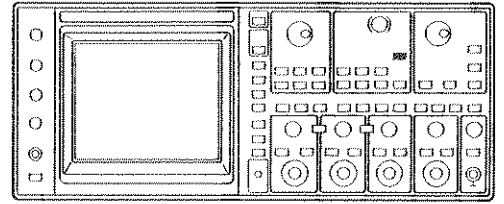
- When you set the A trigger coupling to the TV-V, the B trigger coupling is automatically set to the TV-H coupling.

3.16 Selecting the Trigger Slope

SLOPE



SLOPE



Allows to trigger at the positive or the negative slope.

◆ Key operation

SLOPE

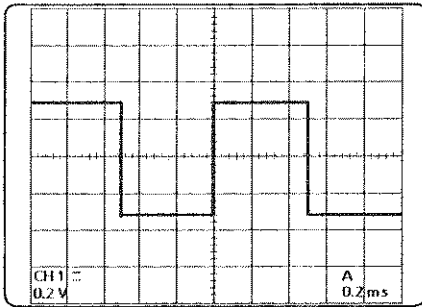



Selecting (LED indicator lights)

+ / -

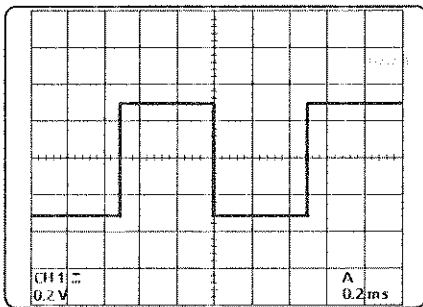
3

◆ Operating procedure



- ① Press the  key and select the + (positive) or the - (negative) slope.

- The signal is triggered at the positive slope.



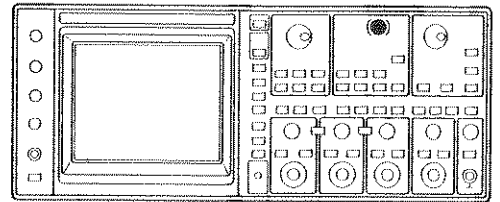
- The signal is triggered at the negative slope.

3.17 Adjusting the Trigger Level

TRIG LEVEL



TRIG LEVEL



Allows to trigger at the desired trigger signal level. It is necessary to trigger the oscilloscope to obtain the stable display.

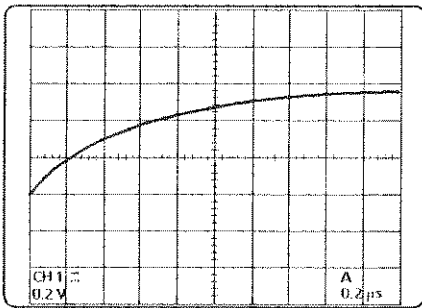
◆ Key operation

TRIG LEVEL



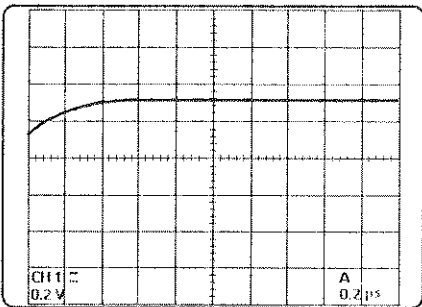
Adjusting
TRIG LEVEL

◆ Operating procedure



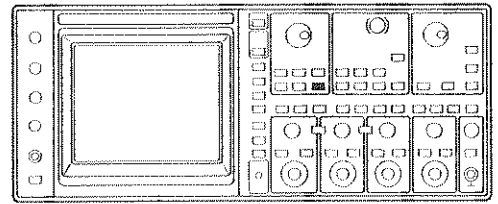
① Using the  TRIG LEVEL, adjust the trigger level.

- Display with the ten o'clock position of the trigger level control.
- Display with the center position of the trigger level control.



3.18 Triggering the A Time Base

HOLD OFF

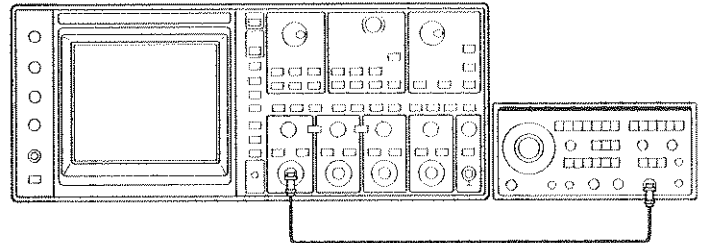


Allows to trigger the complex signal by varying the hold off time.

◆ Preliminary setup

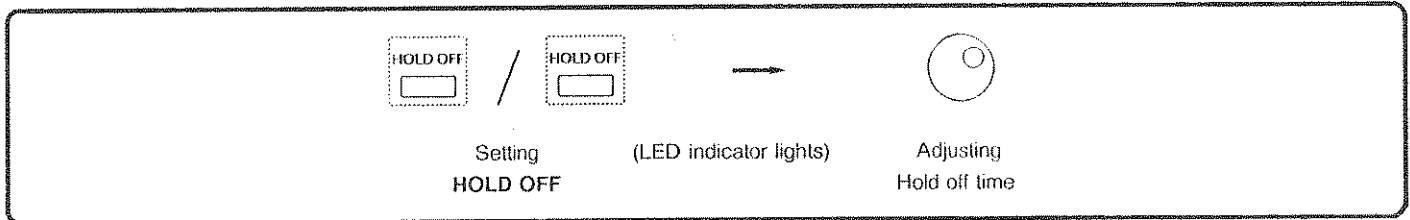
Apply the signal from the signal generator (e.g. FG-350) into the CH1 input.

- Amplitude : 0.6V
- Sweep mode : CONT SWEEP
- time : 1mS
- start : 1kHz
- stop : 2.4kHz



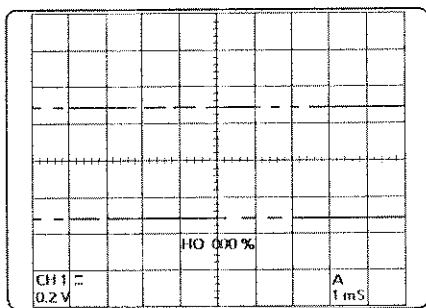
3

◆ Key operation



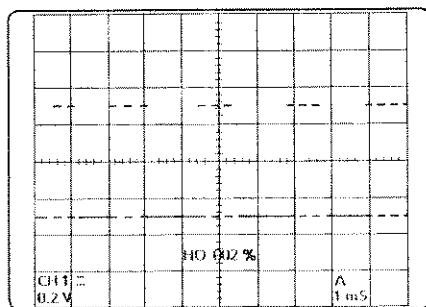
◆ Operating procedure

Display with the improper hold off time



- ① Press the HOLD OFF key and set the **HOLD OFF** function.
- ② Using the **CURSOR** knob, adjust the hold off time.

Clear display with the proper hold off time

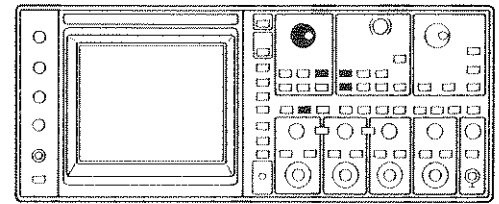


One point advice

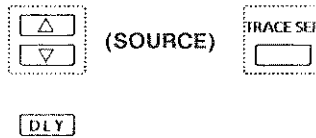


- Pushing the **HOLD OFF** key again clear the hold off message on the screen. But the adjusted hold off time remains the same.
- To set the default hold off time, turn the **CURSOR** knob clockwise and obtain the "HO 000%" message on the screen.
- The message "HO 000%" on the screen shows the minimum hold off time, or the normal condition.

3.19 Setting the Continuous Delay



**RUNS AFTER
TRACE SEP
DLY**

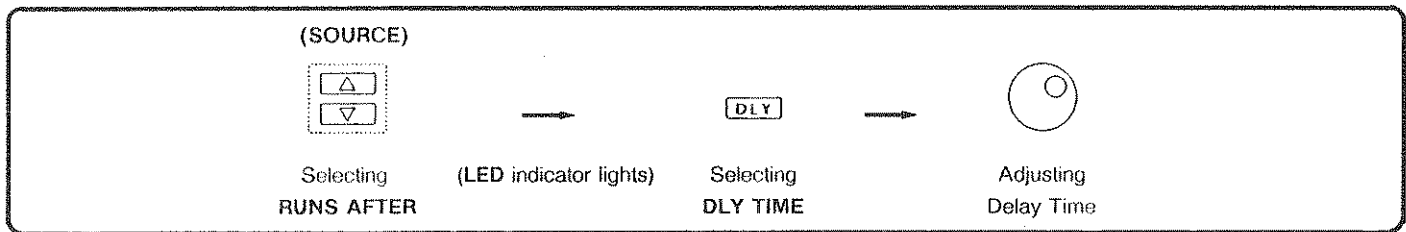


The continuous delay called **RUNS AFTER** allows to delay and display the signal continuously. In the **ALT** display mode, the **A** and **B** sweep display will be separated to obtain the clear display.

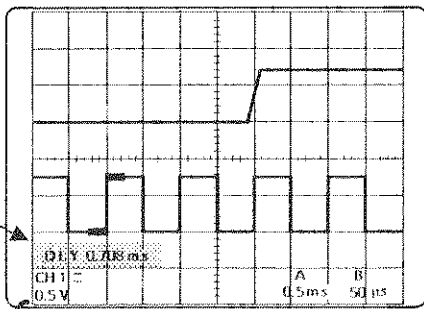
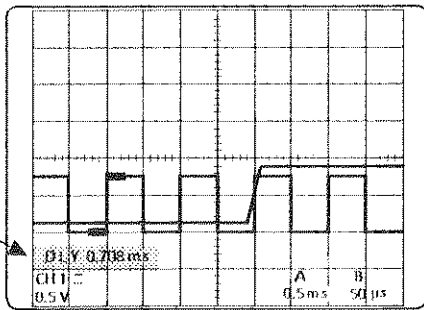
◆ Preliminary setup

- Press the **MODE** key and enable the **B** trigger mode selection.
- Press the **HORIZ DISPLAY** and set the **ALT** display mode.

◆ Key operation



◆ Operating procedure



- ① Press the **(SOURCE)** key and select the **RUNS AFTER** mode.
 - The delayed sweep portion is intensified in the **A** sweep display.
- ② Press the **DLY** key and set the **DLY TIME** mode.
- ③ Using the **RANGE** knob, position the intensified portion to the portion to be expanded.
 - The following procedure describes how to separate the **B** sweep display from the **A** sweep display.
- ④ Press the **TRACE SEP** key and set the **TRACE SEP** mode.
- ⑤ Using the **RANGE** knob, position the **B** time base trace vertically to separate from the **A** time base trace.

One point advice

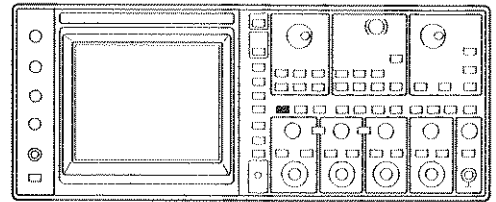
- The **B** sweep position separated by using **TRACE SEP** is always valid until next position setting.



3.20 Selecting the Horizontal Mode HORIZ DISPLAY

A

A



Provides the primary time base.

◆ Key operation

HORIZ DISPLAY

A

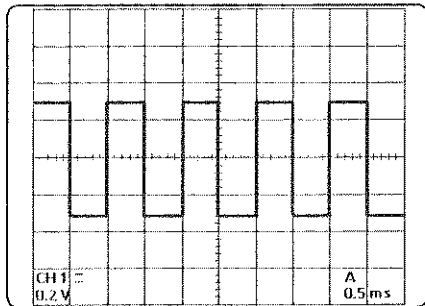
Setting (LED indicator lights)
A time base

3

◆ Operating procedure

① Press the **A** key and set the **A** sweep mode.

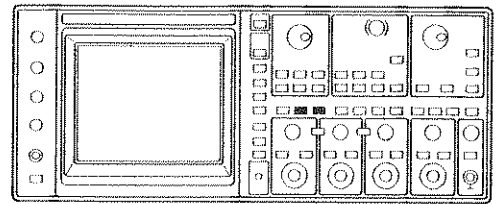
- The selected **LED** indicator lights.



3.20 Selecting the Horizontal Mode HORIZ DISPLAY

ALT, B

[ALT] [B]



Provides the delayed time base.

The **B** mode provides only the delayed sweep, and the **ALT** mode provides the **A** primary sweep intensified by the delayed sweep as well as the delayed sweep.

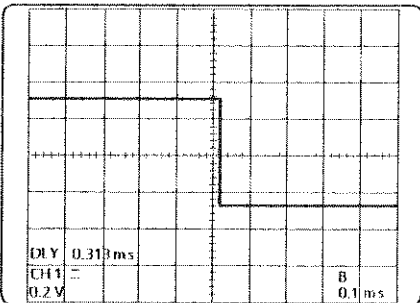
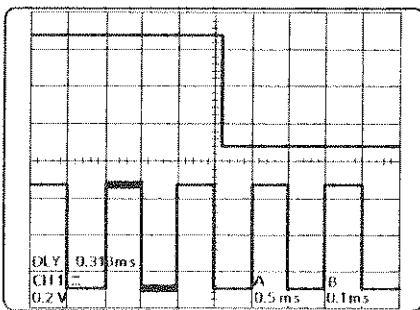
◆ Key operation

HORIZ DISPLAY

[ALT] [B]

Setting (LED indicator lights)
ALT, B

◆ Operating procedure



① Press the [ALT] key or [B] key and set the **ALT** or the **B** horizontal mode.

- The selected LED indicator lights.
- Top drawing : **ALT** sweep display
- Bottom drawing : **B** sweep display

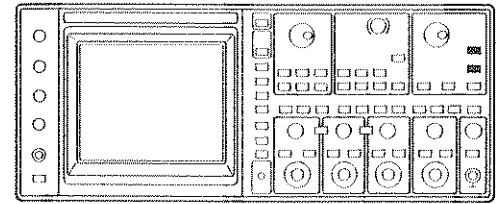
One point advice



- The **TRACE SEP** function allows to separate the **B** sweep display from the intensified **A** sweep display for the clear viewing.
- For the detailed delayed sweep operation, see the "4.3 Delayed Sweep."

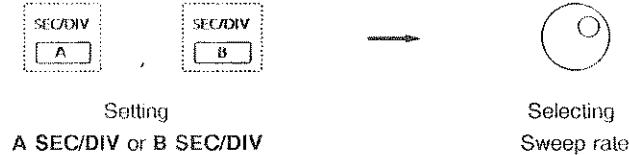
3.21 Selecting the Sweep Rate

SEC/DIV UNCAL



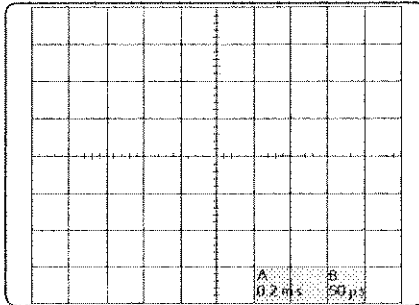
Allows to horizontally expand and compress the display waveform for the best viewing condition. When you expand the signal, you obtain the more detail of the signal, but you see the shorter duration.

◆ Key operation



3

◆ Operating procedure



◆ SEC/DIV

- Press the key or the key and set the A time base or the B time base.

- The lighted LED indicator shows the selected time base.

- Using the RANGE knob, select the sweep rate.

◆ UNCAL

- Press the key again and set the **UNCAL** mode.

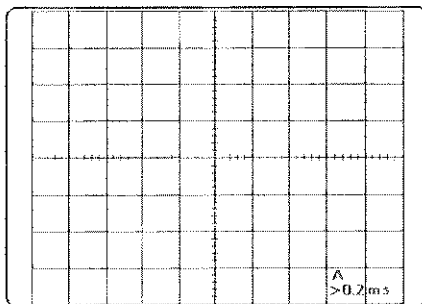
- The **UNCAL** LED indicator lights.

- Using the RANGE knob, decrease the sweep rate continuously. The variable range is from the calibrated sweep rate to the 2.5 times of the calibrated sweep rate..

- Pushing the RANGE knob lets the sweep rate change by step for coarse adjustment.

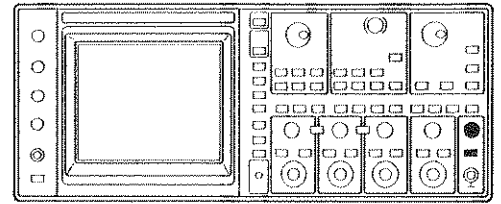
- Counterclockwise turn of the **RANGE** knob before pushing sets the slower sweep rate, and the clockwise turn sets for the faster sweep rate.

One point advice



- In the **UNCAL** mode, the ">" mark is displayed on the screen alongside the calibrated sweep rate.
- Pressing the key in the **UNCAL** mode releases the **UNCAL** mode.
- Setting the **UNCAL** mode, the sweep rate is changed by the variable ratio set last.
- For the X10 sweep magnification, see the "3.22 Positioning the Signal Horizontally."

3.22 Position the Signal Horizontally

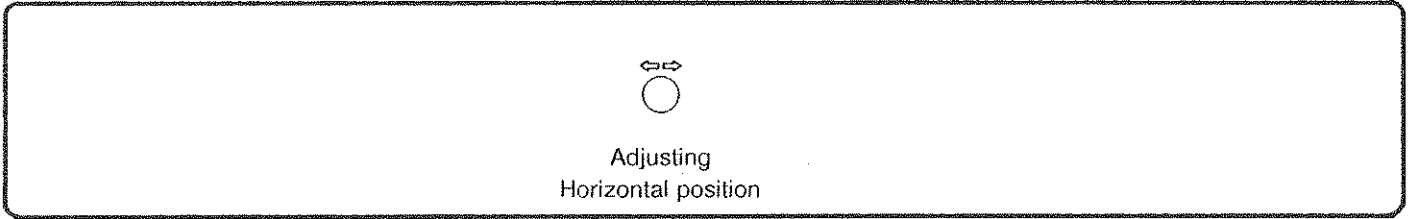


**POSITION
FINE
x 10**

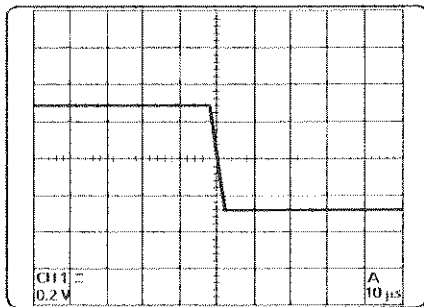
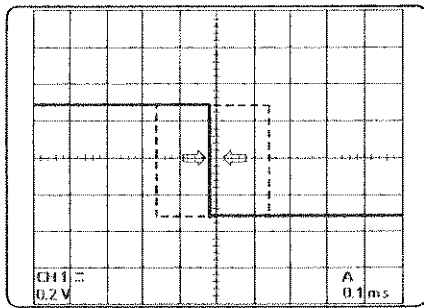





The display signal is positioned and magnified ten times horizontally for the best viewing.

◆ Key operation



◆ Operation procedure



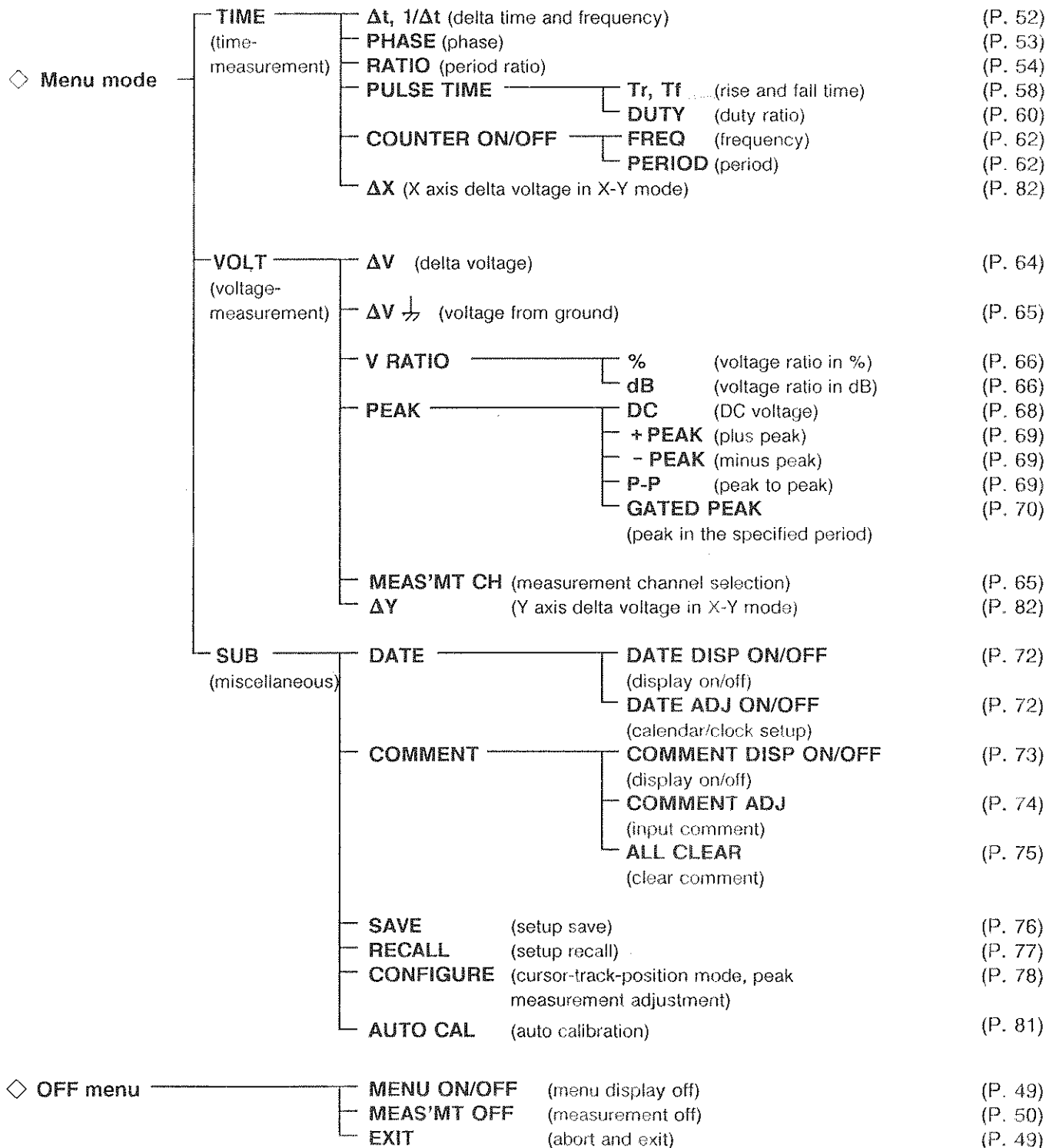
- ① Using the  knob, position the signal portion to be magnified to the horizontal center screen.
- ② Push the  knob and magnify the signal horizontally.
 - Setting the horizontal magnification turns the position to the fine positioning automatically. With the fine position, the signal will be positioned in the fine steps but in narrow positioning range, or one tenth of the normal position range.
 - Pressing the  key releases the fine positioning.

MENU TREE

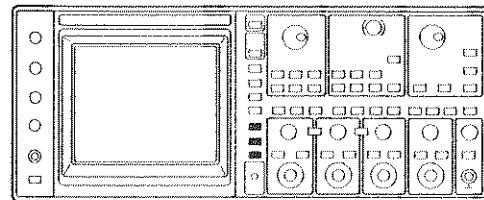
□ (MENU)

◆ The oscilloscope provides the voltage and the time cursor measurements, the calendar/clock function and the auto calibration.

◆ Menu Tree



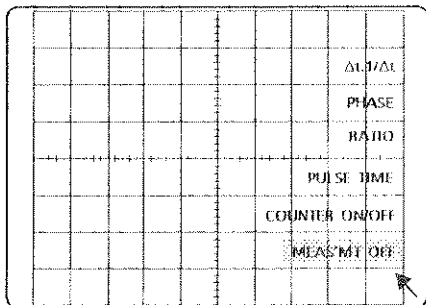
3



COMPLETING THE MENU MEASUREMENT

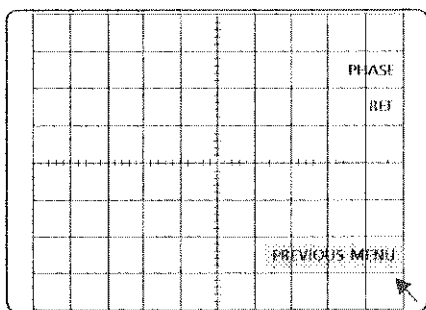
This section describes how to complete the menu measurement.

3



◇ **Completing the menu measurement by using the **F6** MEAS'NT OFF key**

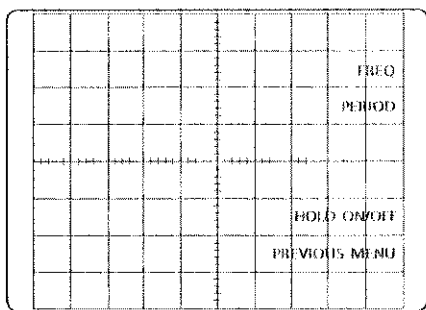
① Press the **F6** key in the menu and set the **MEAS'MT OFF**.



◇ **Completing the menu measurement by using the **PREVIOUS MENU** function**

① Press the **F6** key when the **F6** key represents the **PREVIOUS MENU** message in the menu. You will obtain the **TIME** or **VOLTAGE** menu.

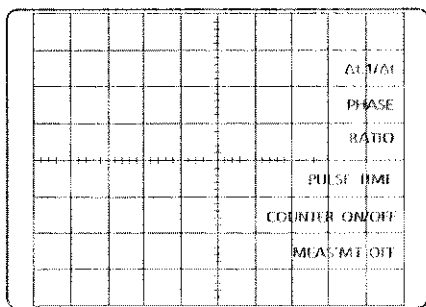
② Press the **F6** key in the menu and set the **MEAS'MT OFF**.



◇ **Completing the counter measurement**

① Press the **F6** **PREVIOUS MENU** key in the **COUNTER** measurement menu and bring back the **TIME** measurement menu.


② Press the **F5** **COUNTER ON/OFF** key and set the **COUNTER OFF**.

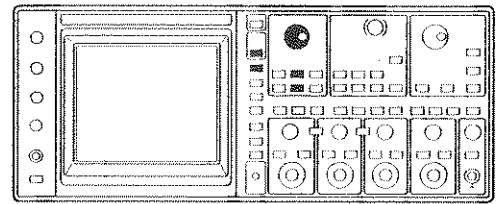


MEMO



3.24 TIME MENU

 (MENU)



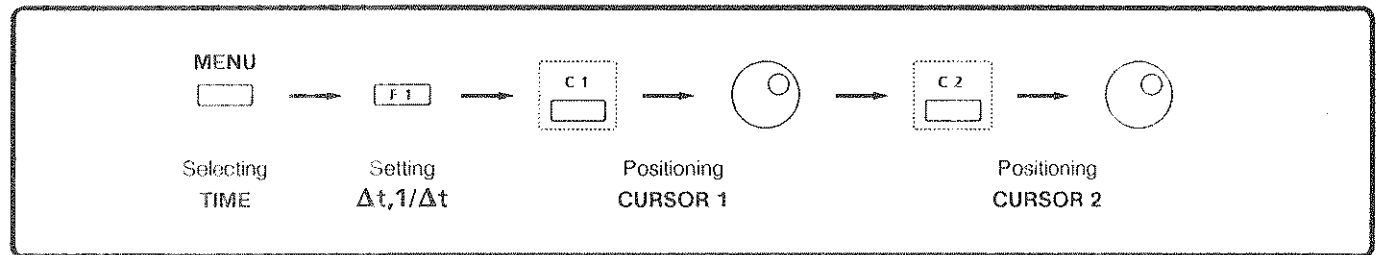
$\Delta t, 1/\Delta t$

 F1

Activates the delta time measurement including the reciprocal of the delta time.

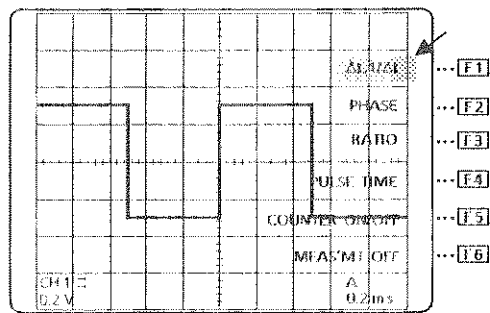
When you set the time cursors to the one cycle of the signal, the frequency measurement is done by reading the reciprocal of delta time.








◆ Key operation

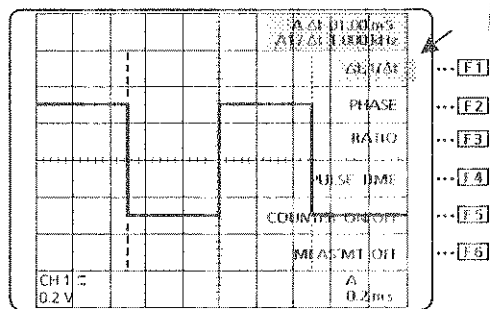


3

◆ Operating procedure





- ① Press the  (MENU) key and select the TIME menu.
 - ② Press the  key and set the $\Delta t, 1/\Delta t$ measurement.
 - ③ Press the  key and set the CURSOR 1.
 - ④ Using the  CURSOR knob, position the CURSOR 1 (|) to the measurement reference point of the display waveform.
 - ⑤ Press the  key and set the CURSOR 2.
 - ⑥ Using the  CURSOR knob, position the CURSOR 2 (|) to the measurement point of the display waveform.
- Pressing the  CURSOR knob forces the cursor to jump one division. The jump direction is set by the last CURSOR movement direction.
 - You can read the time difference between the two cursors by reading the CRT readout at the top-right corner.




One point advice



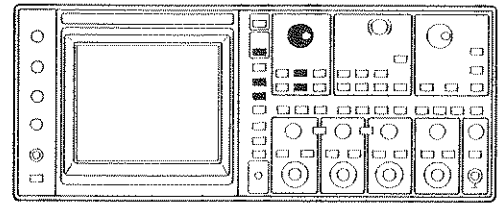
- The measurement result will be a negative value, if you position the CURSOR 2 to the left of the CURSOR 1.
- When you set the ALT sweep mode, the A sweep rate is valid for the TIME measurement.
- If you press the  key in the TIME measurement mode, you will not access the TIME cursors. In this case, press the  key.
- The internal processing rounds measurement value and may cause the difference between the Δt and $1/\Delta t$ value.

3.24 TIME MENU

 (MENU)

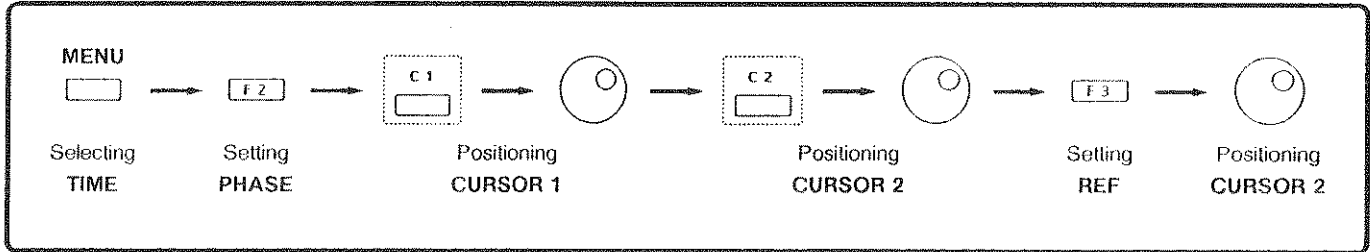
PHASE



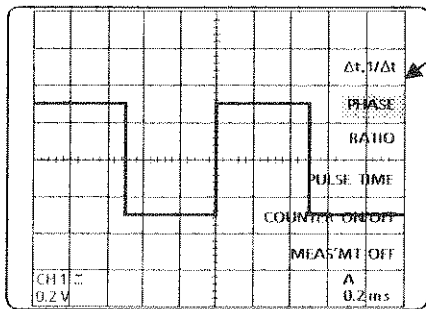



Activates the phase measurement.


◆ Key operation





◆ Operating procedure





① Press the  (MENU) key and select the **TIME** menu.


② Press the  key and set the **PHASE** measurement.


③ Press the  key and set the **CURSOR 1**.


④ Using the  **CURSOR** knob, position the **CURSOR 1** (|) to the start of the cycle.

⑤ Press the  knob and set the **CURSOR 2**.

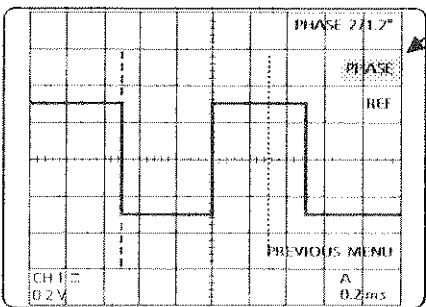
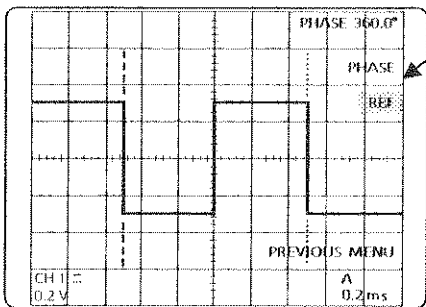
⑥ Using the  **CURSOR** knob, position the **CURSOR 2** (|) to the end of the cycle.

⑦ Press the  **REF** key and set the one cycle assigned by the two cursors as 360° phase.

⑧ Using the  **CURSOR** knob, position the **CURSOR 2** (|) to the measurement point.

- Pressing the  **CURSOR** knob forces the cursor to jump one division. The jump direction is set by the last cursor movement direction.



- The phase measurement is displayed at the right and top corner of the screen.




One point advice



- The measurement result will be a negative value, if you position the **CURSOR 2** to the left of the **CURSOR 1**.

- If you press the  key in the **TIME** measurement mode, you will not access the **TIME** cursors. In this case, press the  key.

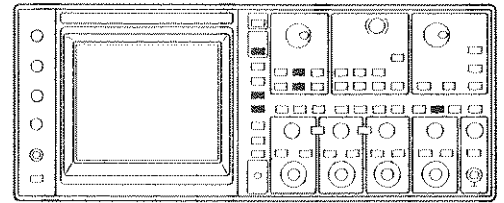
3.24 TIME MENU

 (MENU)

RATIO AUTO REF

 F3

 F3



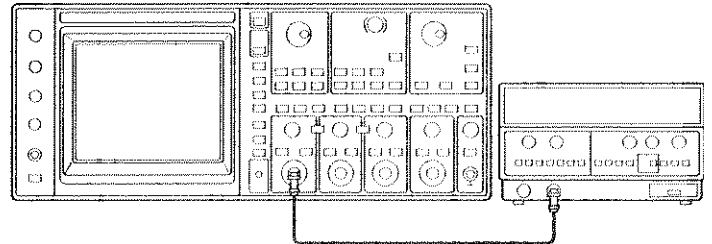
Activates the period ratio measurement to the reference period which is set automatically.

◆ Preliminary setup

Apply the signal from the signal generator, e.g. Iwatsu SG-4111, to the CH1.

Frequency : 1kHz


Amplitude : 0.8Vp-p




3

One point advice

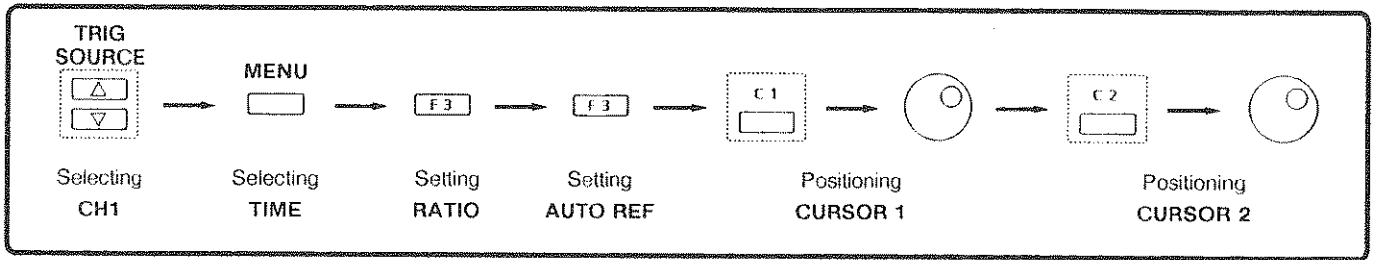


- If you want to undo the **AUTO REF** function, press the  **FORMER CUR POSI** key.
- When you are in the following conditions and set the **AUTO REF** function, the error message will be displayed. Follow the error message and activate the **AUTO REF** function.

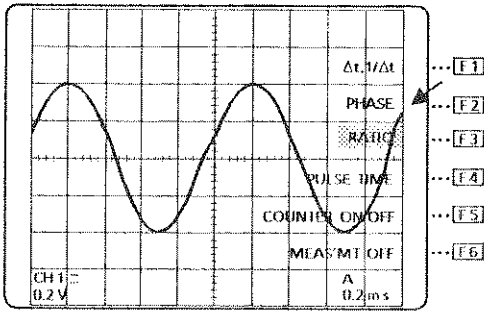
Error condition	Error message
CURSOR 2 will be out of screen.	CHANGE A TIME
CURSOR 2 is within 0.5 div from rightmost scale with the signal displayed less than 0.5 div period.	Back CURSOR1
HORIZ DISPLAY is set to B .	SET H A or ALT

- The reference period is set to the period of the **A** trigger source signal selected by the  **SOURCE** key.

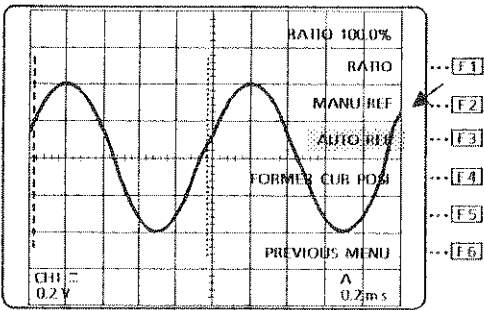
◆ Key operation



◆ Operating procedure



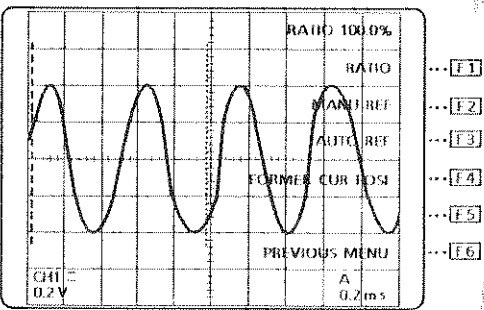
- Press the Δ/∇ (**SOURCE**) key and select the **CH1** trigger source.
The **CH1** trigger source signal is set for the reference period.



- Press the \square (**MENU**) key and set the **TIME** menu.

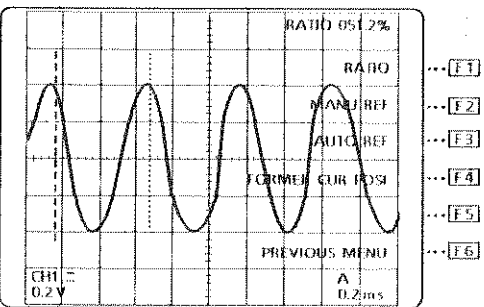
- Press the **F3** key and set the **RATIO** measurement.

- Press the **F3** key and set the **AUTO REF** function which sets the cursors to the reference period automatically.
(Increase the frequency of the input signal.)



- Press the **C1** key and set the **CURSOR 1**.

- Using the \odot **CURSOR** knob, position the **CURSOR 1** (|) to the period start point of the measurement signal.



- Press the **C2** key and set the **CURSOR 2**.

- Using the \odot **CURSOR** knob, position the **CURSOR 2** (|) to the period end point of the measurement signal.

- Pressing the \odot **CURSOR** knob forces the cursor to jump one division. The jump direction is set by the last cursor measurement direction.
- The period ratio is displayed at the top-right corner on the screen.

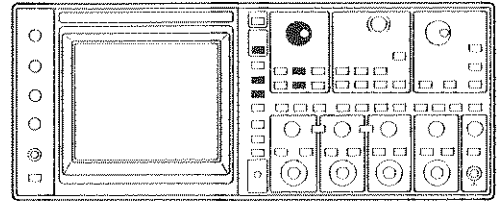
3.24 TIME MENU

RATIO MANU REF

(MENU)

F 3

F 2



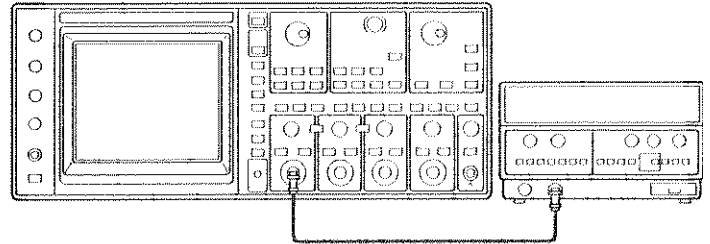
Activates the period ratio measurement to the reference period which is set manually.

◆ Preliminary setup

Apply the signal from the signal generator, e.g. Iwatsu SG-4111, to the CH1.

Frequency : 1kHz

Amplitude : 0.8Vp-p



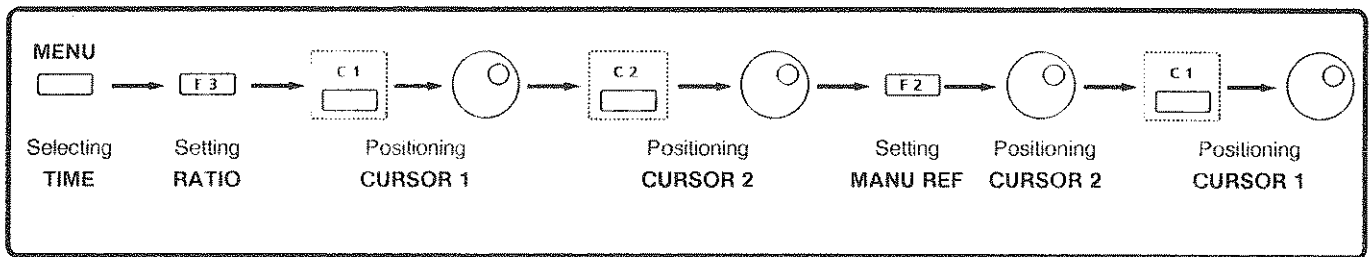
3

One point advice

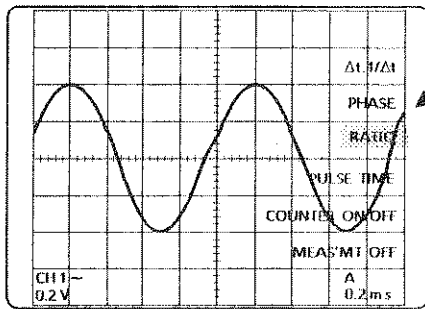


- If you press the VOLT key in the TIME measurement mode, you will not access the TIME cursors. In this case, press the TIME key.

◆ Key operation



◆ Operating procedure



① Press the (MENU) key and set the **TIME** menu.

② Press the key and set the **RATIO** measurement.

③ Press the key and set the **CURSOR 1**.

④ Using the **CURSOR** knob, position the **CURSOR 1** () to the period start point of the reference signal.

⑤ Press the key and set the **CURSOR 2**.

⑥ Using the **CURSOR** knob, position the **CURSOR 2** () to the period end point of the reference signal.

⑦ Press the key and set the **MANU REF** function to obtain the reference cycle.

(Increase the frequency of the input signal.)

⑧ Press the key and set the **CURSOR 1**.

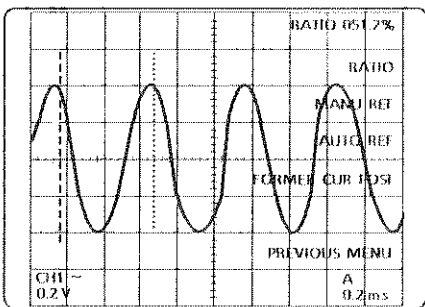
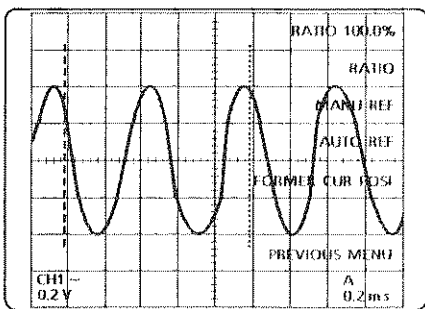
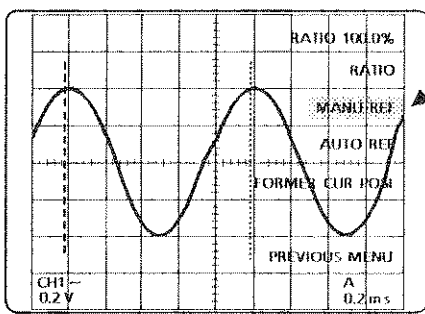
⑨ Using the **CURSOR** knob, position the **CURSOR 1** () to the period start point of the measurement signal.

⑩ Press the key and set the **CURSOR 2**.

⑪ Using the **CURSOR** knob, position the **CURSOR 2** () to the period end point of the measurement signal.

- Pressing the **CURSOR** knob forces the cursor to jump one division. The jump direction is set by the last movement direction.

- The period ratio is displayed at the top-right corner on the screen.



3.24 TIME MENU

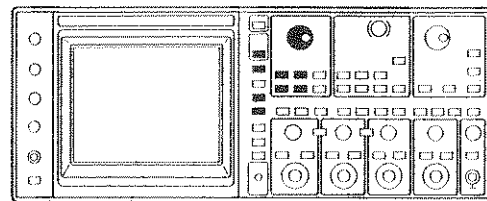
PULSE TIME

Tr, Tf

(MENU)

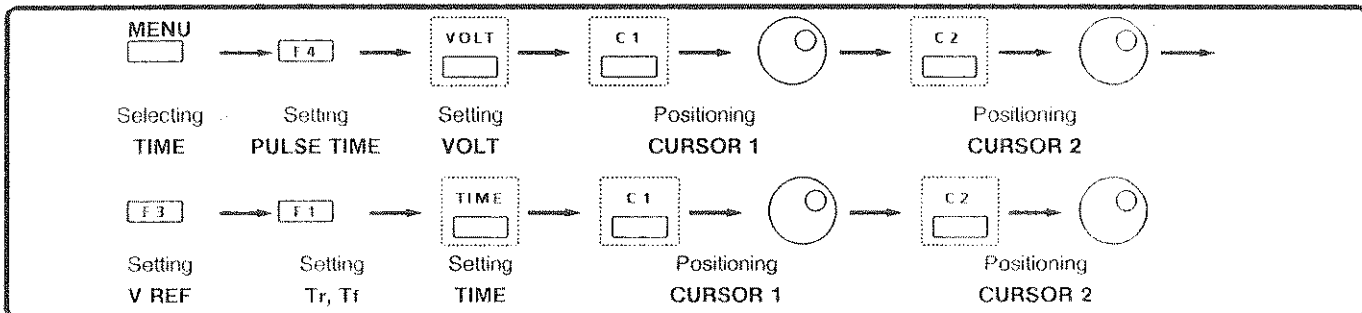
F4

F1

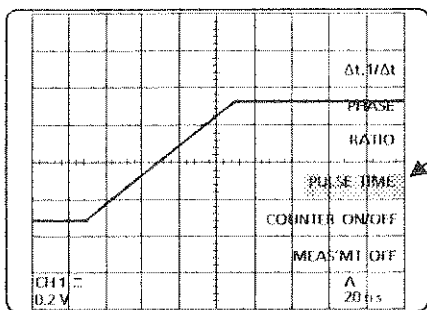


Activates the rise time or the fall time measurement of the pulse waveform.

◆ Key operation



◆ Operating procedure



① Press the (MENU) key and select the **TIME** menu.

② Press the F4 key and set the **PULSE TIME** measurement.

- The two voltage cursors and the two time cursors are displayed.

③ Press the VOLT key and set the **VOLT** cursors.

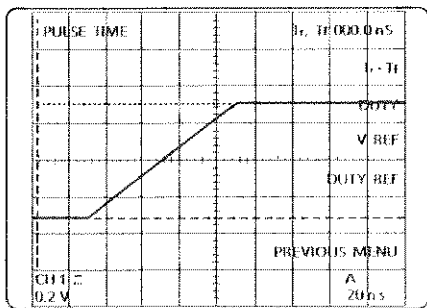
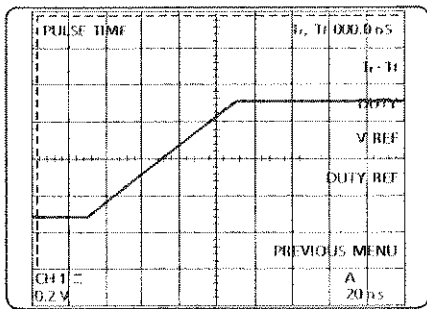
④ Press the C1 key and set the **CURSOR 1**.

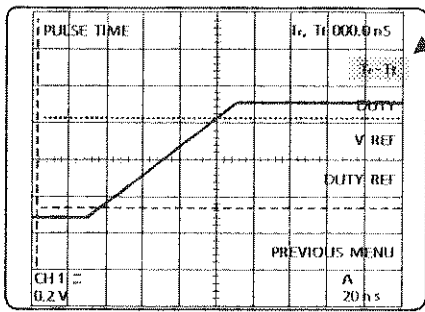
⑤ Using the CURSOR knob, position the **CURSOR 1** (|) to the bottom-base of the pulse.

⑥ Press the C2 key and set the **CURSOR 2**.

⑦ Using the CURSOR knob, position the **CURSOR 2** (|) to the top-base of the pulse.

⑧ Press the F3 key of the **V REF** and set the amplitude assigned by cursors to the reference pulse amplitude.





⑨ Press the **F1** key of the T_r, T_f measurement to obtain the 10%-90% pulse amplitude which is set automatically.

⑩ Press the **TIME** key and select the **TIME** cursors.

⑪ Press the **C1** key and set the **CURSOR 1**.

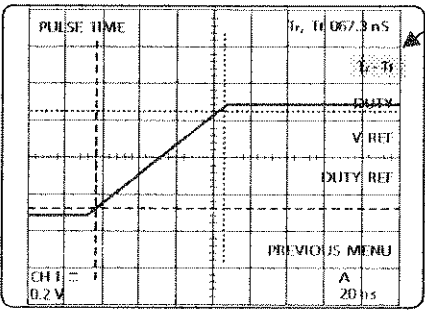
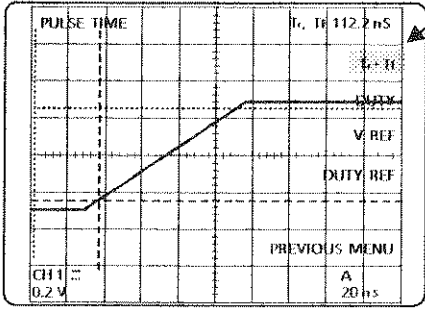
⑫ Using the **CURSOR** knob, position the **CURSOR 1** (|) to the 10% amplitude of the pulse.

⑬ Press the **C2** key and set the **CURSOR 2**.

⑭ Using the **CURSOR** knob, position the **CURSOR 2** (|) to the 90% amplitude of the pulse.

- Pressing the **CURSOR** knob forces the cursor to jump one division. The jump direction is set by the last cursor movement direction.

- The rise time of the pulse is displayed at the right corner of the screen.



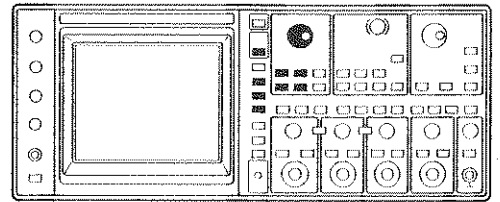
3.24 TIME MENU

MENU

PULSE TIME DUTY

F4

F2



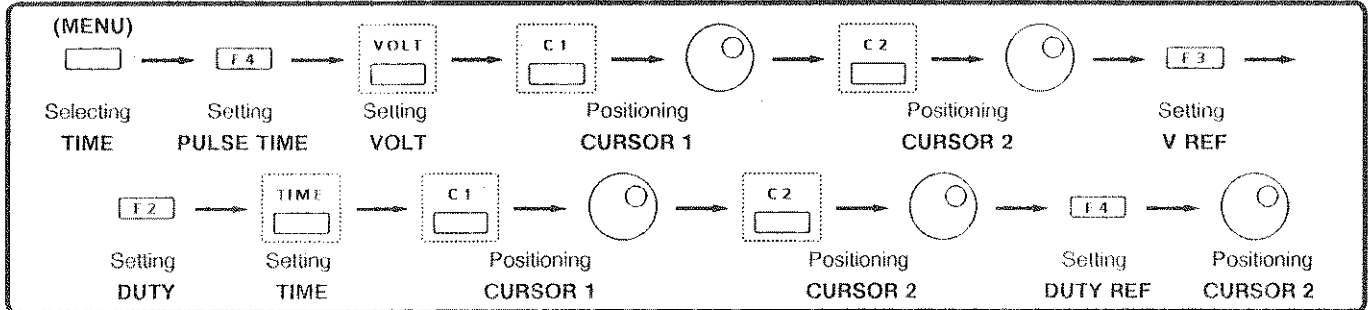
Activates the duty ratio measurement of the pulse.

◆ Preliminary setup

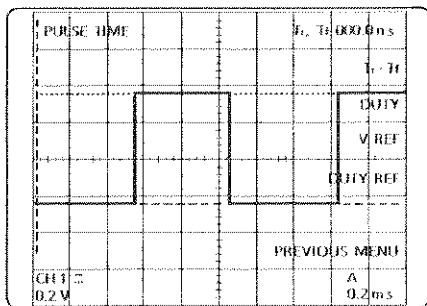
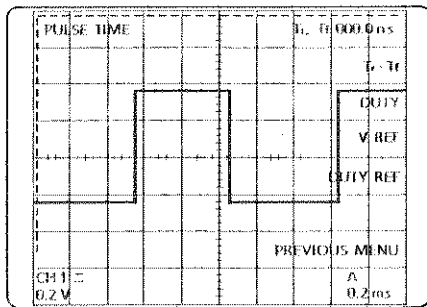
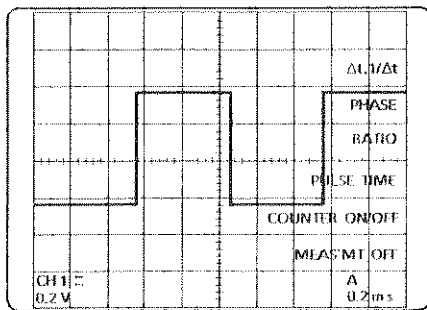
- Set negative triggering slope by pressing the SLOPE key.

◆ Key operation

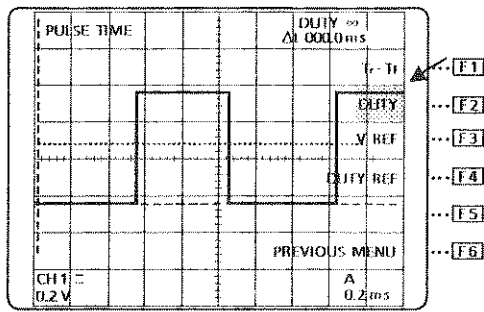
3



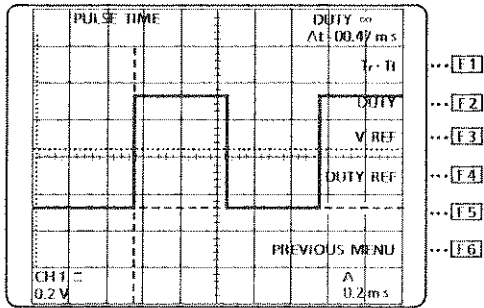
◆ Operating procedure



- ① Press the (MENU) key and select the TIME menu.
- ② Press the F4 key and set the PULSE TIME measurement.
- ③ Press the VOLT key and set the VOLT cursors.
- ④ Press the C1 key and set the CURSOR 1.
- ⑤ Using the CURSOR knob, position the CURSOR 1 to the bottom-base of the pulse.
- ⑥ Press the C2 key and set the CURSOR 2.
- ⑦ Using the CURSOR knob, position the CURSOR 2 to the top-base of the pulse.
- ⑧ Press the F3 key of the V REF and set the amplitude assigned by cursors to the reference pulse amplitude.



⑨ Press the **F2** key of the **DUTY** measurement to obtain the 50% amplitude which is set by the **CURSOR 2** automatically.



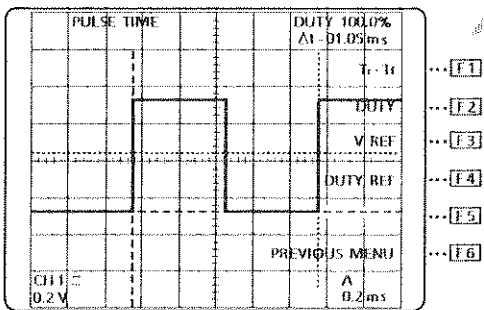
⑩ Press the **TIME** key and set the **TIME** cursors.

⑪ Press the **C1** key and set the **CURSOR 1**.

⑫ Using the **CURSOR** knob, position the **CURSOR 1** to the 50% amplitude of the pulse at the leading edge.

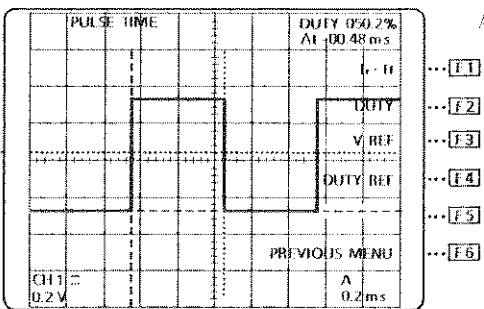
⑬ Press the **C2** key and set the **CURSOR 2**.

⑭ Using the **CURSOR** knob, position the **CURSOR 2** to the 50% amplitude of the pulse at the next leading edge.



⑮ Press the **F4** key of the **DUTY REF** and set the time span assigned by the cursors to the reference one cycle.

⑯ Using the **CURSOR** knob, position the **CURSOR 2** to the 50% amplitude of the pulse at the trailing edge in the cycle.



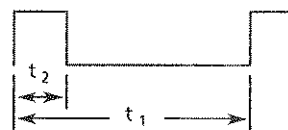
- The duty ratio of the pulse is displayed at the right corner of the screen.

One point advice



The duty ratio is the ratio between the pulse width and the pulse cycle, and is expressed by the followings.

$$\text{Duty ratio (\%)} = \frac{t_2}{t_1} \times 100$$



3.24 TIME MENU

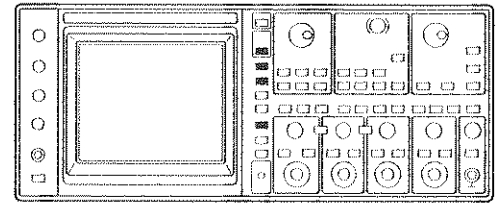
COUNTER FREQ, PERIOD

(MENU)

F5

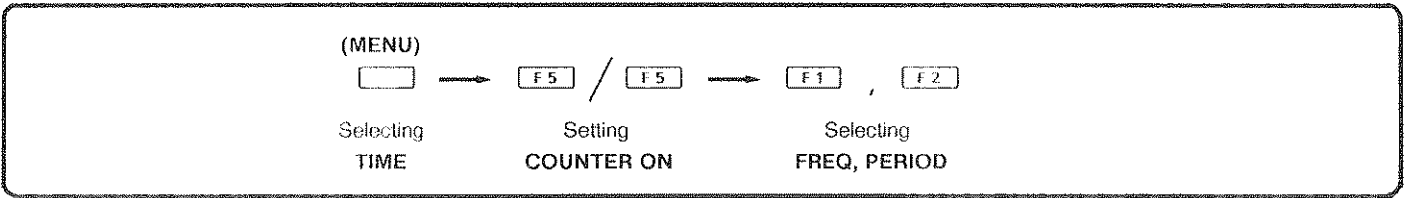
F1

F2



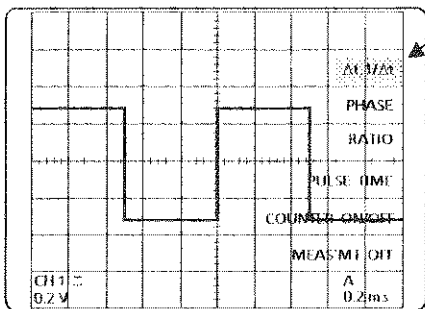
Activates the accurate frequency measurement by the counter.

◆ Key operation



3

◆ Operating procedure



① Press the (MENU) key and select the **TIME** menu.

② Press the F5 key and set the **COUNTER ON/OFF** to the **ON**.

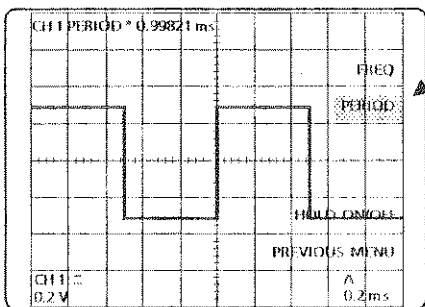
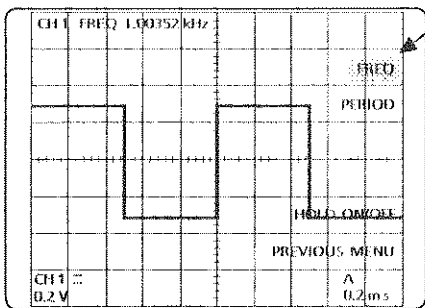
③ Press the F1 **FREQ** or the F2 **PERIOD** key.

F1 **FREQ** key : Frequency measurement

F2 **PERIOD** key : Period measurement

- The frequency or the period measurement is displayed at the top-left corner of the screen.

- When you hold the measurement data, the "*" mark is displayed alongside the measurement result on the screen, e.g. FREQ * 1.00352KHz.



- The **COUNTER** measurement channel is set by the **A TRIG SOURCE**. When you set the **A TRIG SOURCE** to the **VERT** :

VERT MODE	COUNTER measurement channel
CH1,CH2,CH3,CH4	Same as the VERT MODE
CHOP	Lowest numbered channel
ADD,ALT,X-Y	No measurement

One point advice



- When you want to hold the measurement result on the display to take a picture, for instance, press the F5 **HOLD ON /OFF** key to the **ON**. Pressing the again returns to the **OFF**.

- It is necessary to trigger the oscilloscope for the **COUNTER** measurement. Adjust the **A TRIG LEVEL** for the measurement.

MEMO

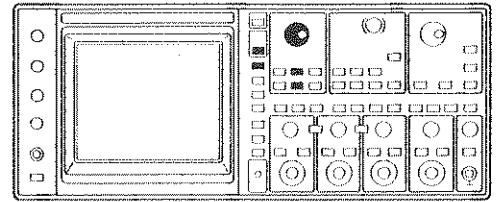


3.25 VOLT MENU

ΔV

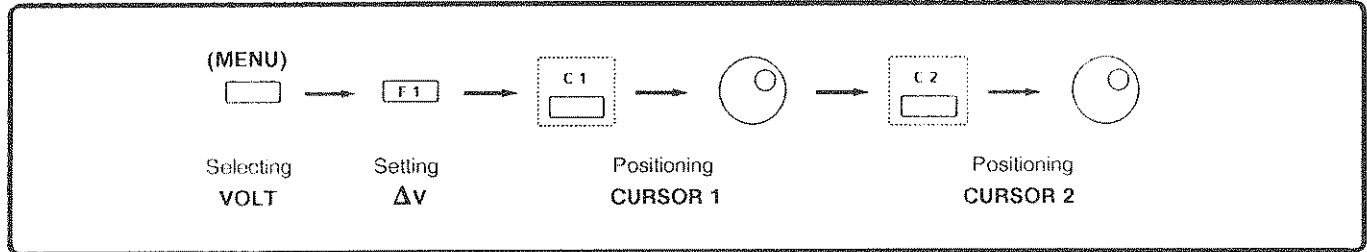
 (MENU)

 F1



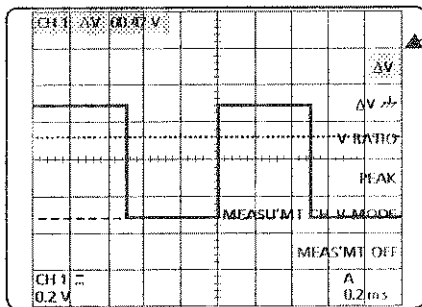
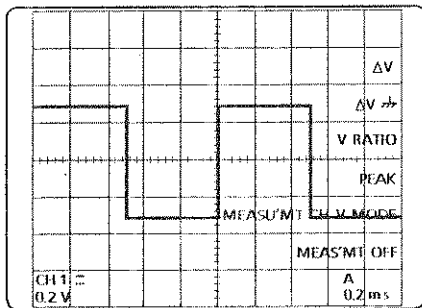
Activates the voltage measurement.

◆ Key operation




3


◆ Operating procedure




① Press the  (MENU) key and select the **VOLT** menu.


② Press the  key and set the **ΔV** measurement.

③ Press the  key and set the **CURSOR 1**.

④ Using the  **CURSOR** knob, position the **CURSOR 1** (---) to the measurement start point.

⑤ Press the  key and set the **CURSOR 2**.

⑥ Using the  **CURSOR** knob, position the **CURSOR 2** (.....) to the measurement stop point.

- Pressing the  **CURSOR** knob forces the cursor to jump one division. The jump direction is set by the last cursor movement direction.

- You can read the delta voltage between the two cursors by reading the CRT readout at the top-left screen.

One point advice




◆ If you position the **CURSOR 2** below the **CURSOR 1**, the measurement result will be a negative value.

◆ You can select the vertical channel for the measurement by setting the **MEAS'MT CH**.

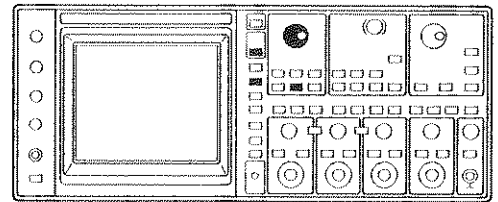
- When you set the **MEAS'MT CH** to the **V MODE**, the vertical display channel is selected as the measurement channel. In the multi-display mode, the lowest numbered channel is selected as a measurement channel.

3.25 VOLT MENU

 (MENU)

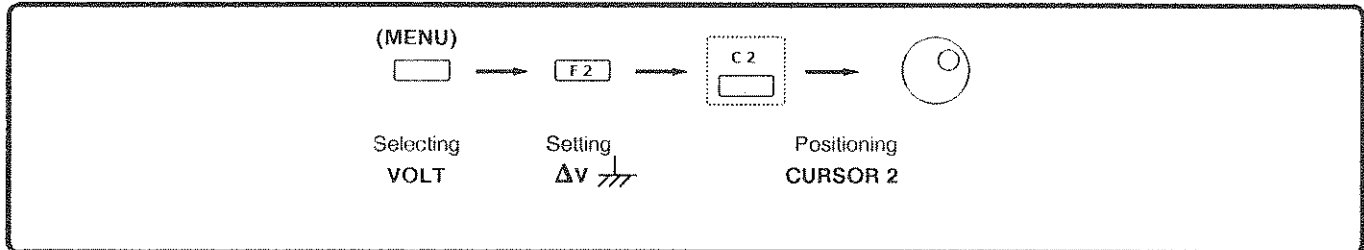
ΔV 

 F2

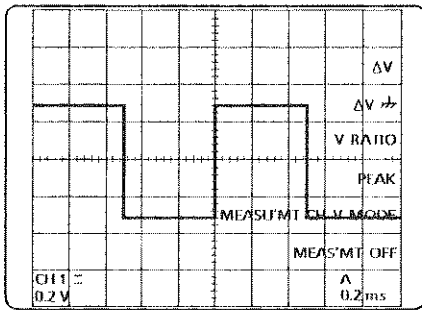



Activates the delta voltage measurement from the ground reference which is set automatically.


◆ Key operation




◆ Operating Procedure




① Press the  (MENU) key and select VOLT menu.

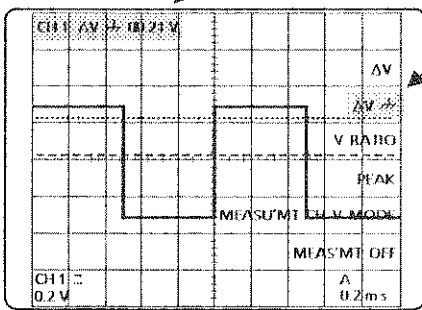
② Press the  key and select ΔV measurement.

The CURSOR 1 automatically jumps to the ground reference.

③ Press the  key and set the CURSOR 2.

④ Using the  CURSOR knob, position the CURSOR 2 to the measurement point of the waveform.

• You can read the voltage from the ground reference by reading the CRT readout at the top-left screen.





One point advice



◆ The ΔV measurement is only available for the CH1 and CH2 vertical channels.

◆ If you position the CURSOR 2 below the CURSOR 1, the measurement result will be a negative value.

• When you want to change the measurement channel, press the  MEAS'MT CH key in the TIME menu. Pressing the  key each time, the measurement channel will be set among V MODE, CH1 and CH2.

• When you set the MEAS'MT CH to the V MODE, the vertical display channel is selected as the measurement channel. In the multi-display mode, the lowest numbered channel is selected as a measurement channel.

• When you activate the ΔV measurement at no display of CH1 and/or CH2, the "SET CH1 or CH2 V MODE ON" message will be displayed. After setting the VERT MODE to CH1 and/or CH2, activate the ΔV measurement.

3.25 VOLT MENU

V RATIO

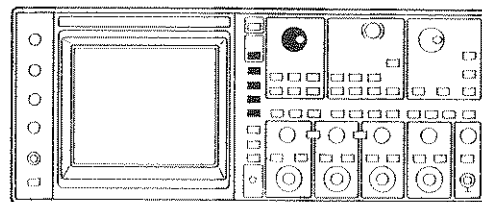
%, dB

(MENU)

F3

F1

F3

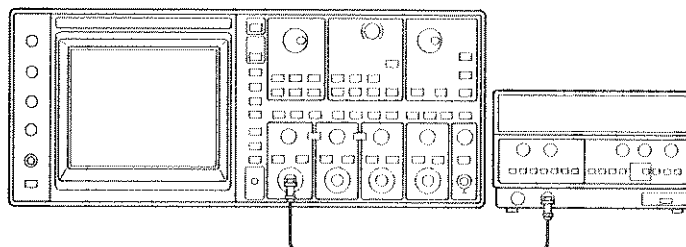


Activates the voltage ratio to the reference voltage.

◆ Preliminary setup

Apply the signal from the generator (i.e. Iwatsu SG-4111) into the CH1 input.

Signal frequency : 1kHz
amplitude : 0.6Vp-p



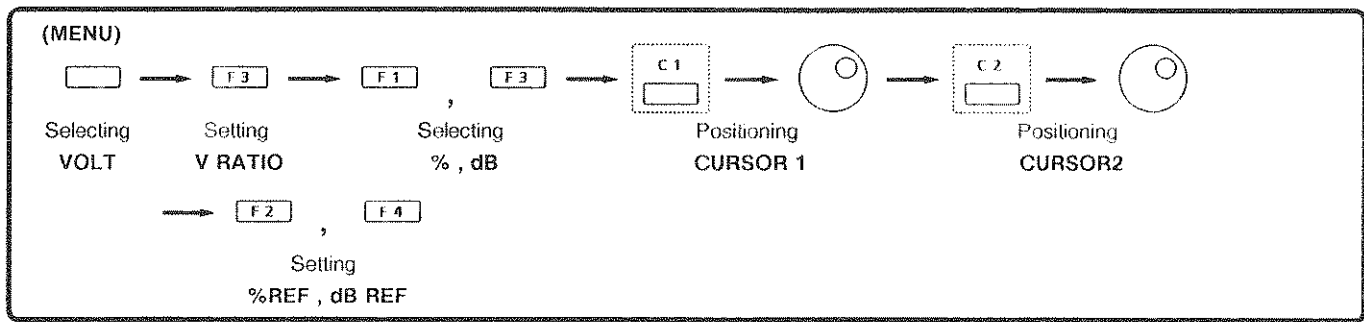
3

One point advice

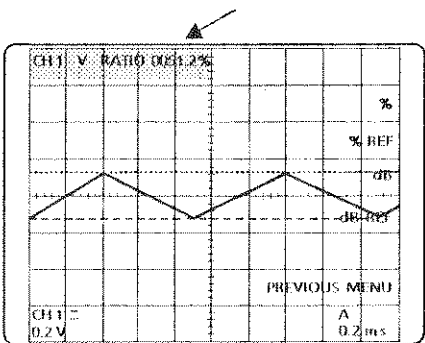
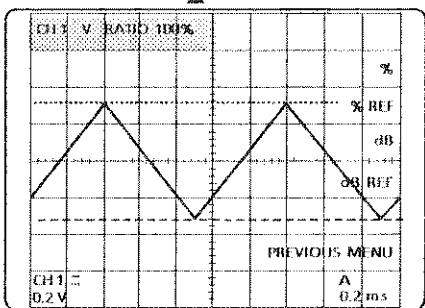
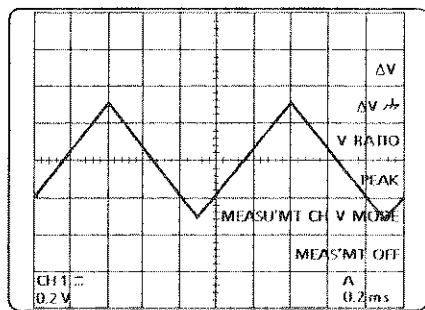


- When you want to change the measurement channel, press the **F5** MEAS'MT CH key in the TIME menu.
- When you set the MEAS'MT CH to the V MODE, the vertical display channel is selected as the measurement channel. In the multi-display mode, the lowest numbered channel is selected as a measurement channel.

◆ Key operation



◆ Operating procedure



- ① Press the (MENU) key and select **VOLT** menu.
- ② Press the F3 key and select **V RATIO** measurement.
- ③ Press the F1 % key or the F3 dB key.
 - F1 % key : ratio in %
 - F3 dB key : ratio in dB
- ④ Press the C1 key and set the **CURSOR 1**.
- ⑤ Using the CURSOR knob, position the **CURSOR 1** to the start level of the reference voltage.
- ⑥ Press the C2 key and set the **CURSOR 2**.
- ⑦ Using the CURSOR knob, position the **CURSOR 2** to the end level of the reference voltage.
- ⑧ Press the F2 % REF key or the F4 dB REF key according to the step 3.
 - The 100 % or the 0 dB readout is displayed respectively. (Decreases the input signal amplitude to the 0.3Vp-p.)
- ⑨ Using the CURSOR knob, position the **CURSOR 2** to the signal plus peak voltage.
- ⑩ Press the C1 key and set the **CURSOR 1**.
- ⑪ Using the CURSOR knob, position the **CURSOR 1** to the signal negative peak voltage.
 - You can read the voltage ratio to the reference by reading the CRT readout at the top-left screen.

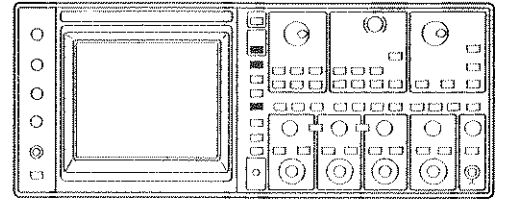
3.25 VOLT MENU

PEAK DC

(MENU)

F4

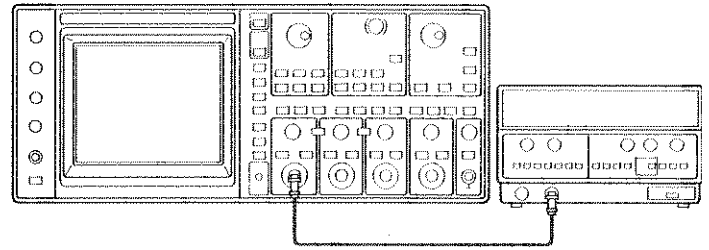
F1



Activates the automatic DC voltage measurement.

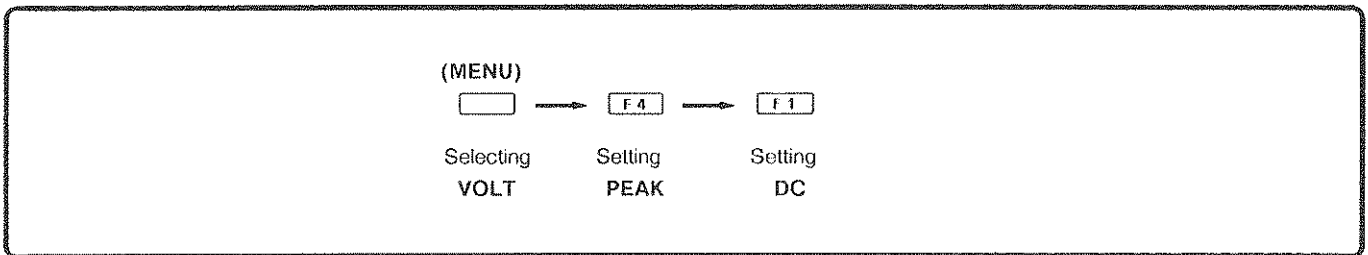
◆ Preliminary setup

Apply the DC voltage from the generator (e.g. Iwatsu SG-4111) to the CH1 input.

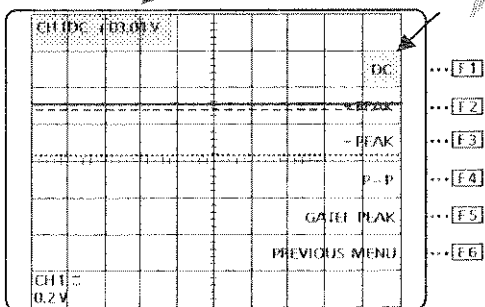
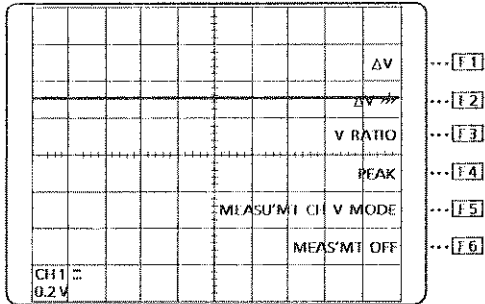


3

◆ Key operation



◆ Operating procedure



① Press the (MENU) key and select the **VOLT** menu.

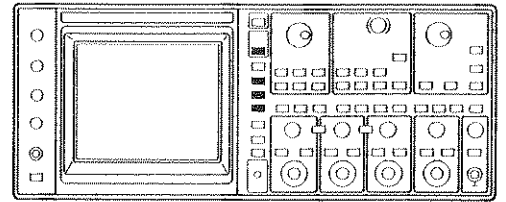
② Press the **F4** key and set the **PEAK** measurement.

③ Press the **F1** key and set the **DC** mode.

- The **CURSOR 1** jumps to the DC voltage level.
- The **CURSOR 2** jumps to the ground reference level.
- The measurement result is displayed at the top-left corner of the screen.

3.25 VOLT MENU

(MENU)

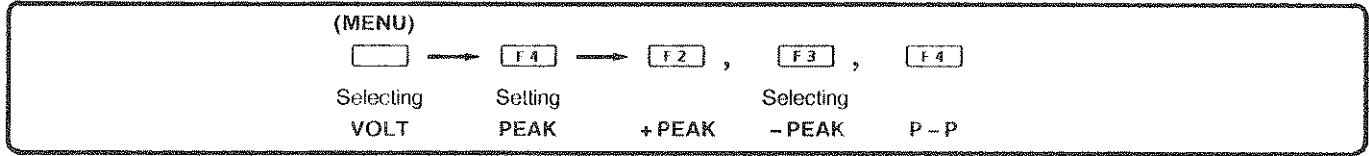


PEAK
+PEAK, -PEAK, P-P

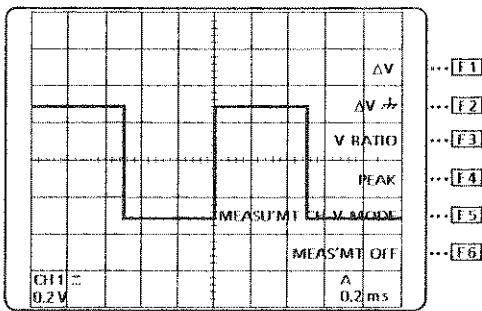
F4
F2, F3, F4

Activates the automatic peak measurement.

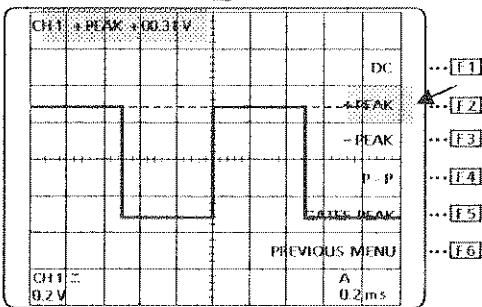
◆ Key operation



◆ Operating Procedure



① Press the (MENU) key and select VOLT menu.



② Press the F4 key and set the PEAK measurement.

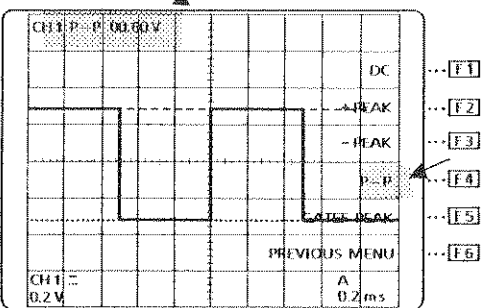
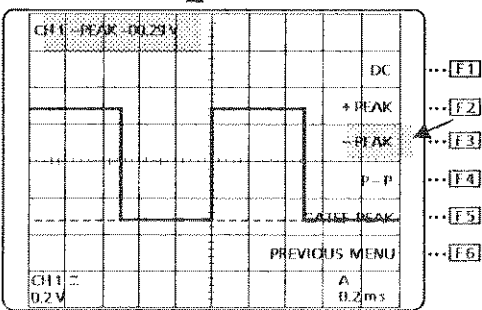
③ Press the F2, F3, or F4 key.

- The F2 +PEAK key : sets for the plus measurement.

- The F3 -PEAK key : sets for the minus measurement.

- The F4 P-P key : sets for the peak to peak measurement.

- The peak value is displayed at the top-left corner of the screen.



One point advice



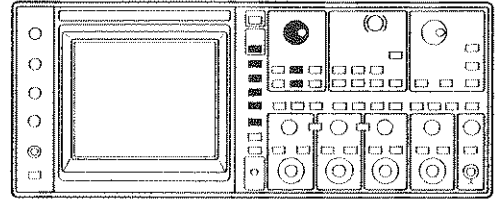
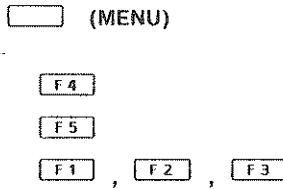
- When you set the peak measurement in the multiple display mode of the VERT MODE, The SET V MODE CH1 or CH2 error message will prompt you to change the VERT MODE to the CH1 or CH2 display mode.

- The +PEAK and -PEAK voltage are measured from the ground reference voltage which is sought automatically.

- The P-P voltage is measured between the two cursors.

3.25 VOLT MENU

PEAK
GATED PEAK
GATED +P, GATED-P, GATED P-P



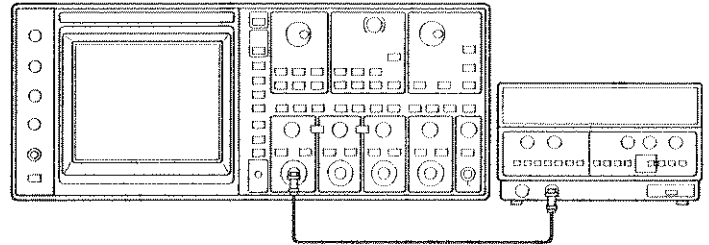
Activates the peak measurement within the time window defined by the marker or the intensified portion.

◆ Preliminary setup

Apply the signal from the signal generator (e.g. Iwatsu SG-4111) to the CH1 input.

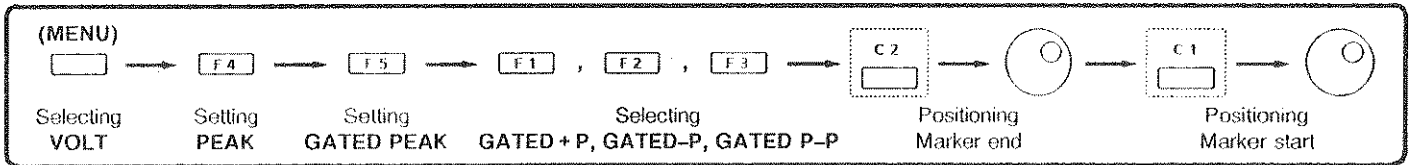
Signal Frequency : 1kHz

Amplitude : 0.6Vp-p

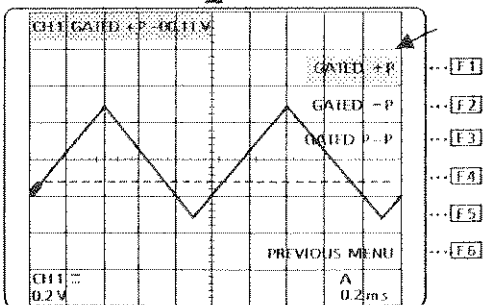
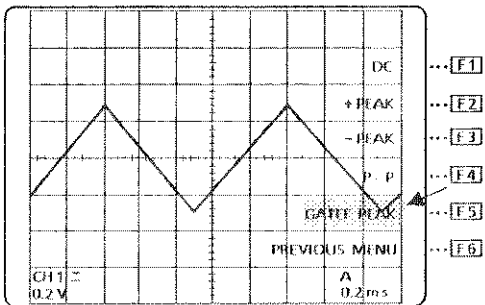
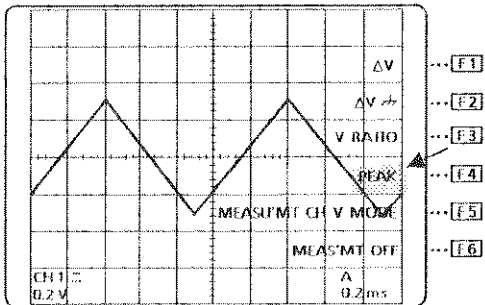


3

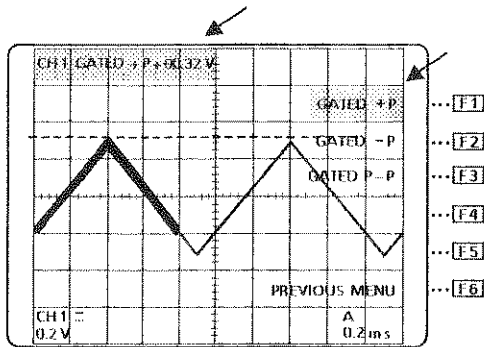
◆ Key operation





◆ Operating procedure





- ① Press the **(MENU)** key and select the **VOLT** menu.
- ② Press the **F4** key and set the **PEAK** measurement.
- ③ Press the **F5** key and set the **GATED PEAK** measurement.
- ④ Press the **F1**, **F2**, or **F3** key to obtain the marker at the sweep start.
 - The **F1** key : sets the plus peak measurement.
 - The **F2** key : sets the minus peak measurement.
 - The **F3** key : sets the peak to peak measurement.



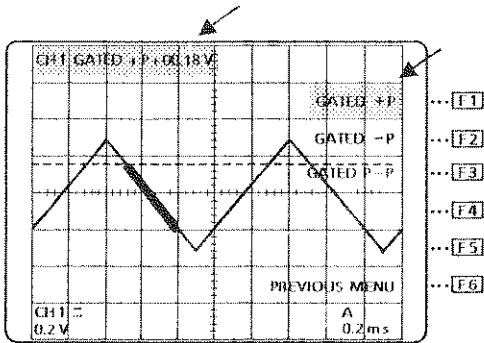
⑤ Press the  key for positioning the marker end.

⑥ Using the  **CURSOR** knob, position the marker end to the end of the time window.

⑦ Press the  key for positioning the marker start.

⑧ Using the  **CURSOR** knob, position the marker start to the start of the time window.

- The **GATED PEAK** measurement result is displayed at the top-left corner on the screen.



One point advice



- When you set the peak measurement in the multiple display mode of the **VERT MODE**, The **SET V MODE CH1** or **CH2** error message will prompt you to change the **VERT MODE** to the **CH1** or **CH2** display mode.
- The **+PEAK** and **-PEAK** voltage are measured from the ground reference voltage which is sought automatically.

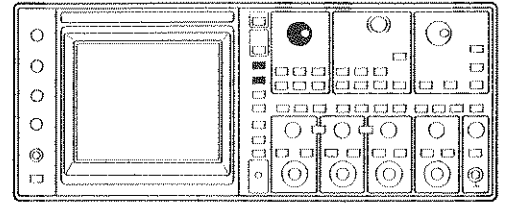
- The **P-P** voltage is measured between the two cursors.
- Set the **HORIZ DISPLAY** to the **A**, otherwise the "SET H DISP A" error message will be displayed.

3.26 SUB MENU

(MENU)

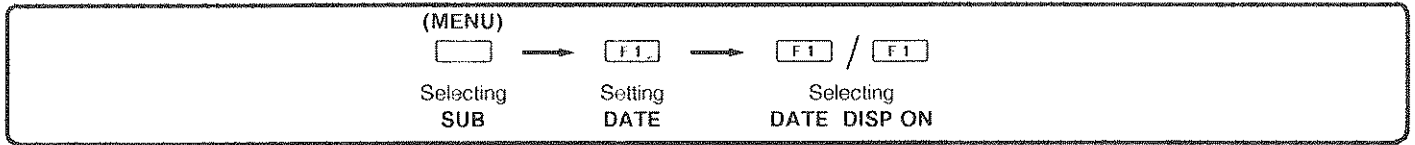
DATE

F1

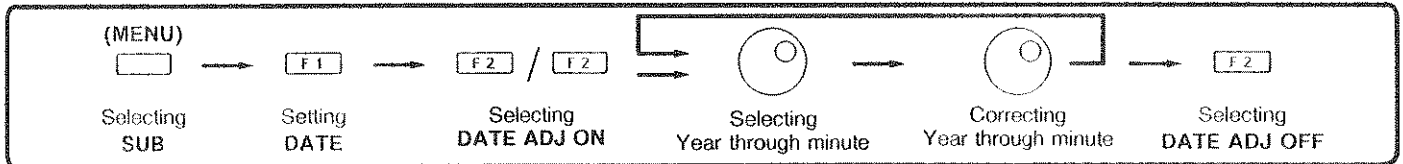


Allows you to display or set the date and time.

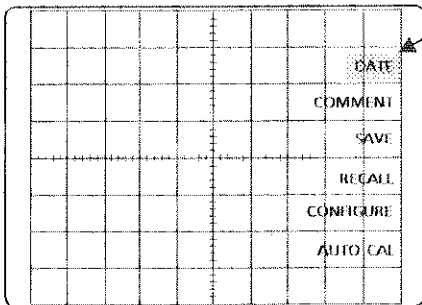
◆ Key operation for displaying the data and time



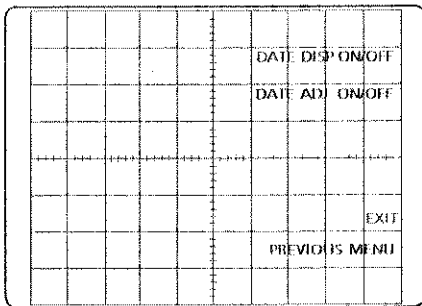
◆ Key operation for setting the data and time



◆ Operating procedure



① Press the (MENU) key and select the **SUB** menu.



② Press the F1 key and select the **DATE** mode.

③ Press the F2 **DATE DISP ON/OFF** key and set to the **ON**.

Setting the date and time.

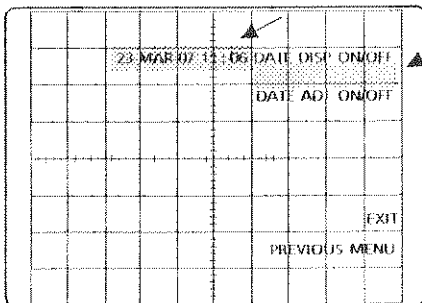
④ Push the CURSOR knob and select the item for the correction.

The selected item will blink.

⑤ Using the CURSOR knob, correct and set the item.

⑥ Repeat step ④ and ⑤ until all corrections will be done.

⑦ Press the F2 key and finish the correction.



One point advice

◆ To finish the date and time display :

- Press the F1 key and set the **DATE DISP OFF**.
- Press the F5 **EXIT** key and set the last measurement setup.
- Press the F6 **PREVIOUS MENU** key and set the **SUB** menu display.

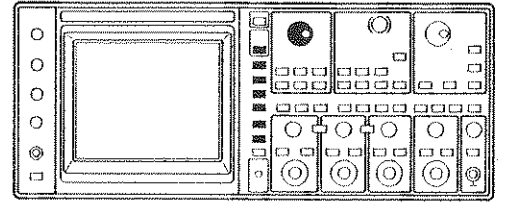


3.26 SUB MENU

(MENU)

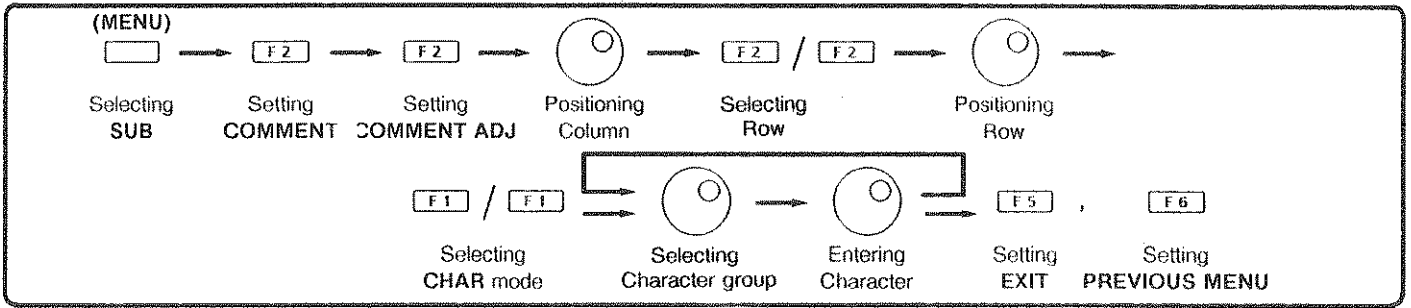
WRITING COMMENT

F2

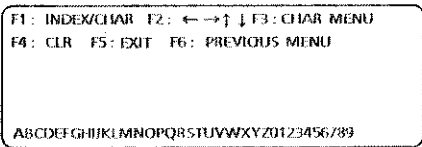
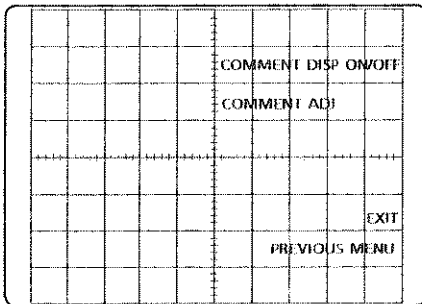
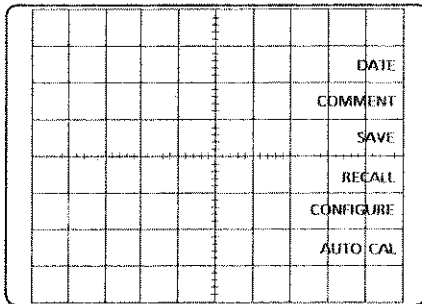


Allows you to write the comment at the enter marker on the screen.

◆ Key operation



◆ Operating procedure



ABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789
 abcdefghijklmnopqrstuvwxyz 0123456789
 ! " # \$ % & ' () * + , - . / : ; < = > ? @ { } ^ _ ` [] ~ ± × ÷ ≤ ≥ ≅ ∞ ∼ ∥ [] → ← ↑
 ↓ Ω μ π ° / 0123456789

- ① Press the (MENU) key and select the **SUB** menu.
- ② Press the F2 key and set the **COMMENT** menu.
- ③ Press the F2 key and set the **COMMENT ADJ** menu.
- ④ Using the CURSOR knob, position the enter marker to the desired column.
- ⑤ Press the F2 key and set the row position mode.
- ⑥ Using the CURSOR knob, position the enter marker to the desired row.
- ⑦ Press the F1 INDEX/CHAR key and set the **CHAR** mode by letting the **CHAR** message to blink.
- ⑧ Press the F3 CHAR MENU key to obtain the character groups including the character you want.
Using the CURSOR knob, select the character within the character groups.
The selected character is indicated by the bar below the character.
- ⑨ Push the CURSOR knob and enter the character.
- ⑩ Repeat the step 8 and 9 until the whole comments are entered.
Press the F5 EXIT key or the F6 PREVIOUS MENU key and finish entering the comment.

One point advice



- If you want to clear the comment of the screen temporarily, set the COMMENT DISP ON/OFF to the OFF in the COMMENT menu.
- You can enter the characters up to eighty including space character.

3.26 SUB MENU

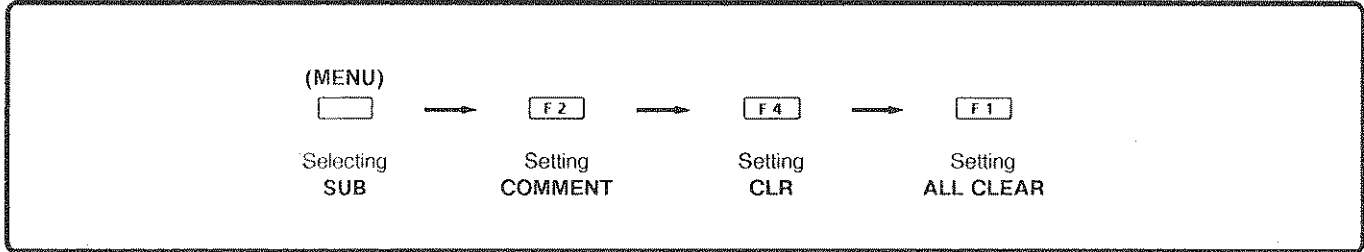
(MENU)

CLEARING COMMENT

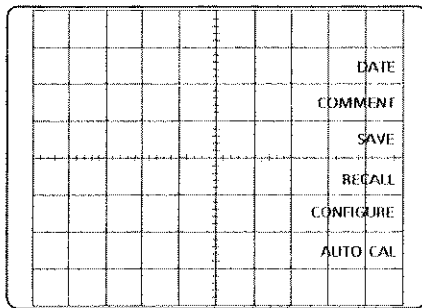
F2

Allows you to clear the comment in the memory.

◆ Key operation



◆ Operating Procedure

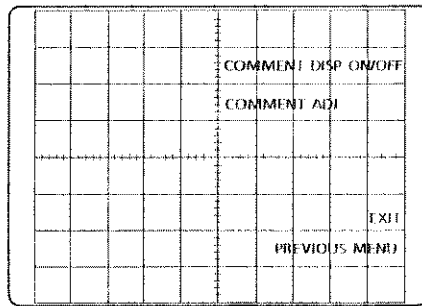


① Press the (MENU) key and select the **SUB** menu.

② Press the F2 key and set the **COMMENT** menu.

③ Press the F4 key and set the **CLR** menu.

④ Press the F1 **ALL CLEAR** menu and clear all the comment.
Press the F5 **EXIT** key and return to the measurement.




F1: INDEX/CHAR F2: ← → ↑ ↓ F3: CHAR MENU
F4: CLR F5: EXIT F6: PREVIOUS MENU

ABCDEFGHIJKLMN OPQRSTU VWXYZ0123456789

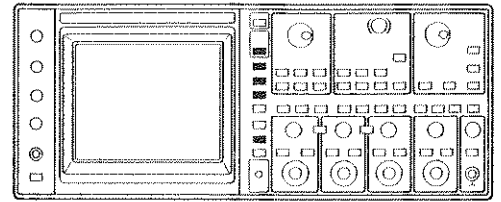
F1: ALL CLEAR F5: EXIT F6: PREVIOUS MENU

3.26 SUB MENU

 (MENU)

SAVE

 F3



Allows you to save the setups up to 10.

◆ Preliminary setup

Set the oscilloscope to the desired setup to save.

◆ Key operation

3

(MENU)



Selecting
SUB

→



Setting
SAVE

→



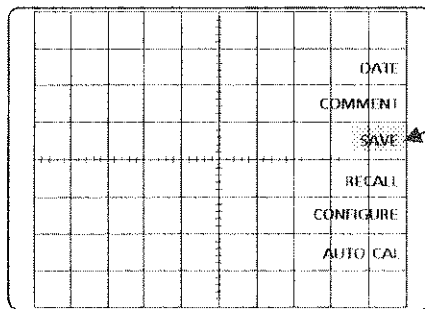
Selecting
Address

→





Setting
ENTRY


◆ Operating procedure

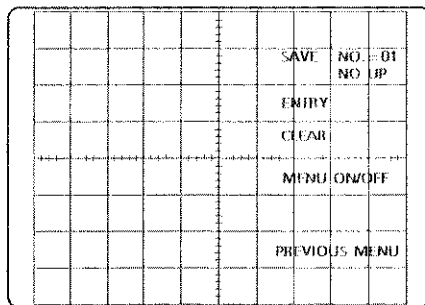


① Press the  (MENU) key and select the **SUB** menu.

② Press the  key and set the **SAVE** menu.

③ Press the  key several times to obtain the address number into which you want to save the setup.



④ Press the  key and save the setup.




One point advice



◆ When you want to clear the setup memory:

- ① Press the  key several times in the **SAVE** menu and select the address number at which you want to erase.
- ② Press the  **CLEAR** key.
- Overwriting the memory erases the old setup previously saved.

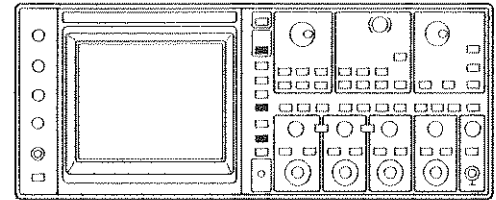
◆ If you want to see the setup readouts overwritten by the **SAVE** menu, press the  **MENU ON/OFF** key to set the display off.

◆ The setup conditions which can not be saved are:

- **CH3** and **CH4** positions
- Date and time
- **INTENSITY**, **FOCUS**, **SCALE** and **READOUT** intensity control levels

3.26 SUB MENU

(MENU)

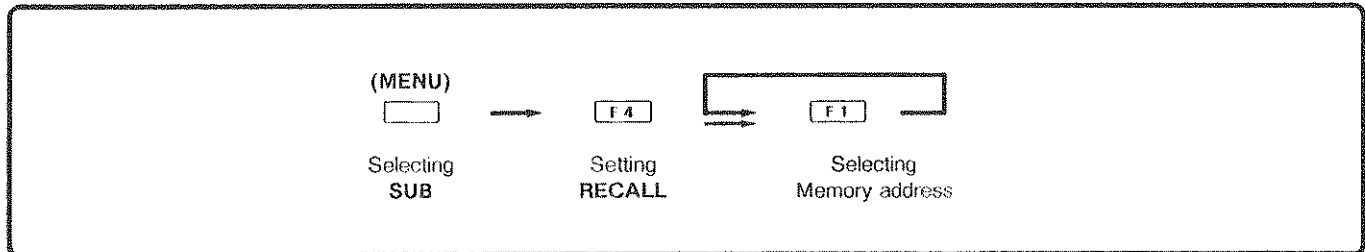


RECALL

F4

Allows you to recall the saved setup up to 11.

◆ Key operation



◆ Operating Procedure

					DATE	...[F1]
					COMMENT	...[F2]
					SAVE	...[F3]
					RECALL	...[F4]
					CONFIGURE	...[F5]
					AUTO CAL	...[F6]

① Press the (MENU) key and select the SUB menu.

② Press the F4 key and set the RECALL menu.

③ Press the F1 key several times and select the address from which you want to recall the setup.

- You cannot select the empty address.

					RECALL NO. = 00	...[F1]
					NO LP	...[F2]
						...[F3]
					MENU ON/OFF	...[F4]
						...[F5]
					PREVIOUS MENU	...[F6]

One point advice



At the address 00, the last setup before you recall is saved for your safety.

- If you want to see the setup readouts overwritten by the SAVE menu message, press the F4 MENU ON/OFF key to set the display off.

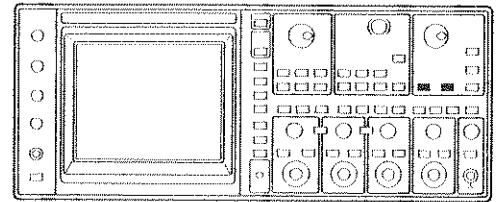
3.26 SUB MENU

CONFIGURE PEAK CAL

 (MENU)

 F5

 F1



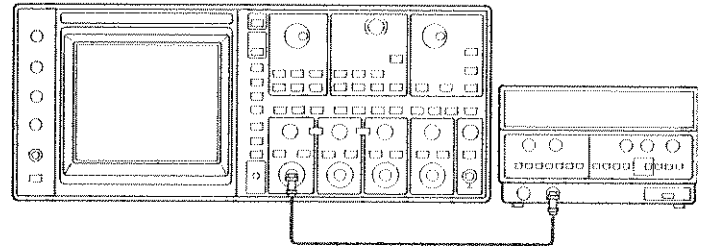
Allows you to minimize the peak measurement error caused by the environment change.

◆ Preliminary setup

Apply the signal from the signal generator, e. g. Iwatsu SG-4111, into the CH1 input.

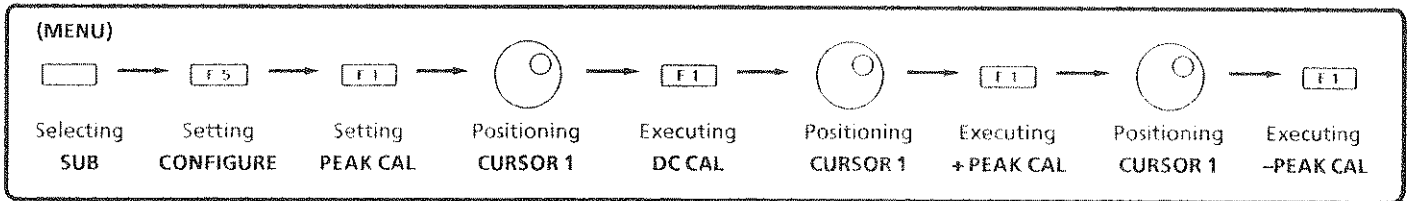
Frequency : 1kHz sine wave

Amplitude : 0.8Vp-p

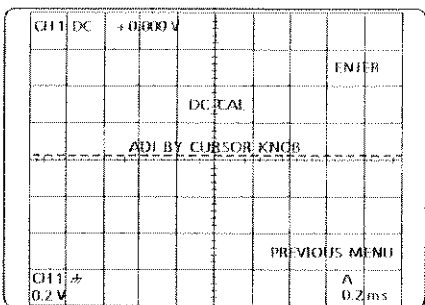
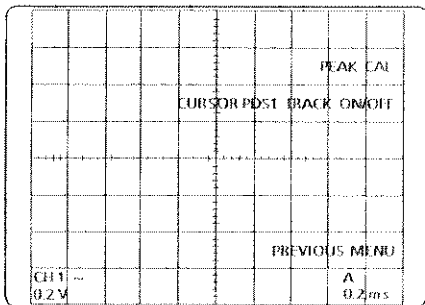
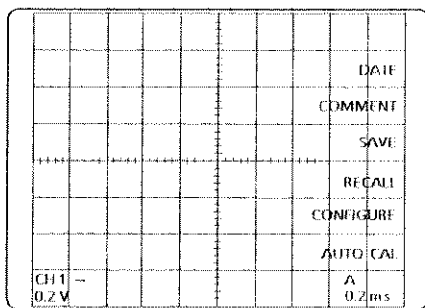







3

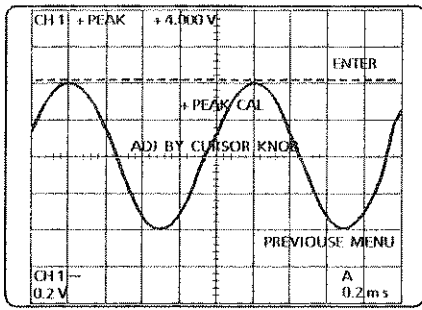
◆ Key operation




◆ Operating procedure



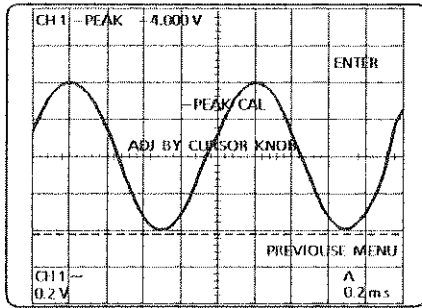
- ① Press the  (MENU) key and select the menu.
- ② Press the  key and set the **CONFIGURE** function.
- ③ Press the  key and set the **PEAK CAL**.
 - The **CH1 GND** coupling will be automatically set and the ground level will be displayed.
 - The **VOLT CURSOR 1** will be set and displayed.
- ④ Using the  CURSOR knob, position the **CURSOR 1** to the ground level trace.
- ⑤ Press the  key and execute the **DC CAL**.
 - **+PEAK CAL** mode will be set after the **DC CAL** mode is done.
 - The **CH1** input coupling will be set to the **AC**.




⑥ Using the  CURSOR knob, position the **CORSOR 1** to the plus peak voltage of the signal.

⑦ Press the **F1** key and execute the **+ PEAK CAL**.

- **- PEAK CAL** mode will be set after the **+ PEAK CAL** is done.



⑧ Using the  CURSOR knob, position the **CORSOR 1** to the minus peak voltage of the signal.

⑨ Press the **F1** key and execute the **- PEAK CAL**.

- The **SUB** menu will be displayed after the all calibration are done.



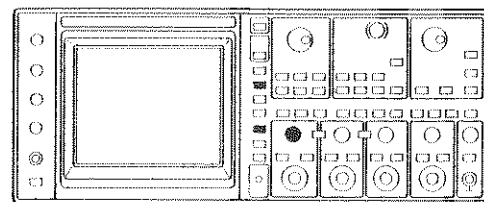
3.26 SUB MENU

CONFIGURE CURSOR POSI TRACK

(MENU)

F5

F2

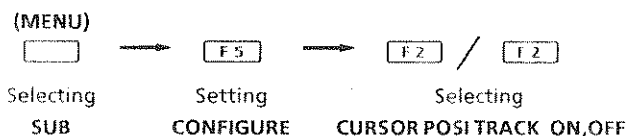


Allows the cursors to track the vertical positioning. When the **CORSOR POSI TRACK** mode is on, the cursors follow trace as you move the trace up and down.

◆ Preliminary setup

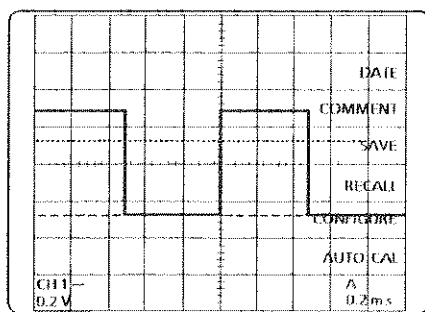
Activate the delta cursor measurement and set the cursors to the peak to peak value of the signal.

◆ Key operation



3

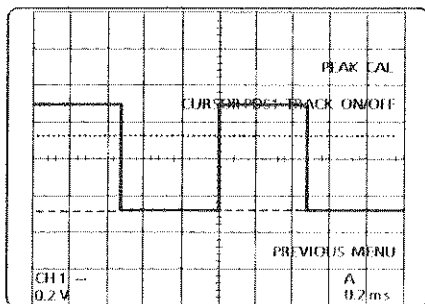
◆ Operating procedure



① Press the (MENU) key and select the **SUB** menu.

② Press the F5 key and set the **CONFIGURE** function.

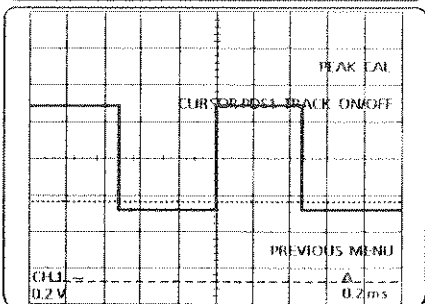
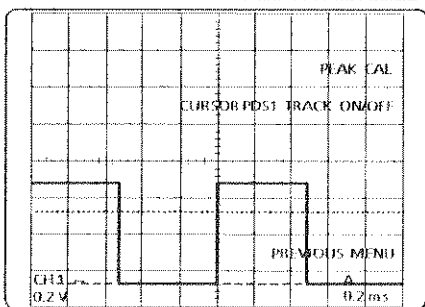
③ Press the F2 **CURSOR POSI TRACK ON/OFF** key and set on.



④ Using the knob, move the trace up and down. The cursors will follow the trace.

ON : The cursors will follow the trace.

OFF : The cursors will not follow the trace.




One point advice



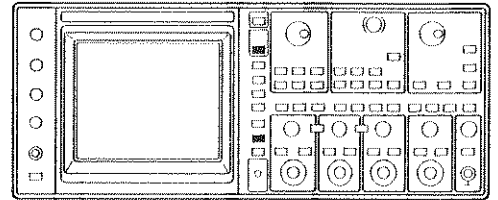
- Regardless of the **CURSOR POSI TRACK ON** or **OFF**, the cursors will be set automatically in the **PEAK** measurement mode.
- When the **CH2** is set to **INV**, the **CURSOR POSI TRACK ON** is not available.

3.26 SUB MENU

 (MENU)

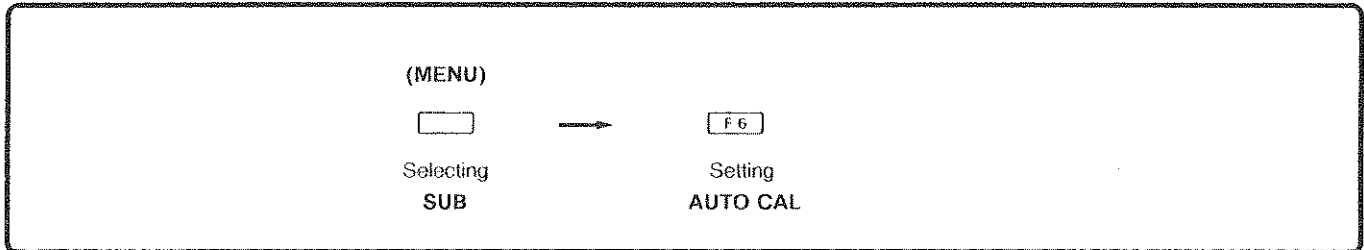
AUTO CAL

 F 6

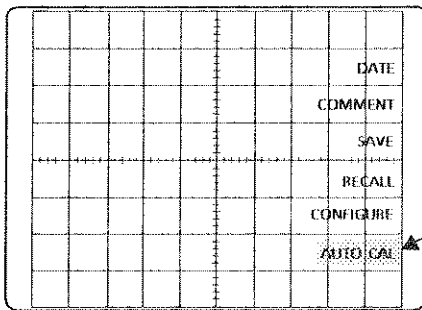



Allows to calibrate the attenuator dc balance automatically.


◆ Key operation



◆ Operating procedure



① Press the  (MENU) key and set the SUB menu display.

② Press the  key and set the AUTO CAL function.

- The message "AUTO CALL START" will be displayed at the center screen.
- When the AUTO CAL function is done, the message "AUTO CAL COMPLETE" will be displayed at the center screen.

One point advice



- Apply no signal into the CH1 and CH2 inputs during the AUTO CAL operation.
- No AUTO CAL function is available for the CH3 and CH4 inputs.
- Do not turn the power off during the AUTO CAL execution. When the power goes off during the AUTO CAL execution, execute the AUTO CAL again after turning the power on.

MEMO

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Applications

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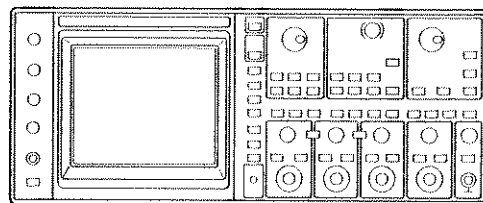
MEMO

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4. APPLICATIONS

Differential measurement

Provides the instantaneous result of the signal difference between the two signals by using the **ADD** and **CH2 INV** functions.

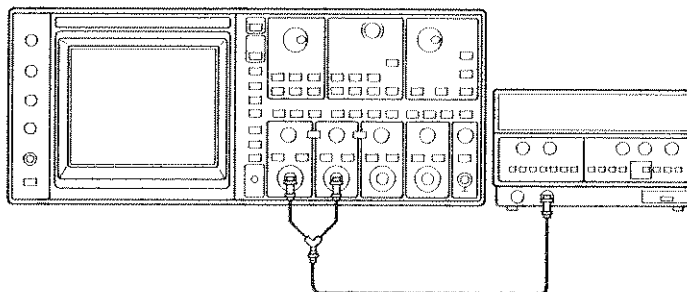


◆ Preliminary setup

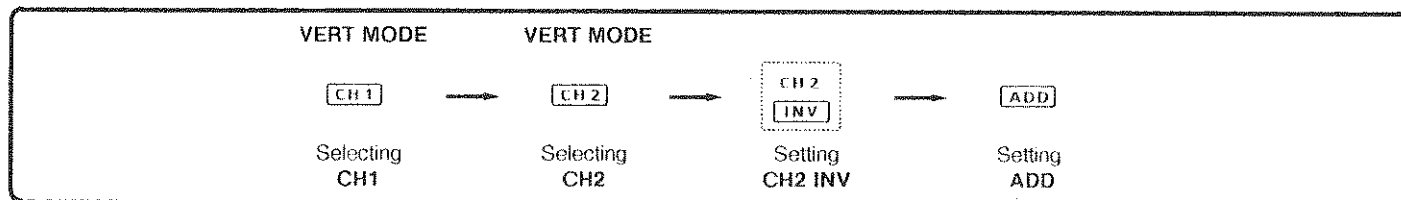
Apply the signals from the generator (e.g. Iwatsu SG-4111) into the **CH1** and **CH2** inputs.

Frequency : 1kHz

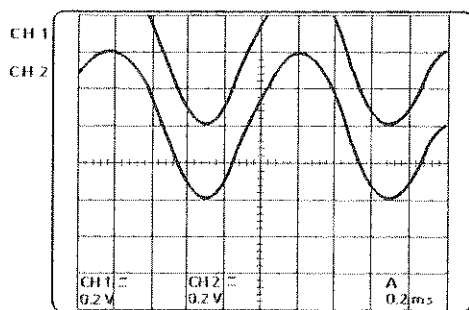
Amplitude : 0.8V_{P-P}



◆ Key operation

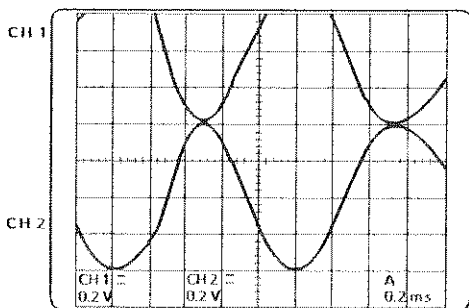


◆ Operating procedure

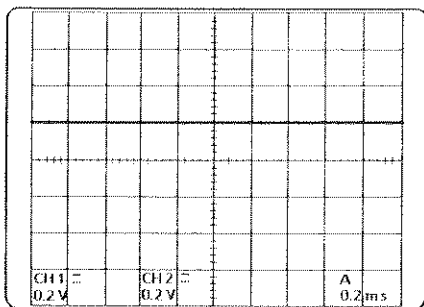


① Press the **CH1** and **CH2** keys display the **CH1** and **CH2** traces on the screen.

② Press the **INV** key and invert the **CH2** signal polarity.

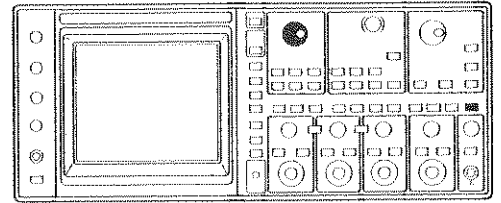
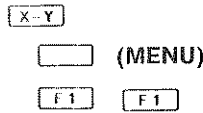


③ Press the **ADD** key and set the differential measurement mode.



4. APPLICATIONS

Phase difference measurement $\Delta X, \Delta Y$



Displaying the Lissajous pattern in the X-Y operation, you can measure the phase difference between the two signals.

◆ Preliminary setup

- Apply the signal from the signal generator (e. g. Iwatsu SG-4111) into the **CH1** input.
- Apply the signal from the signal generator into the **CH2** input via the signal conditioner.

The signal generator

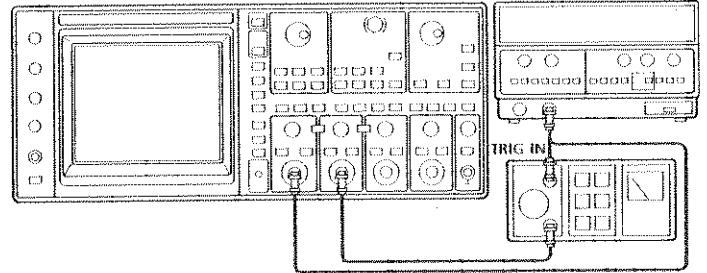
Frequency : 1kHz
Amplitude : 0.7Vp-p

The signal conditioner

Phase between the input and output : Variable
Output amplitude : 1Vp-p

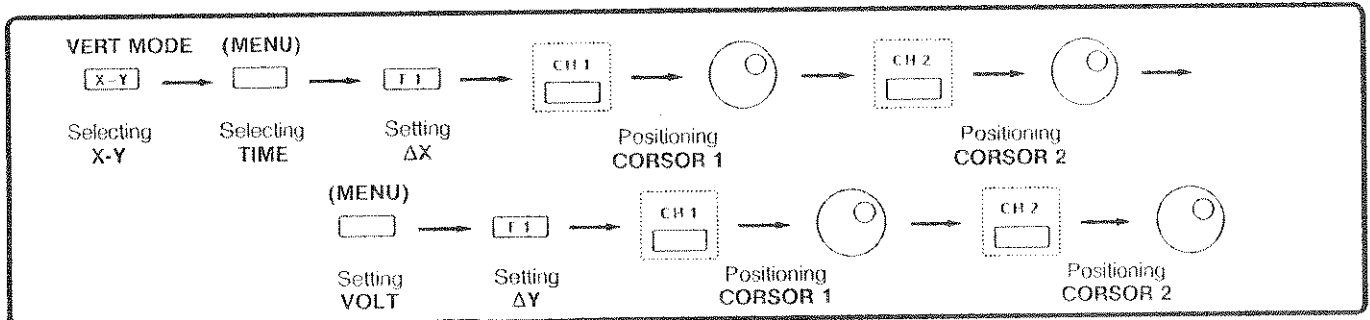
The oscilloscope setup

CH1 and CH2
VOLTS/DIV : 0.2V/div
VERT MODE : CH2

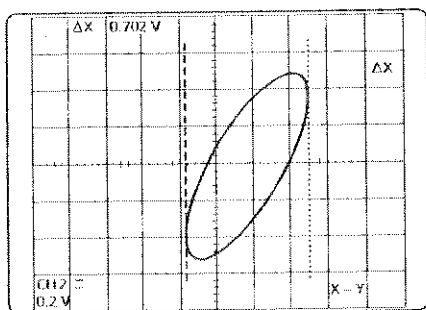


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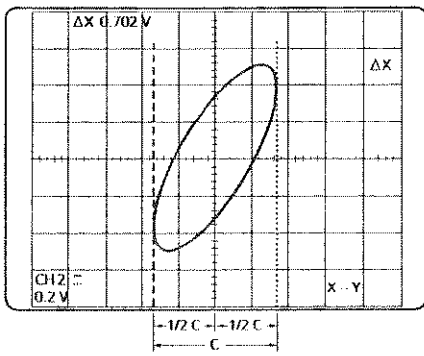
◆ Key operation








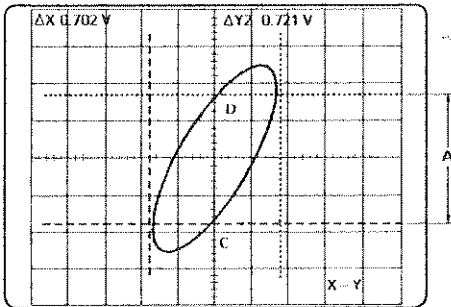
◆ Key operation








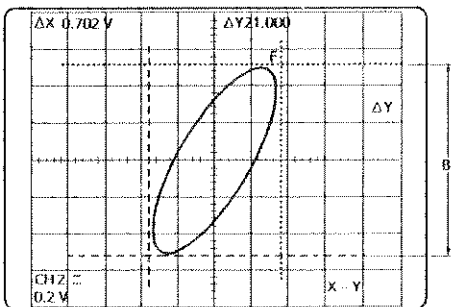
- ① Press the **X-Y** key and set the **X-Y** operation. The Lissajous pattern will be displayed.
- ② Press the **(MENU)** key and set the **TIME** measurement menu.
- ③ Press the **F1** key and set the ΔX measurement.
- ④ Press the **CH1** key and set the vertical **CURSOR 1**.
- ⑤ Using the **CURSOR** knob, position the **CURSOR 1** to the left end of the display pattern.
- ⑥ Press the **CH2** key and set the vertical **CURSOR 2**.






- ⑦ Using the  **CURSOR** knob, position the **CURSOR 2** to the right end of the pattern.
- ⑧ Press the  key again and set the cursor tracking mode.
 - The cursor 1 and cursor 2 LED indicators will light.
- ⑨ Using the  **CURSOR** knob, position the two cursors at the screen center over the center vertical scale line.
- ⑩ Using the  knob, position the pattern to fit in between the two cursors.
- ⑪ Press the  (**MENU**) key and set the **VOLT** measurement menu.



- ⑫ Press the  key and set the ΔY measurement.
- ⑬ Press the  key and set the horizontal **CURSOR 1**.
- ⑭ Using the  **CURSOR** knob, position the **CURSOR 1** to the lower crossing (point C) between the pattern and the center vertical scale line.
- ⑮ Press the  key and set the horizontal **CURSOR 2**.
- ⑯ Using the  **CURSOR** knob, position the **CURSOR 2** to the upper crossing (point D) between the pattern and the center vertical scale line.



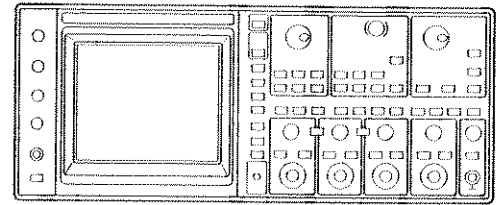
- Write down the $\Delta Y2$ measurement value at the right and topcorner of the screen as value A.
- ⑰ Using the  **CURSOR** knob, position the **CURSOR 2** to the top end (point F) of pattern.
 - ⑱ Press the  key and set the horizontal **CURSOR 1**.
 - ⑲ Using the  **CURSOR** knob, position the **CURSOR 1** to the bottom end (point E) of the pattern.
 - Write down the $\Delta Y2$ measurement value as value B.
Calculate the phase difference as:

$$\text{Phase difference} = \text{SIN}^{-1} \frac{A}{B}$$

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4. APPLICATIONS

Delayed Sweep



There are two ways of continuous delay and triggered delay.

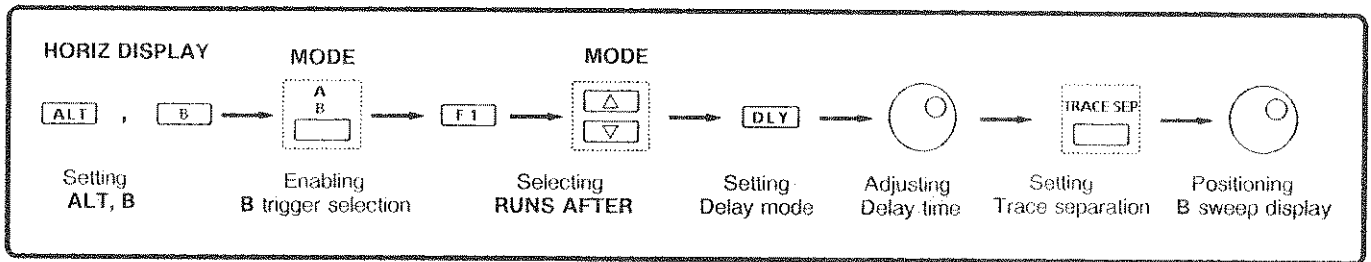
The continuous delay called **RUNS AFTER** allows to delay and display the signal continuously.

The triggered delay allows to trigger the oscilloscope by the trigger signal after the delay time set by the **DLY TIME** control.

The triggered delay has the advantage of the reduced delay jitter, but the disadvantage of the discrete delay time.

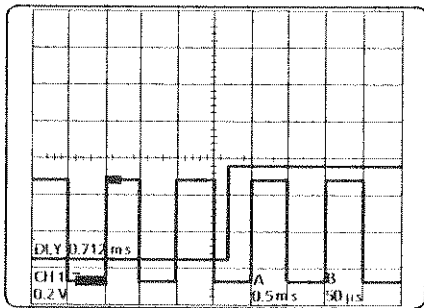
◆ Continuous delay

◆ Key operation



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◆ Operating procedure



Enabling B trigger selection

- 1 Press the **ALT** or the **B** key and set the **ALT** or **B** display mode.

In this example, set the **ALT** display mode.

- 2 Press the **MODE** key and enable the **B** trigger selection.
- 3 Press the **F1** key and select the **RUNS AFTER** or the continuous delay mode. Press the **MODE** key and exit the **B** trigger menu.

- 4 Press the **DLY** key and set the delay mode.

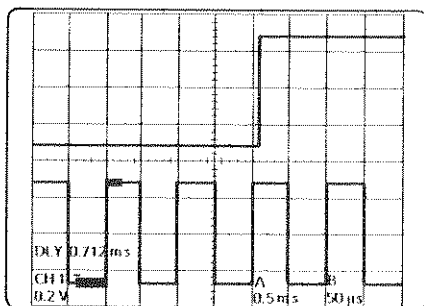
- 5 Using the **RANGE** knob, adjust the delay time.

- The delay time is defined as the period from the **A** sweep start to the **B** sweep start.
- The intensified portion in the **A** sweep display is correspond to the **B** sweep display.

The following procedure describes how to separate the **B** sweep display from the **A** sweep display.

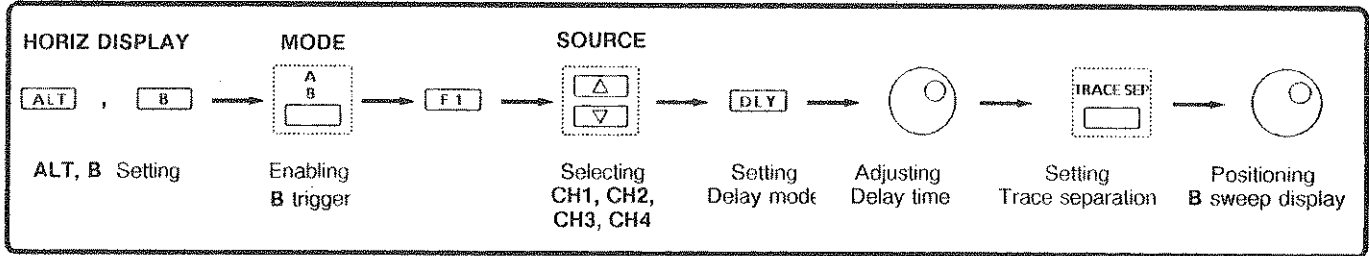
- 6 Press the **TRACE SEP** key and set the **TRACE SEP** function.

- 7 Using the **CORSOR** knob, position the **B** sweep display.

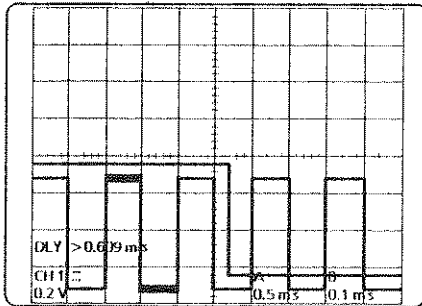


◆ Triggered delay

◆ Key operation



◆ Operation procedure



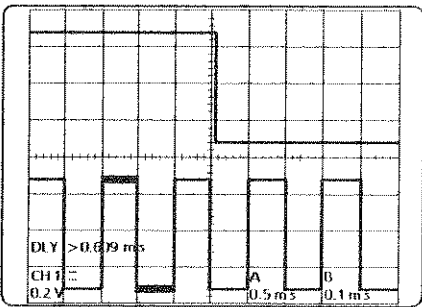
① Press the **ALT** or the **B** key and set the **ALT** or **B** display mode. In this example, set the **ALT** display mode.

② Press the **MODE** key and enable the **B** trigger selection.

③ Press the key and set the **CH1**, **CH2**, **CH3**, or **CH4** trigger source. In this example, set the **CH1** trigger source.

④ Press the **DLY** key and set the delay mode.

⑤ Using the **RANGE** knob, adjust the delay time.



⑥ Press the **TRACE SEP** key and set the **TRACE SEP** function.

⑦ Using the **CURSOR** knob, position the **B** sweep display.

• The magnification ratio is calculated as:

$$\text{Magnification ratio} = \frac{\text{A sweep rate}}{\text{B sweep rate}}$$

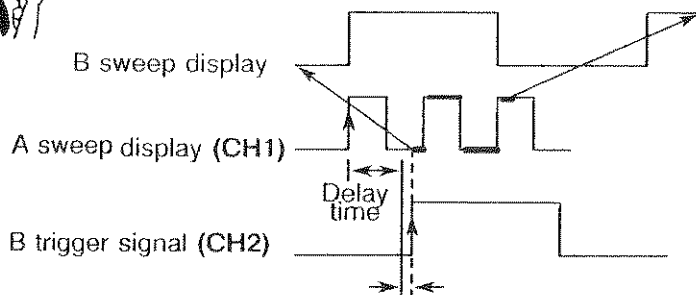
One point advice



• The following timing charts are illustrated under:

A trigger signal : CH1

B trigger signal : CH2

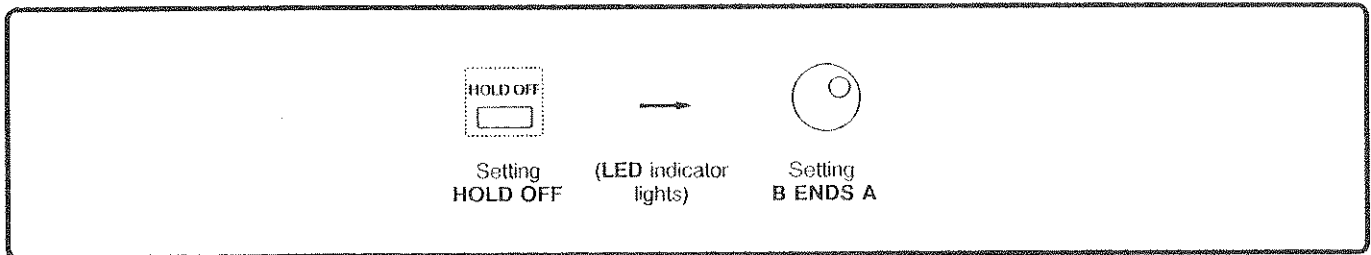


• As in the charts, the **B** sweep starts by the first **B** trigger signal after the delay time. Therefore, the **DLY** value on the screen does not show the actual delay time and it is stamped with the ">" mark alongside.

◆ B ENDS A

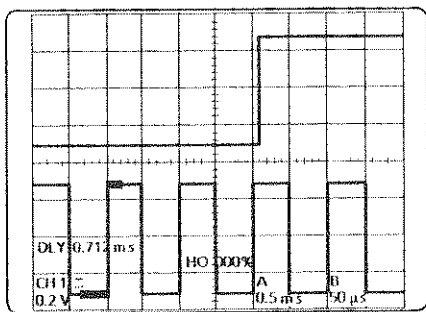
Terminates the **A** sweep when the **B** sweep ends. Allows to increase the sweep repetition rate and the intensity for the better viewing.



◆ Key operation

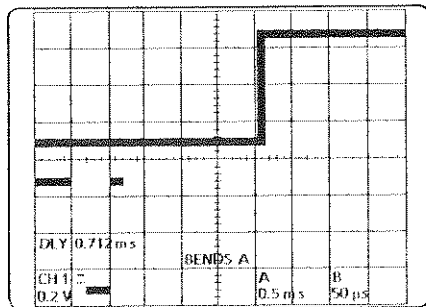


◆ Operating procedure

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- ① Press the  key and set the **HOLD OFF**.
- ② Push the  **CURSOR** knob and set the **B ENDS A** function.
 - The **A** sweep ends at the last of the intensified portion, or the end of the **B** sweep.



One point advice



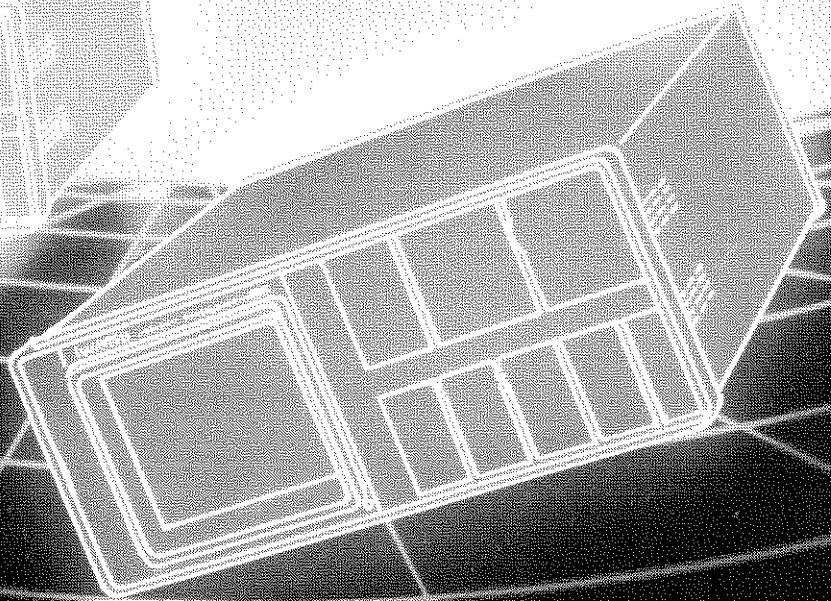
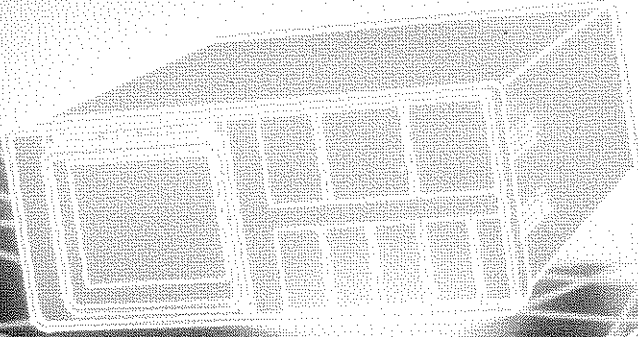
- Push  **CURSOR** knob again to exit the **B ENDS A** function.
- When you activate the **B ENDS A** function, you cannot access the **HOLD OFF** controls.

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Daily Check



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5. DAILY CHECK

Cleaning

This page describes how to clean the oscilloscope to keep it in good condition over a long period of time.

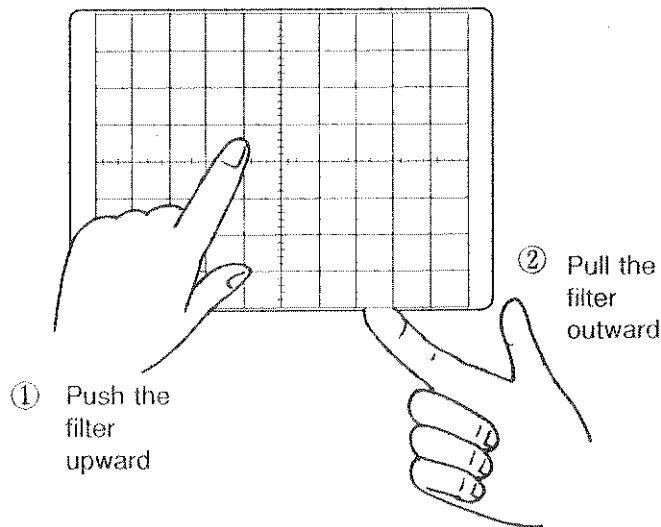
◆ Follow the next instructions

◇ Use the appropriate cleaner.

Clean the covers and panels gently with the soft cloths dipped in the water or the mild detergent. Using the prohibited cleaner in the list may change the coloring or cause the unexpected damage.

Recommended cleaner	Prohibited cleaner
Water, mild detergent	Acetone, gasoline, ether, alcohol, lacquer, thinner, methyl-ethyl-ketone, detergent containing ketone

◇ How to take off the filter

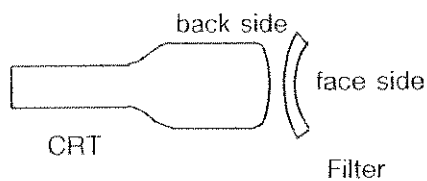


* The filter and the screen face of the CRT may get the dust for a long time use.

Clean the filter and the screen face gently with the soft cloths. Use the mild detergent if necessary.

One point advice

- Place the filter with the right side.



5. DAILY CHECK

Quick Calibration

◆ Periodical calibration

The peiodical calibration ensures the accurate measurement and may reduce the risk of the instrument damage as well. The six month callbration interval is recommended for the normal use and the one thousand hour interval is recommended for the frequent use.

◆ Quick check

The following lists the quick check procedures.




Check	Adjustment
Unaligned trace and cursors .	Adjust the TRACE ROTATION control to align the horizontal scale with the horizontal scale graticule.
Out of focus	Adjust the FOCUS control.
Position change of the ground level at varying the VOLTS/DIV	See the " AUTO CAL " in the " 3.25 SUB menu."
Probe phase compensation	See the probe manual.


5. DAILY CHECK

Quick Diagnostics

◆ Quick diagnostics

Follow the next procedure when the oscilloscope does not operate properly.

Symptom	Check	Action
No trace display	<ul style="list-style-type: none"> • Is the oscilloscope plugged in ? • Is the power switch turned on ? • Is the INTEN control turned counterclockwise? • Is the sweep mode set to the SINGLE? • Is the display positioned correctly? 	<p>Plug in the oscilloscope. Turn the power switch on. Turn the INTEN control clockwise.</p> <p>Set the sweep mode to the AUTO. Push the READOUT key to activate the BEAM FIND function.  Turn the  and the  knobs to bring the signal into the screen.</p>
Obscure scale	<ul style="list-style-type: none"> • Is the SCALE control turned counterclockwise? • Are the illumination lamps burnt out? 	<p>Turn the SCALE control clockwise.</p> <p>If yes, call the nearest dealer.</p>
No character readout	<ul style="list-style-type: none"> • Is the READOUT INTEN control turned counterclockwise? 	Turn the READOUT INTEN control clockwise.
Out of focus	<ul style="list-style-type: none"> • Is the FOCUS control adjusted correctly? 	Adjust the FOCUS control correctly.
No signal display	<ul style="list-style-type: none"> • Is the probe damaged? • Is the vertical coupling set to the GND? • Is the VERT MODE set to the correct channel? • Is the VOLTS/DIV switch set too low sensitivity? 	<p>Change the probe.</p> <p>Set the vertical coupling to the AC or the DC.</p> <p>Set the VERT MODE to the channel into which the signal is applied.</p> <p>Set the VOLTS/DIV switch to the higher sensitivity.</p>
No triggering	<ul style="list-style-type: none"> • Is the trigger condition enabling switch set properly? • Is the trigger source selected correctly? • Is the TRIG LEVEL adjusted correctly? 	<p>Set A enable to select the A trigger conditions.</p> <p>Set the trigger source to the channel into which the signal is applied.</p> <p>Adjust the TRIG LEVEL to the right level.</p>
Jittering display	<ul style="list-style-type: none"> • Is the line voltage below the rating? 	Use the oscilloscope within the rating.

Note : When you cannot obtain the stable display on the screen, press the  key.

5. DAILY CHECK

Storing and transporting

◆ Storing

Store the oscilloscope under the circumstances in the right table.

Avoid to store at the sunny or dusty place, or corrosive gas area.

Storage temperature	-20°C to +70°C
Storage humidity	80% RH at +70°C

◆ Transporting

Transporting the oscilloscope, pack it with the original packings or equivalent ones.



MEMO

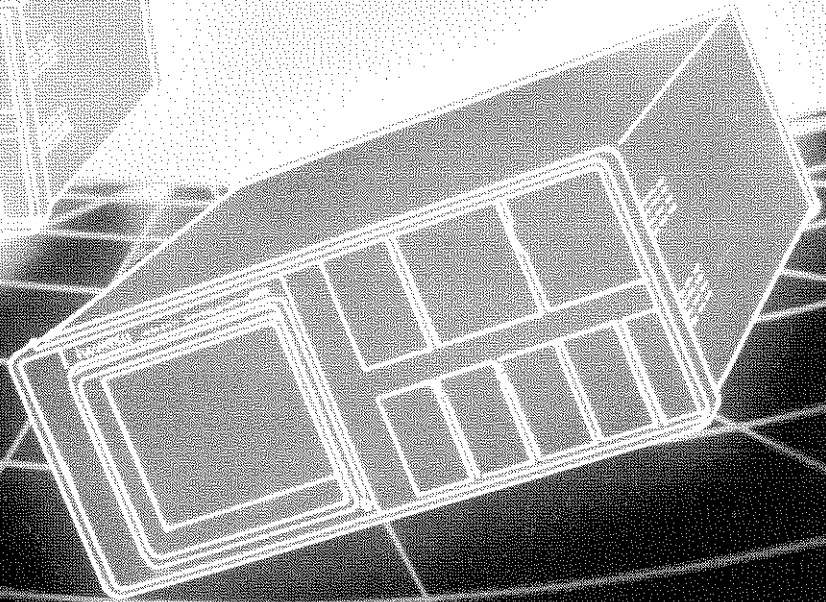
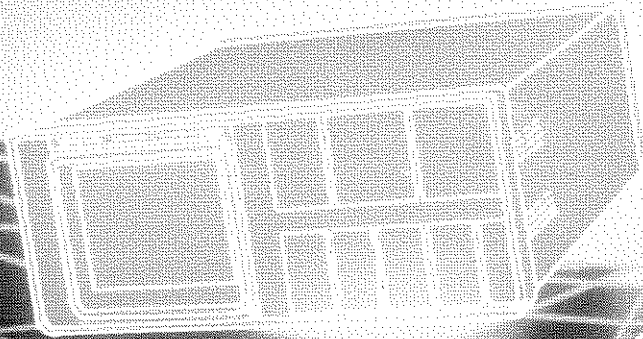
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Specifications



6

6. SPECIFICATIONS

SPECIFICATIONS

All the specifications in this section are:

- 1). applicable to the both units of the SS-7611 and the SS-7607 if not specified.
- 2). valid within +10°C to +35°C, unless noted.
- 3). valid after 30-minute warm-up time.

ELECTRICAL SPECIFICATIONS

Vertical deflection system (Y axis)

Mode : CH1, CH2, CH3, CH4, ALT, CHOP, ADD, X-Y
(CHOP switching frequency : 800kHz \pm 5%)

CH1 and CH2

Deflection factor : 5mV/div to 5V/div in a 1-2-5 sequence of 10 steps
1mV/div and 2mV/div with \times 5MAG
5mV/div to 12.5V/div (continuously variable with VARIABLE)

Accuracy

5mV/div to 5V/div : \pm 2%
 \pm 5% (-10°C ~ +50°C)
1mV/div, 2mV/div : \pm 4%
 \pm 8% (-10°C ~ +50°C)

Frequency response :

SS-7611

Sensitivity	Bandwidth
1mV/div, 2mV/div	DC~ 50MHz (-3dB)
10mV/div~2V/div	DC~100MHz (-3dB)
5mV/div, 5V/div	DC~100MHz (-3.5dB)

SS-7607

Sensitivity	Bandwidth
1mV/div, 2mV/div	DC~30MHz (-3dB)
5mV/div~2V/div	DC~60MHz (-3dB)
5V/div	DC~60MHz (-3.5dB)

<Note>

- The lower cutoff frequency (-3dB) at AC coupling is 4Hz.
- When the bandwidth limit is on, the bandwidth is limited to 20MHz.

Rise time : At 10mV/div
SS-7611 : 3.5ns
SS-7607 : 5.8ns
(Rise time is calculated from : Bandwidth \times Rise time = 0.35)

Pulse response : At 10mV/div
Overshoot : 3%
Sag (at 1kHz) : 1%
Other distortions : 3%

Signal delay : 30ns or greater (delay time on the screen)

Input coupling : AC, DC, GND
Input RC : $1\text{M}\Omega \pm 1.5\% // 25\text{pF} \pm 2\text{pF}$ (without probe)
 $10\text{M}\Omega \pm 3\% // 14.5\text{pF} \pm 2\text{pF}$ (with SS - 080R probe)
Maximum input voltage : $\pm 400\text{V}$ (DC + AC peak) (without probe)
 $\pm 600\text{V}$ (DC + ACpeak) (with SS - 080R probe)
 $\pm 1000\text{V}$ (DC + ACpeak) (with SS - 081R probe)
Drift : 0.1div/hour or 2mV/hour, whichever is greater after 30
minute warm-up (typical value)
Polarity : CH2 only
Common mode rejection ratio : At 10mV/div
50:1 (1kHz sine wave)
15:1 (20MHz sine wave)

CH3 and CH4

Deflection factor : 0.1V/div and 0.5V/div
Accuracy : $\pm 4\%$
 $\pm 8\%$ (-10°C to $+50^\circ\text{C}$)

Frequency response : SS-7611
0.1V/div DC to 100MHz (-3dB)
0.5V/div DC to 100MHz (-3.5dB)
SS-7607
0.1V/div DC to 60MHz (-3dB)
0.5V/div DC to 60MHz (-3dB)

<Note >

- The lower cutoff frequency (-3dB) at AC coupling is 4Hz.
- When the bandwidth limit is on, the bandwidth is limited to 20MHz.

Pulse response : The value in the parentheses is for the SS-7607.

	0.1V/div	0.5V/div
Overshoot	7% (6%)	8% (6%)
Sag (at 1kHz)	2%	2%
Others	5%	6% (10%)

Input coupling : AC, DC
Input RC : $1\text{M}\Omega \pm 1.5\% // 25\text{pF} \pm 3\text{pF}$ (without probe)
 $10\text{M}\Omega \pm 3\% // 14.5\text{pF} \pm 2\text{pF}$ (with SS - 080R probe)
Maximum input voltage : $\pm 400\text{V}$ (DC + ACpeak) (without probe)
 $\pm 600\text{V}$ (DC + ACpeak) (with SS - 080R probe)
 $\pm 1000\text{V}$ (DC + ACpeak) (with SS - 081R probe)



Triggering
A triggering

Trigger sensitivity:

The value in the parentheses is for the SS-7607.

Coupling	Frequency range	Maximum sensitivity
DC	DC to 10MHz	0.4 div
	10MHz to 100(60)MHz	1.0 div
AC	100Hz to 10MHz	0.4 div
	10MHz to 100(60)MHz	1.0 div
FIX (at sine wave)	100Hz to 10MHz	1.0 div
	10MHz to 60MHz	2.0 div
TV - V		Sync pulse
TV - H		amplitude 1.5div

<Note>

- The lower limit frequency at **AUTO** mode is 50Hz.
- At **REJ** coupling, the trigger signal is attenuated at the frequency of:
 - HF REJ : 10kHz or higher
 - LF REJ : 10kHz or lower
- The composite video signal amplitude consists of 70% video signal and 30% sync signal.

Trigger source : VERT, CH1, CH2, CH3, CH4, LINE
Coupling : FIX, AC, DC, HF REJ, LF REJ, TV-V, TV-H
Polarity : Positive(+), negative(-)

B triggering

Trigger sensitivity : Same as in the A trigger sensitivity.

Trigger source : RUNS AFTER, CH1, CH2, CH3, CH4
Coupling : FIX, AC, DC, HF REJ, LF REJ, TV-H
Polarity : Positive(+), negative(-)



Horizontal deflection system (X axis)

Horiz Display	:	A, ALT, B
A sweep		
Sweep mode	:	AUTO, NORM, SINGLE
Sweep rate	:	20ns/div to 0.5s/div in a 1-2-5 sequence of 23 steps 20ns/div to 1.25s/div (continuously variable with VARIABLE) Accuracy I : (over center 8 divisions) $\pm 2\%$ Accuracy II: (over any 2 divisions within center 8 divisions) $\pm 5\%$
Holdoff time	:	Variable with HOLD OFF
B sweep		
Delay	:	Continuous delay (RUNS AFTER) or triggered delay (CH1, CH2, CH3, CH4)
Sweep rate	:	20ns/div to 50ms/div in a 1-2-5 sequence of 20 steps Accuracy I : (over center 8 divisions) $\pm 2\%$ Accuracy II: (over any 2 divisions within center 8 divisions) $\pm 5\%$
Delay range	:	0.2 to 10.2 div delay position at 1ms/div
Delay time accuracy	:	1 μ s/div to 0.5ms/div (A sweep rate) and 1 μ s/div to 0.5ms/div (B sweep rate) $\pm 0.5\%$ of reading $\pm 1\%$ of full scale – 30ns
Delay jitter	:	1/20,000 or less



Sweep magnification : 10 times (max. sweep rate: 2ns/div)
Accuracy I : (over center 8 divisions)
 20ns/div, 50ns/div ± 5%
 0.1µs/div to 0.5s/div ± 3%
Accuracy II: (over any 2 divisions within center 8 divisions)
 20ns/div to 2µs/div ± 8%
 5µs/div to 0.5s/div ± 5%

<Note>

The first 30nsec and last 40nsec of the sweep are not valid for this specification.

X-Y operation

X axis

Input : CH1
Deflection factor : Same as that of CH1
 Accuracy : 5mV/div to 5V/div ± 3%
Frequency response : DC to 4MHz (-3dB)
Input RC : Same as that of CH1
Max. input voltage : Same as that of CH1

Y axis

Input : CH1, CH2, CH3, CH4, ADD
Deflection factor : Same as that of CH1 CH2, CH3, and CH4
Frequency response : Same as that of CH1 CH2, CH3, and CH4
Input RC : Same as that of CH1 CH2, CH3, and CH4
Max. input voltage : Same as that of CH1 CH2, CH3, and CH4

Phase difference : Within 3° (at DC to 100kHz)

External intensity modulation (Z axis)

Min. modulation voltage : 0.5Vp-p
Polarity : Positive going signal decreases intensity, and negative going signal increases intensity.
Frequency range : DC to 5MHz
Input R : Approx. 4.6kΩ
Max. input voltage : ± 30V

Signal output

Calibrator

Waveform	:	Square wave
Repetition rate	:	1kHz
		Accuracy : $\pm 0.1\%$
Duty ratio	:	45% to 55%
Output voltage	:	0.6V
		Accuracy : $\pm 1\%$

CH1 signal output

Output voltage	:	20mV $\pm 20\%$ for 1 division screen amplitude (at 50 Ω load)
Bandwidth	:	SS-7611 DC to 50MHz – 3dB SS-7607 DC to 30MHz – 3dB
Output impedance	:	50 $\Omega \pm 20\%$

Readout and cursor measurement

Readout

Vertical readouts	:	CH1 through CH4 deflection factors with automatic factor correction by using SS-080R or SS-081R probe, UNCAL, $\times 5\text{MAG}$ with automatic factor correction, AC, DC, GND, INV, VERT MODE, BW
Horizontal readouts	:	A and B sweep rate, UNCAL, $\times 10\text{MAG}$ with automatic factor correction, DLY time, HOLD OFF, B ENDS A
Cursors	:	Two voltage cursors (horizontal cursors) and two time cursors (vertical cursors)
Menu display	:	TIME, VOLT, and SUB menus



Frequency counter

Measurement channel : Same source as the A trigger source .

	Frequency range	Maximum sensitivity
SS-7611	10 Hz to 10 MHz	0.8 div
	10 MHz to 100 MHz	2.0 div
SS-7607	10 Hz to 10 MHz	0.8 div
	10 MHz to 60 MHz	2.0 div

Display digit : Six digits

Maximum count time : 0.1s

Frequency range : SS-7611
10Hz to 100MHz
SS-7607
10Hz to 60MHz

Period range : SS-7611
0.1s to 10ns
SS-7607
0.1s to 17ns

Measurement error : 10MHz or higher, or 0.1µs or slower
Base oscillator accuracy ± 1 count
10MHz or lower, or 0.1µs or faster
Base oscillator accuracy $\pm \frac{\text{trigger error} \pm 1 \text{ base oscillator period}}{\text{input frequency} \times 0.1s}$

Base oscillator

Frequency : 10MHz

Aging rate : ± 3 ppm / year

Temperature stability: ± 10 ppm / 0°C to 50°C

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Peak voltage measurement

The value in the parentheses in the left column is for the SS-7607

Measurement	Accuracy
DC voltage	± (0.5% of reading + 1.6% of full scale + 20% of one division) within center 6 vertical divisions
+ PEAK, -PEAK 45Hz to 100(60)MHz and one division or more screen amplitude	± (0.5% of reading + 1.6% of full scale + 20% of one division + 0dB/-2dB* + CH1 and/or CH2 vertical frequency response) within center 6 vertical divisions < Note > 0dB/-2dB*: is the value between 0dB and -2dB, and follows the curve of the peak detector frequency response. The cursor may jump 0.2 div or so depending on the some input frequency.
GATED +PEAK, GATED -PEAK 45Hz to 100(60)MHz and one division or more screen amplitude in the gated period and one cycle or more display signal	± (0.5% of reading + 1.6% of full scale + 30% of one division + 0dB/-2dB* + CH1 and/or CH2 vertical frequency response) within center 6 vertical divisions and one horizontal division or more gated period at 5ms/div to 0.2 μs/div sweep rate < Note > 0dB/-2dB*: is the value between 0dB and -2dB, and follows the curve of the peak detector frequency response. The cursor may jump 0.3 div or so depending on the some input frequency.

< Note >

- The accuracy mentioned above are specified after executing the **AUTO CAL** function.
- The peak voltage measurement accuracy includes the cursor disposition error, or ± 20% or 30% of one division.



Cursor measurement

TIME cursor measurement

Delta time (Δt)	$\pm 0.5\%$ of reading $\pm 1.3\%$ of FS
Frequency ($1/\Delta t$)	} Calculated from the delta time value.
Phase (PHASE)	
Period ratio (RATIO)	
Rise time and fall time (T_r, T_f)	
Duty ratio (DUTY)	

VOLT

Delta voltage (ΔV)	$\pm 0.5\%$ of reading $\pm 1.6\%$ of full scale
Delta voltage from GND (ΔV_{GND})	} Calculated from the delta voltage value.
Voltage ratio (V RATIO)	

Cursor position range	: VOLT cursors	: ± 3.6 divisions or more from the screen center
	TIME cursors	: ± 4.5 divisions or more from the screen center

< Note >

The cursor tracking mode, which allows to position the cursors maintaining the span between the cursors, is available.

Date and time

Display format

: DD-MMM-YY HH:MM
DD : day (2-digit number, 01 to 31)
MMM : month (3-digit alphabet, Jan through Dec)
YY : year (2-digit number, 00 to 99)
HH : hour (2-digit number, 00 to 23)
MM : minute (2-digit number, 00 to 59)

Leap year : Auto correction of a leap year



Comment display

- Display area : 4th row through 14th row from the top of the screen
 Number of characters : Up to 80 characters
 Character set:

	!	"	#	\$	%	&	'	()	*	+	,	-	.	/
0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	X	Y	Z	[¥]	^	_
'	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z	{		}	~	±
x	÷	≤	≥	≠	∞	~		[]		→	←	↑	↓	Ω
μ	π	°	/												

- Data memory : Backup by built-in batteries
 Storage data : 10 setup memories excluding the last setup at power-off
 Battery life : Approx. 40,000 hours (at room temperature)

CRT

- Shape : Rectangular, 6 inches
 Display area : 8 div × 10 div (1div = 10mm) Non-parallax internal graticule with scale illumination
 Phosphor : B31
 Accelerating voltage : Approx. 16kV

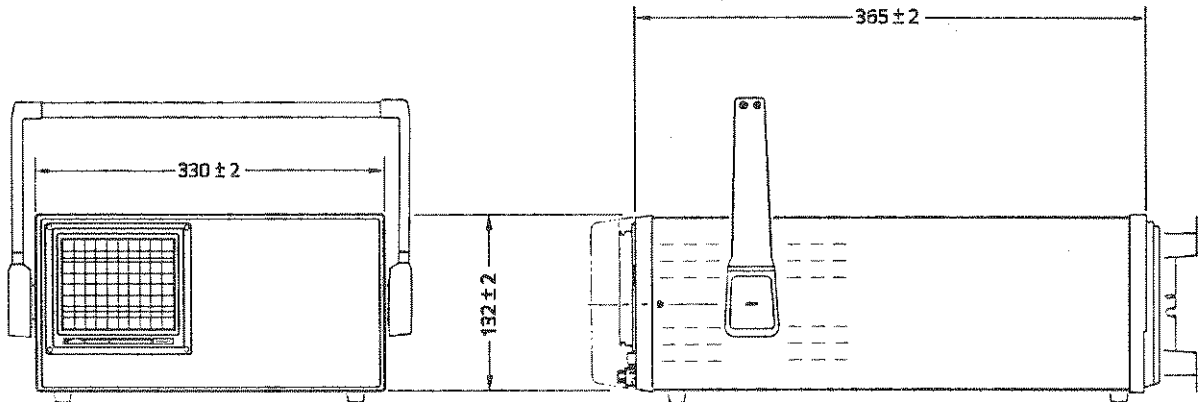
Power supply

- Voltage range : 90V to 250V AC
 Frequency range : 50Hz to 440Hz
 Power consumption : Approx. 85W (at 100V AC)



WEIGHT AND DIMENSIONS

- Weight : Approx. 7.5kg (excluding the panel covers and accessories)
- Size : 330 ± 2 mm (W) × 132 ± 2 mm (H) × 365 ± 2 mm (L)



ENVIRONMENTAL CHARACTERISTICS

- Operating temperature : -10°C to +50°C
- Operating humidity : 90% at 40°C (relative humidity)
- Storage temperature : -20°C to +70°C
- Altitude : Operating : 5,000m; barometric pressure of 405 mmHg
Non-operating : 15,000m; barometric pressure of 90 mmHg
- Vibration test : Start from 10Hz to 55Hz and back in one minute. Peak-to-peak amplitude 0.67 mm; for 15 minutes each in vertical, horizontal, and longitudinal directions for a total of 45 minutes.
- Shock test : Raise one side by 10 cm and let it fall onto a piece of a hard wood; 4 times for each side.
- Drop test : Pack the instrument in the transportation carton and drop it from the height of 90 cm.

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ACCESSORIES

- Power cord (3-core) 1
- Fuse (2A/250V, slow blow) 2
- Probe (SS-080R) 2
- Panel cover 1
- Instruction manual 1
- Accessory bag 1

7

1 2 3 4 5 6

Panel Layout

7

MEMO



7. PANEL LAYOUT

Rear Panel Layout

