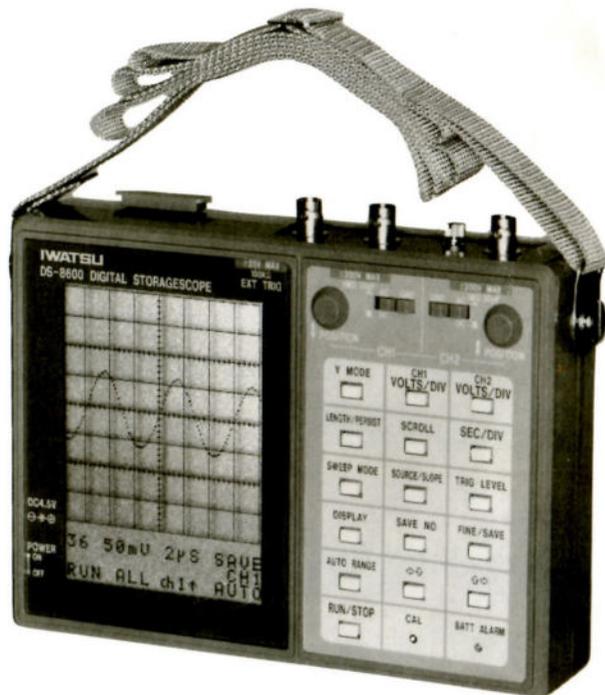


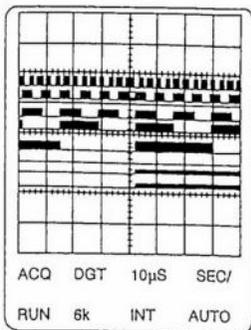
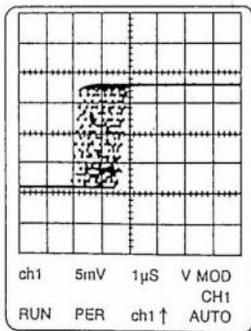
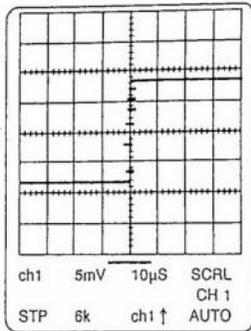
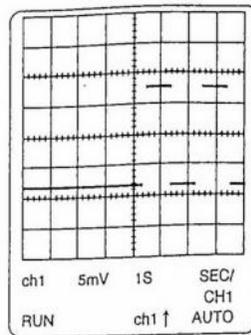
DIGITAL STORAGE SCOPE
DS-8600
OPERATION MANUAL



Read Precautions Before Use. ▮▮▮▮▶

Features of the DS-8600

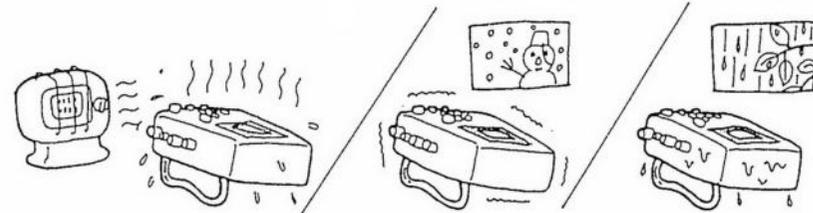
- ◆ Two-way operation : Three AA-size batteries or AC adaptor operation.
 - ◆ Wide viewing angle LCD display
 - ◆ Small size (A5 size or 8.4"W x 5.7"H) and light weight (1kg) by sophisticated design.
 - ◆ Simultaneous fast sampling rate (16MS/SEC) on both channels
 - ◆ DC to 2MHz wide bandwidth
 - ◆ Memory save and recall up to 50 waveforms
 - ◆ Auto sweep range setup
 - ◆ Strip chart recorder-like display in Roll mode for slow transitional signal
-
- ◆ 6.4k word/CH maximum memory length and horizontal post expansion / SCROLL capability.
-
- ◆ Overwriting waveforms in PERSIST mode
-
- ◆ Additional 8-channel logic analyzer capability using optional logic probe
-
- ◆ Hard copy output to optional printer



Precautions in Handling

Read the following precautions before use.

- ◆ Do not use the oscilloscope in the harsh environment.
The environmental characteristics are :
Operating temperature : 0° C to + 40° C
Operating relative humidity : 90%RH at 29° C

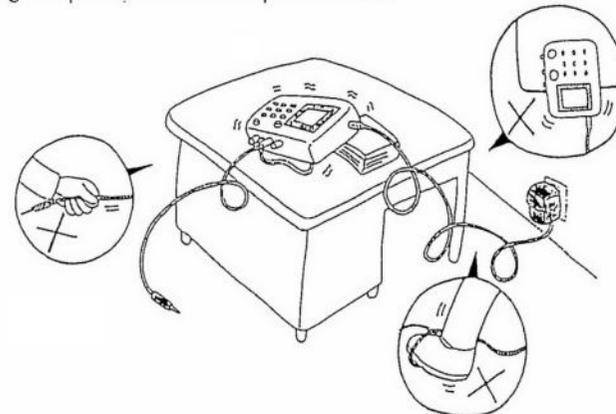


- ◆ Never apply an excessive voltage into the inputs.

Input	Maximum input voltage
CH1, CH2	± 200V (DC + AC peak) without probe ± 600V (DC + AC peak) with 10 : 1 probe
EXT TRIG	± 25V (DC + AC peak)

- ◆ Never apply an excessive shock.

The oscilloscope is light weight, or only 1 Kg (2.2 lb.) approximately.
Be careful not to drop the oscilloscope to the floor from the desk by accidentally drawing the power cord or the probe cable.



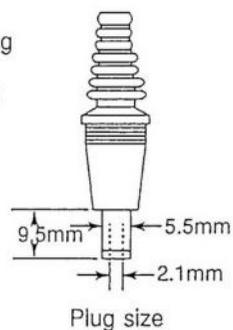
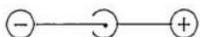
◆ Use the appropriate cleaner.

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

◆ Use the only AC adaptor specified as follows.

1. Output voltage : 4.5V
2. Output current : 1A
3. Female plug : See the right drawing
4. Polarity :



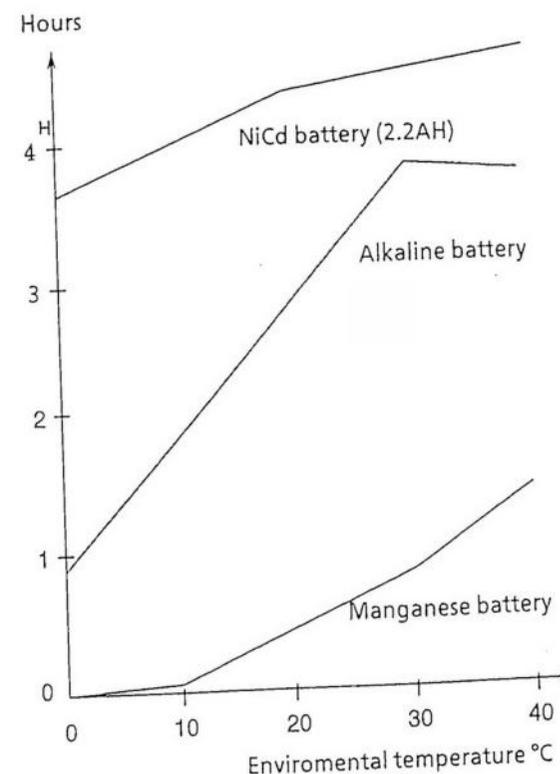
◆ Call your dealer when the internal battery has been drained, since the internal battery is not commercially available. PUSH AUTO-KEY message will be displayed when the internal battery has been drained.

The internal battery backs up the waveform memories and setup conditions during power off. The life cycle of the internal battery is about 40,000 hours.

◆ Exchange all the three AA-type batteries at the same time when the batteries have been drained. If you do not use the oscilloscope for more than one month, remove all the AA-type batteries out of the battery compartment. The life cycle of the battery depends on the ambient temperature as follows.

- Setup
 - CH1 VOLTS/DIV : 5mV
 - CH2 VOLTS/DIV : 5mV
 - V MODE : SPLIT
 - SEC/DIV : 1 μ S
 - PERSIST : OFF
 - SOURCE : EXT
 - SWEEP MODE : AUTO
 - RUN/STOP : RUN
- Signal input
 - CH1, CH2 : 2MHz Sinewave

Typical Battery Life under continuous operation



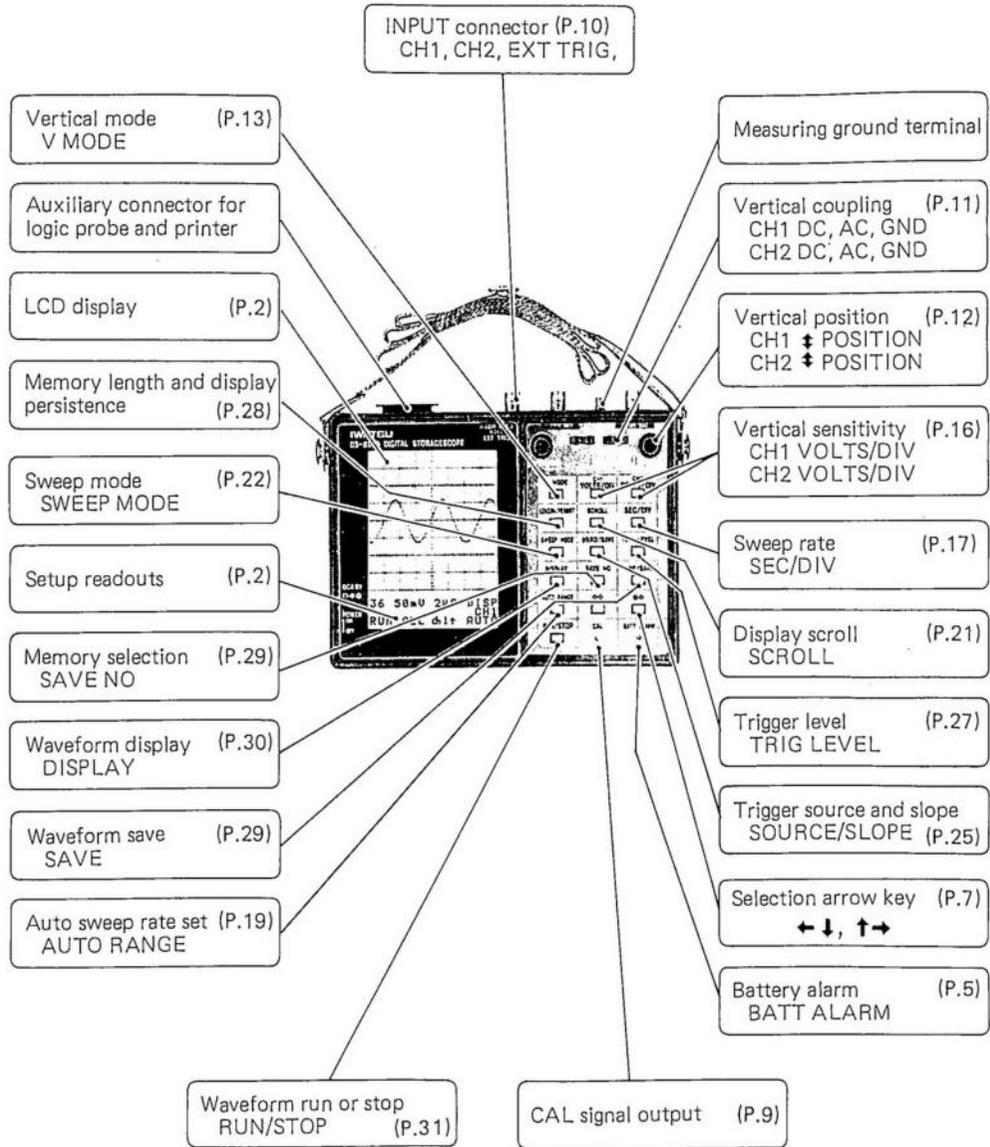
NOTE : When you leave the oscilloscope ready to trigger in NORM or SINGLE sweep mode, this may shorten the battery life extremely.

◆ The refreshing time of the LCD display may be varied by the ambient temperature.

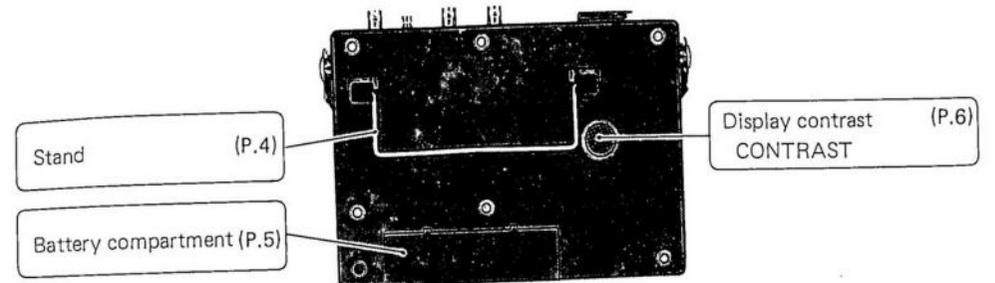


Panel Layout

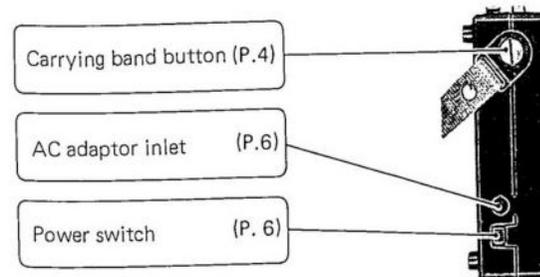
Front Panel

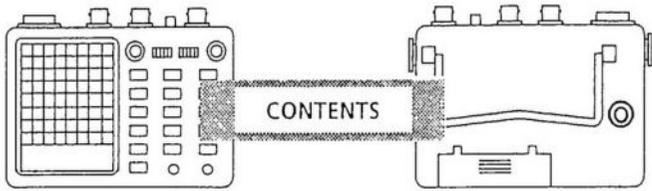


Rear Panel



Side Panel





- Features of the DS-8600
- Precautions in Handling
- Panel Layout
- Table of Contents

1. Getting to Know This Manual

- Notations and Conventions
- Viewing Area and Messages in the Screen
- Auxiliary Messages on the Screen

2. Basic Operation

- Using the Stand
- Exchanging the Batteries
- Turning the Power ON and OFF
- Displaying the CAL Signal

3. Functions and Operations

3.1 Setting Up the Oscilloscope

- Using the CAL Signal

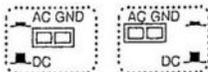
3.2 Applying the Signal

- CH1, CH2, EXT TRIG



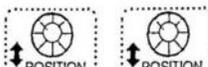
3.3 Coupling the Signal

- AC, DC, GND



3.4 Positioning the Waveform

- CH1 POSITION
- CH2 POSITION



3.5 Displaying the Signal

- CH1, CH2
- SPLIT, DUAL
- ADD, SUB



Page

I

II

V

VII

1

2

3

4

5

6

7

9

10

11

12

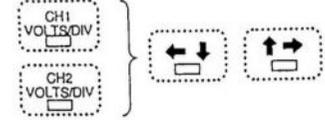
13

14

15

3.6 Changing the Signal Amplitude

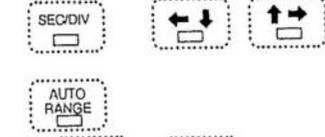
- CH1 VOLTS/DIV
- CH2 VOLTS/DIV



16

3.7 Selecting the Sweep Rate

- SEC/DIV
- ROLL
- AUTO RANGE



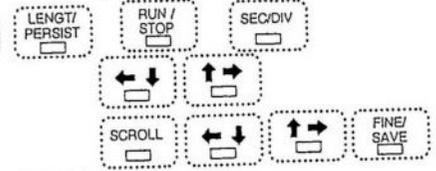
17

18

19

3.8 Expanding and Scrolling the Signal

- MAGNIFIER
- SCROLL

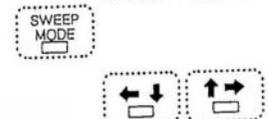


20

21

3.9 Selecting the Sweep Mode

- AUTO
- NORM
- SINGLE



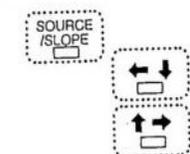
22

23

24

3.10 Selecting the Trigger Source

- SOURCE
- SLOPE

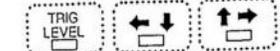


25

26

3.11 Adjusting the Trigger Level

- TRIG LEVEL



27

3.12 Overwriting the Waveform

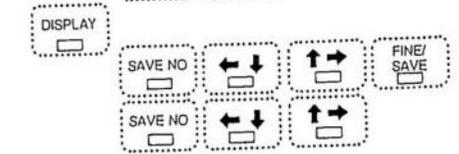
- PERSIST



28

3.13 Saving and Recalling the Signal

- SAVE
- RECALL

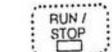


29

30

3.14 Holding the Signal

- RUN/STOP



31

32

4. Specifications

1 Getting to Know This Manual

Notations and Conventions

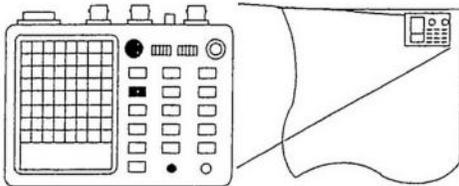
◆ Style

Each function and operation are described in the following order.

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

◆ Panel and Key

◇ 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.

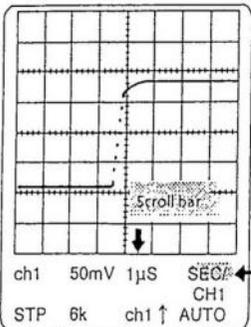
◇ Key notations

- is used to indicate the actual key or switch.
- / is used to indicate the 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.

◆ Notation in the Operating procedure

- ①, ②, ③, ... is used to indicate the operation order.
- SCROLL is used to indicate the function to be selected.
- connects between the procedure and the illustration.

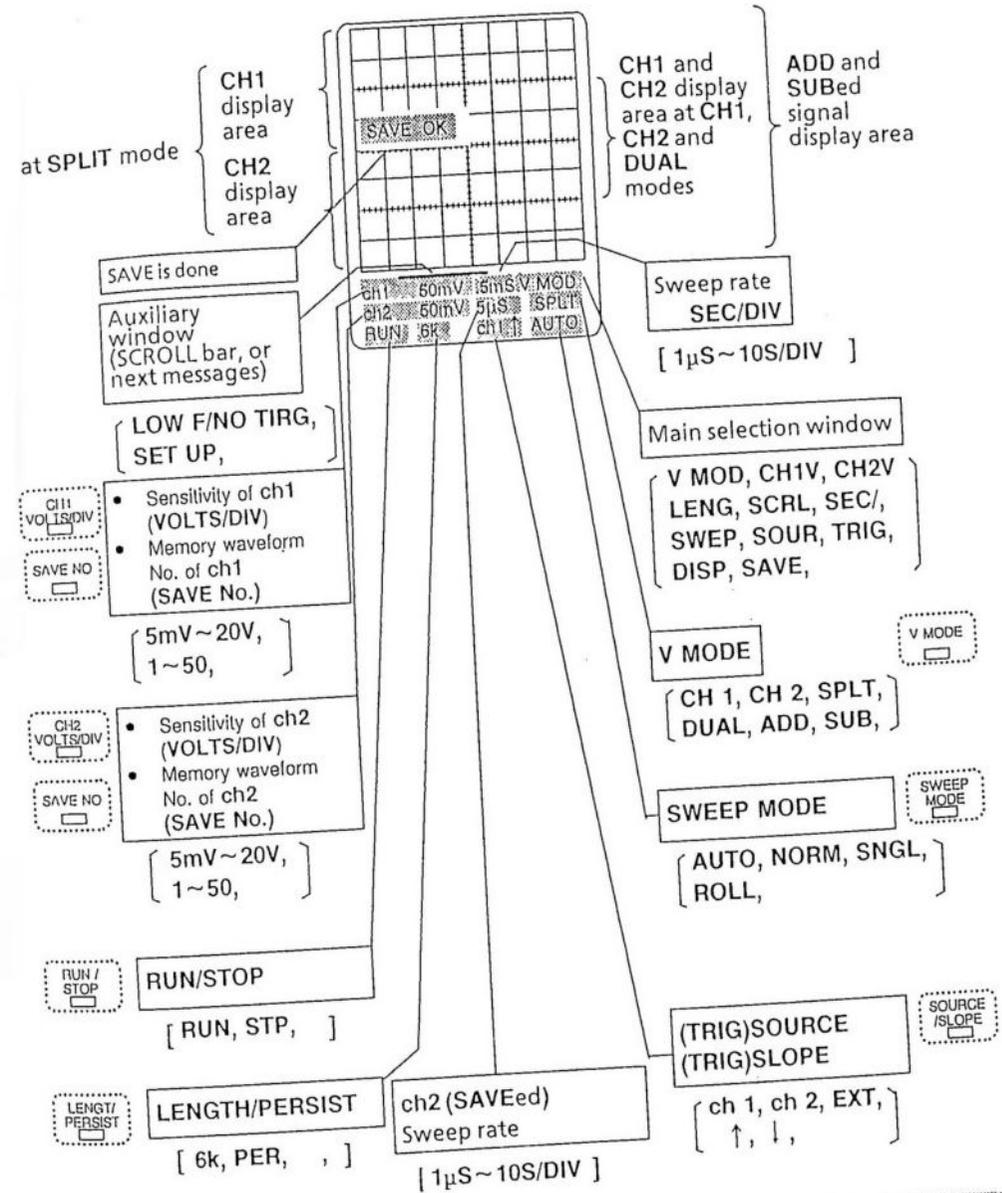
◆ Marks in the screen display illustration



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

1 Getting to Know This Manual

Viewing Area and Messages on the Screen



<Caution>

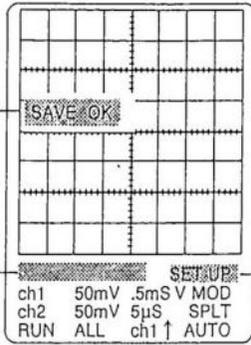
- The waveform display screen (LCD) may slightly differ from scale due to accuracy or tolerance of parts or assembly.

1 Getting to Know This Manual

Auxiliary Messages on the Screen

The auxiliary messages are displayed on the screen after some key operations or some input signal conditions.

The **SAVE** operation is done. (P29)



The setup condition has been changed but the display signal is not renewed.

• **NO-OP**

You tried to operate some illegal function.

• **LOW F/NO TRIG**

No triggering in the **AUTO RANGE** by applying the trigger signal of lower frequency or amplitude than the specification. (P19)

• **HI-FREQ**

No triggering in the **AUTO RANGE** by applying the trigger signal of higher frequency than the specification. (P19)

• **BUSY**

The hold operation is busy after you select the **STOP** mode by pressing the



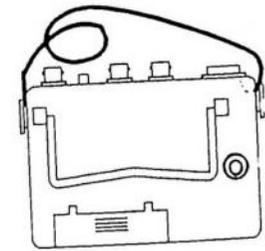
key.

• **NO TRIGGER?**

You tried to select the **STOP** mode by pressing the  key at no triggering condition. The message follows **BUSY** message.

2 Basic Operation

Using the Stand



2

- ◆ You can use the oscilloscope in the way of :
 - Placing the oscilloscope flatly on the desk.
 - Propping up the oscilloscope by using the stand.
 - Suspending the oscilloscope from the neck by using the carrying band.

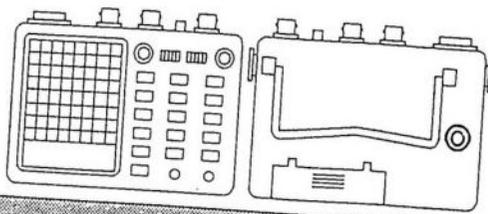
In any way of the above, handle the oscilloscope carefully and position the oscilloscope LCD display at the best viewing angle, since the LCD display contrast depends on the room lighting.

- ◆ Using the stand



2 Basic Operation

Exchanging the Batteries



2

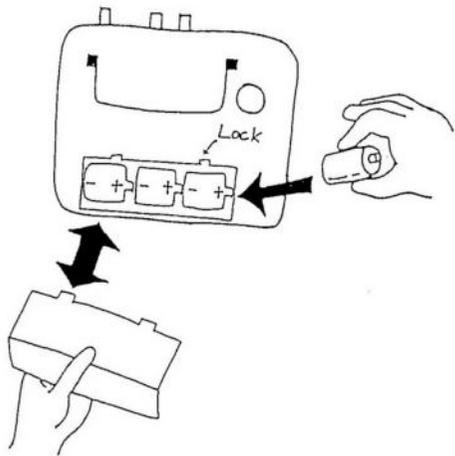
<Caution>

- Install the batteries with the correct polarity according to the guide attached in the battery compartment.
- Exchange all the three batteries at the same time, and only use the batteries specified.

◆ Exchanging the Batteries

- ◇ Opening the lid of the battery compartment
- ◇ Exchanging the batteries
- ◇ Closing the lid

- ① Place the oscilloscope backward.
- ② Pushing the notches on the lid, slide the lid out.
- ③ Remove the drained batteries.
- ④ Insert the batteries with the correct polarity according to the guide in the battery compartment.
- ⑤ Place the lid on the guide rail.
- ⑥ Slide the lid in to fix the lock.



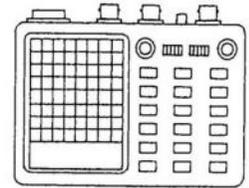
- When the batteries are drained, the **BATT ALARM** indicator will light, or flash occasionally. Exchange the batteries as soon as you get the warning message.



BATT ALARM indicator

2 Basic Operation

Turning the Power On and Off

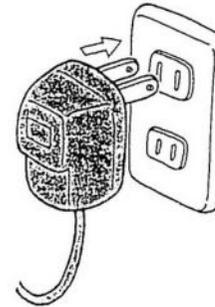


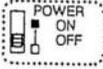
2

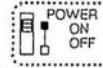
<Caution>

- Use the three AA-type batteries for the battery operation.
- Use the only AC adaptor specified, which meets the appropriate safety requirement.

◆ Turning on the power



- ① Set the  **POWER** switch to the **OFF** position.
- ② Insert the AC adaptor plug into the oscilloscope inlet.
- ③ Insert the AC adaptor line plug into the outlet in a wall.

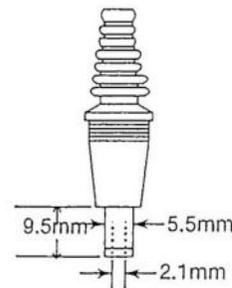
- ④ Turn the  **POWER** switch to the **ON** position.

◆ Turning off the power

- ⑤ Adjust  knob on the rear panel to obtain clear display.

No special procedure is required for turning off the power.

◆ Use the only AC adaptor specific as follows.



Plug size

1. Output voltage : +4.5V
2. Output current : 1A
3. Female plug illustrated as in the left.
4. Polarity : 



- The last setup before the power down is backed up by the internal fixed lithium battery. When the oscilloscope is turned on, the last setup before power down is recalled. Using the AC adaptor automatically selects the power source to the AC line voltage, even though the batteries are installed.

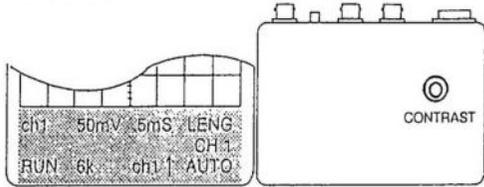
2 Basic Operation

Displaying the CAL Signal

(The CAL signal is used for compensating the probe phase.)

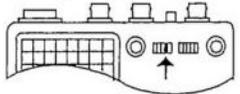
Displaying the signal on the screen is the first step for the oscilloscope users. For a first-time user, the following steps describe how to display the signal on the screen.

I. CONTRAST



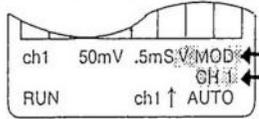
① Adjust the  knob to obtain the clear display.

II. GND coupling



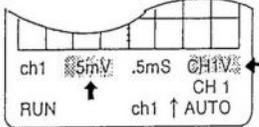
② Push in the  switch and select GND coupling.

III. CH1 VERTICAL mode



③ Press the  key and set the V MODE.

IV. CH1 VOLTS/DIV 5mV

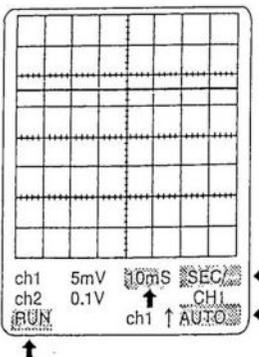


④ Press the  key or the  and select CH1.

⑤ Press the  key and select the CH1 VOLTS/DIV.

⑥ Press the  key or the  key and select 5mV/DIV sensitivity.

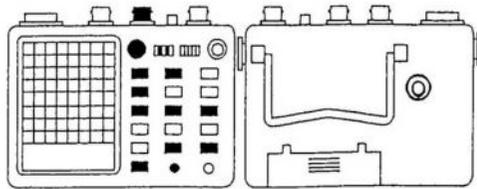
V. AUTO RANGE



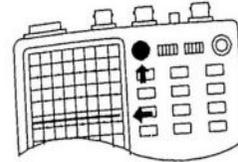
⑦ Press the  key to obtain the trace on the screen.

The oscilloscope is set to :

SOURCE : CH1
SEC/DIV : 10mS
SWEEP MODE : AUTO

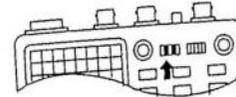


VI. POSITION



⑧ Using the  knob, position the trace the 2.4 divisions up from the bottom of the screen scale.

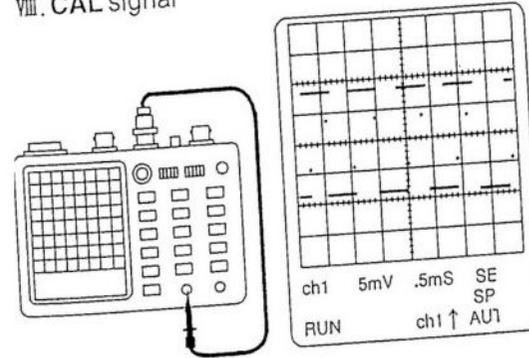
VII. DC coupling



⑨ Push out the  switch and select the DC coupling.

Push out the  switch and release GND coupling.

VIII. CAL signal



⑩ Using the standard probe, apply the CAL signal into the CH1 input.

⑪ Press the  key to obtain the 4 to 5 cycles of the CAL signal on the screen.

Now you obtain the CAL signal on the screen. In the next chapter, you will learn the detailed function and operations.

3 Functions and Operations

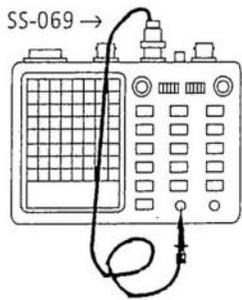
3.1 Setting Up the Oscilloscope

Using the CAL Signal

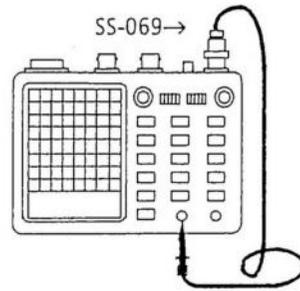
In this chapter, the **CAL** signal is used as the test signal unless the test signal is specified. The next illustrations show the probe connections. Use the standard probe SS-069.

3

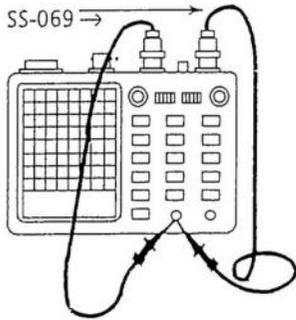
I. CH1 input connection



II. CH2 input connection



III. CH1 and CH2 connections



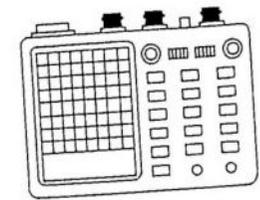
IV. What you have learned in the "2. Basic Operation".

In the "2. Basic Operation", you have learned the following functions by displaying the **CAL** signal.

CONTRAST
GND coupling
V MODE
CH1 VOLTS/DIV
AUTO RANGE
POSITION
DC coupling

3.2 Applying the Signal

CH1, CH2, EXT TRIG



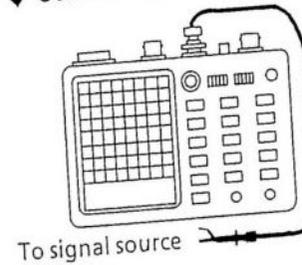
There are the two vertical input connectors and the one external trigger connector. The vertical inputs are for the **CH1** and the **CH2** vertical systems. The external trigger connector (**EXT TRIG**) is for triggering the signal externally.

<Caution> Never apply an excessive voltage into the inputs.

Input	Maximum input voltage
CH1, CH2	±200V (DC+AC peak) without probe
	±600V (DC+AC peak) with 10 : 1 probe (SS-069)
EXT TRIG	±25V (DC+AC peak)

3

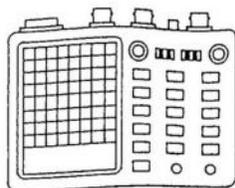
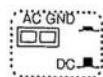
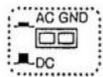
◆ Connecting the probe



- Use the standard probe SS-069 or the coaxial cable.
- Connect the ground under test with the alligator clip of the probe.
- The attenuation factor of the probe SS-069 is **10 : 1** or 10 times. Using the probe SS-069, multiply the sensitivity on the screen by 10.
- Triggering the signal externally, apply the external signal into the **EXT TRIG** input via coaxial cable.

3.3 Coupling the Signal

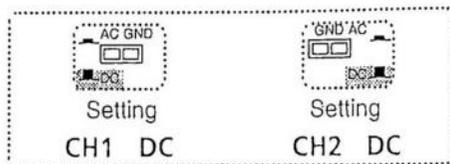
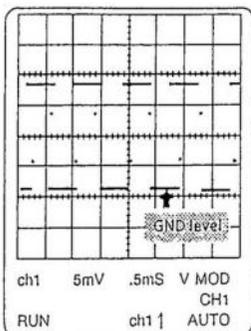
DC, AC, GND



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

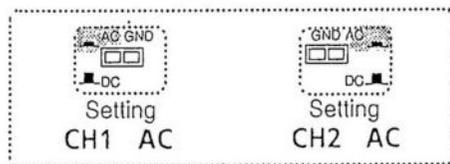
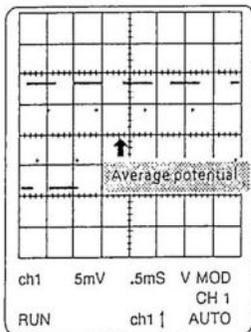
3

◆ DC coupling



① Push out the key.

◆ AC coupling



① Push in the key.

◆ GND coupling



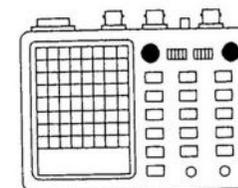
① Set the **SWEEP MODE** to the **AUTO**.

② Set the **RUN / STOP** to the **RUN**.

③ Push in the or key to obtain the trace referencing the ground level.

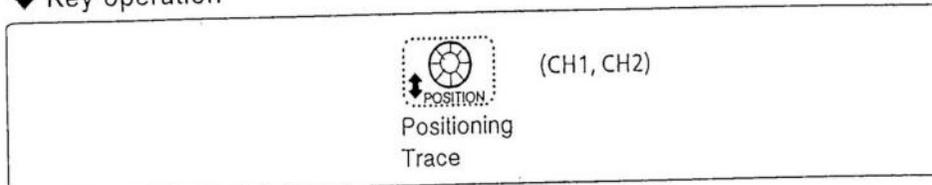
3.4 Positioning the Waveform

CH1 POSITION CH2 POSITION



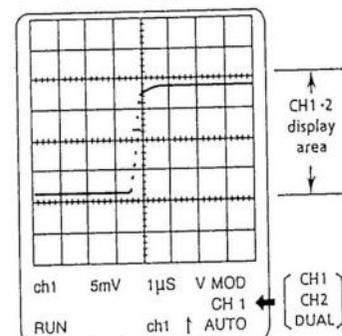
You can position the trace up and down.

◆ Key operation



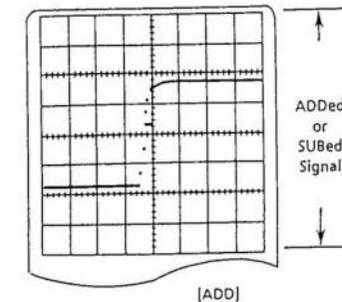
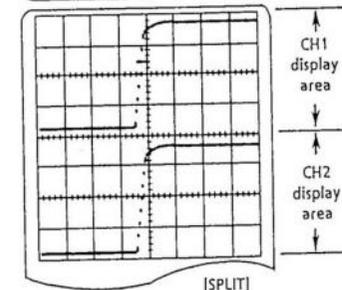
3

◆ Operating procedure



① Using the knob, position the trace to obtain the best viewing figure. The display area varies depending on the **V MODE** as follows :

MODE	Display area
CH1, CH2, DUAL	4 divisions at screen center
SPLIT	CH1 : 4 divisions at upper screen CH2 : 4 divisions at lower screen
ADD,SUB	8 divisions

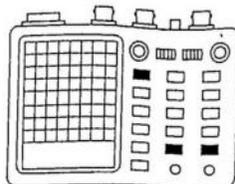


One point Advice

- No horizontal positioning is available.
- Avoid to position the waveform beyond the display area.

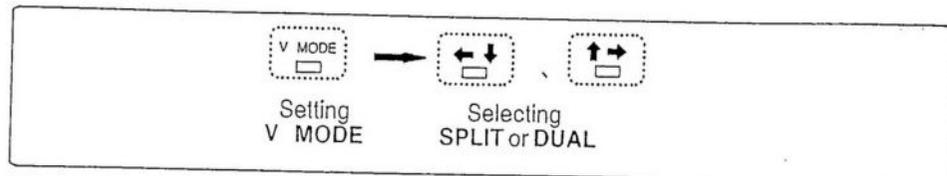
3.5 Displaying the Signal

CH 1, CH 2

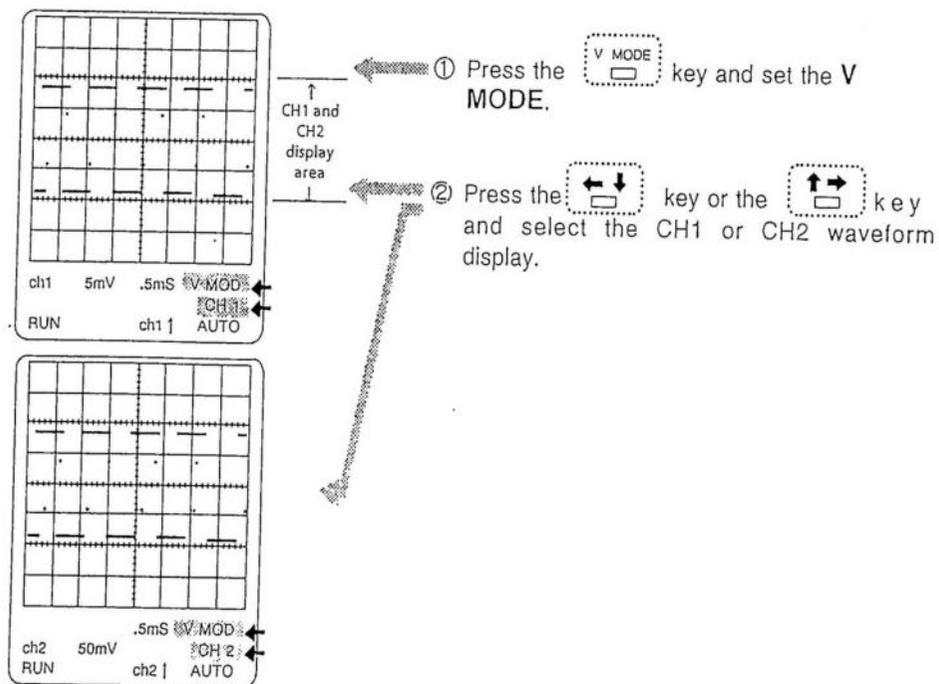


You can display the either CH1 or CH2 waveform. (to be continued)

◆ Key operation

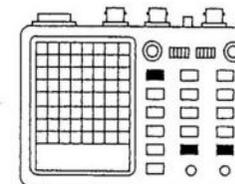


◆ Operating procedure



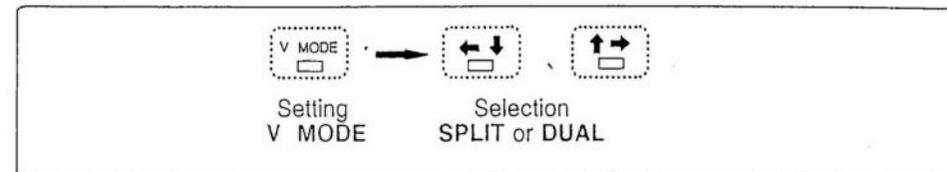
3.5 Displaying the Signal

SPLIT, DUAL

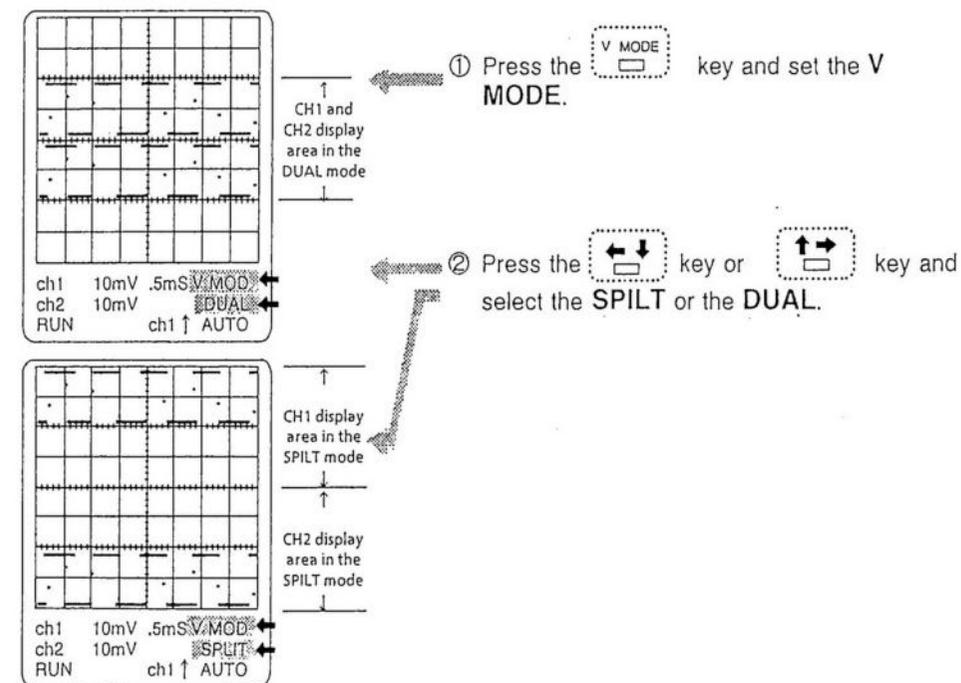


You can display the CH1 and CH2 signals on the screen at the same time. In the **SPLIT** screen, the two signals are displayed in the separate display area. In the **DUAL** mode, the two signals are displayed in the same display area. In the **DUAL** mode, you can not use the memory functions of the **SAVE** (see page 29) and **RECALL** (see page 30) . (continued from the previous page and to be continued)

◆ Key operation



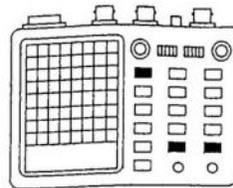
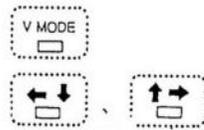
◆ Operating procedure



One point Advice
 Setting the **SWEEP MODE** to the **AUTO** (see page 22) and the **RUN/STOP** to the **RUN** (see page 31) may be helpful for the operation.
 In the **DUAL** mode, you can superimpose the two signals for close check, but you may lose the distinction of the two signal.

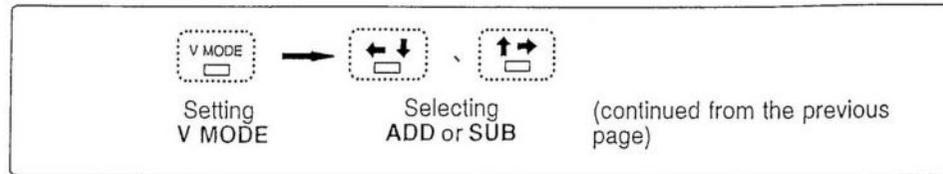
3.5 Displaying the Signal

ADD, SUB



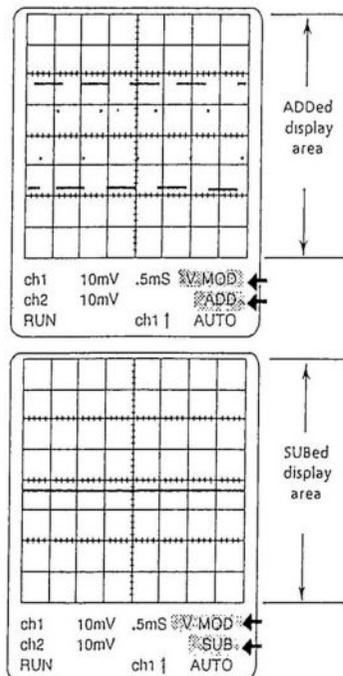
You can display the algebraic addition (ADD) or subtraction (SUB) of the CH1 and CH2 signals on the screen. Using the SUB function makes easy to measure the signal differences between two inputs.

◆ Key operation



◆ Operating procedure

Apply the CAL signal into the CH1 and CH2 inputs.



① Press the key and set the V MODE.

② Press the key or key and select the ADD or SUB.

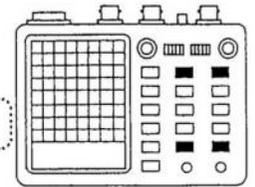
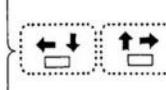
In the ADD or SUB mode, the viewing area is two times wider vertically than in the other modes.



- Setting the SWEEP MODE to the AUTO (see page 22) and the RUN/STOP to the RUN (see page 31) may be helpful for the operation.
- In the ADD or SUB mode, you can not control the TRIG LEVEL.

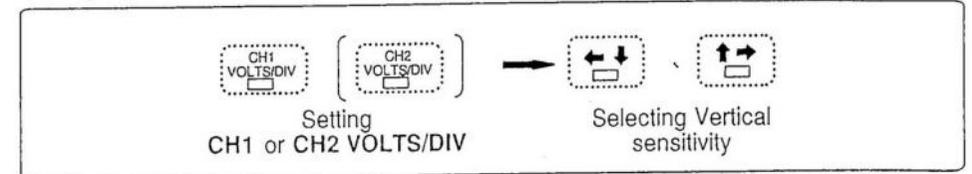
3.6 Changing the Signal Amplitude

CH1 VOLTS/DIV CH2 VOLTS/DIV

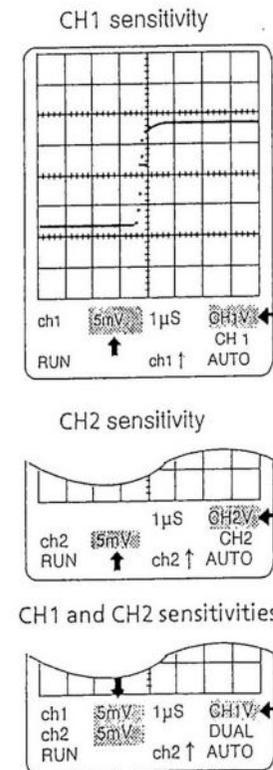


You can change the signal amplitude in order to obtain the appropriate signal size on the screen.

◆ Key operation



◆ Operating procedure



① Press the key or key and set CH1 or CH2 VOLTS/DIV.

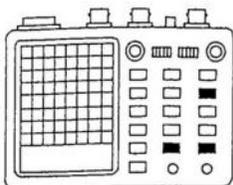
② Press the key or key and select the appropriate vertical sensitivity.



The sensitivity is set in 1-2-5 step sequence from the 5mV/div up to the 20V/div.

3.7 Selecting the Sweep Rate

SEC/DIV



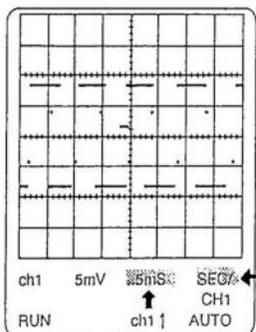
You can expand and compress the display waveform for the best viewing condition. When you expand the signal, you obtain the more detail of the signal, but you see the shorter duration.

◆ Key operation



Selecting Sweep rate
(10SEC~1 μ SEC/DIV)

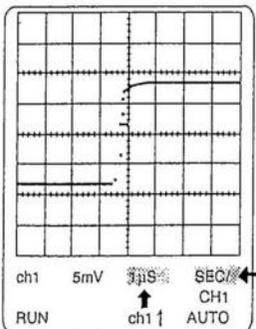
◆ Operating procedure



① Press the key and set the SEC/DIV.

② Press the key or key and select the appropriate sweep rate.

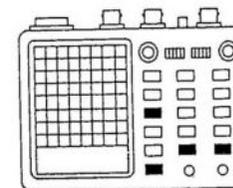
The illustrations are the CAL signals at 5mS/div (upper) and 1 μ S/div (lower) sweep rate respectively.



Setting the 0.5S/div to the 10S/div sweep rate automatically selects the ROLL mode. At the 0.5S/div sweep rate, you can select the normal sweep mode or the ROLL mode.

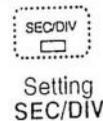
3.7 Selecting the Sweep Rate

ROLL



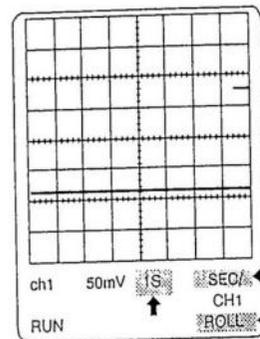
The ROLL mode is automatically turned on when you set the sweep rate between the 0.5S/div and the 10S/div. The ROLL mode provides the display in the similar fashion the chart recorder provides. In this mode, you will see the real time waveform change on the screen for the slow speed signal.

◆ Key operation



Selecting sweep rate
(.5SEC~10 SEC/DIV)

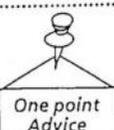
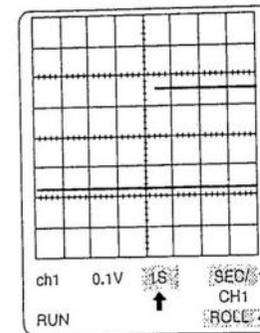
◆ Operating procedure



① Press the key and set the SEC/DIV.

② Press the key and set the key and select the slow sweep rate within the 0.5S/div and 10S/div.

- The top illustration shows the CAL signal just after the signal applied.
- The bottom illustration shows the CAL signal for the longer period than in the top illustration.
- In the ROLL mode, the signal is updated at the right corner of the screen.
- Press the key to stop running.

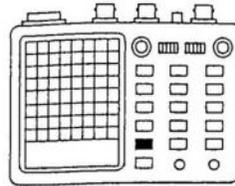


• In the ROLL mode, you cannot use the trigger functions since it is meaningless.

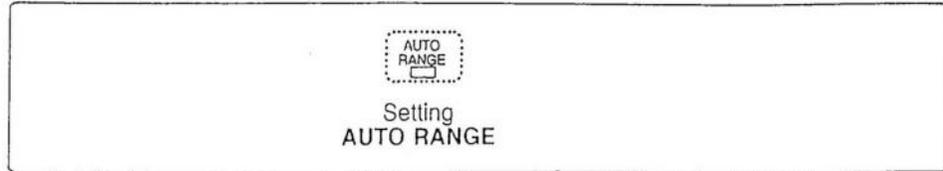
3.7 Selecting the Sweep Rate

AUTO RANGE

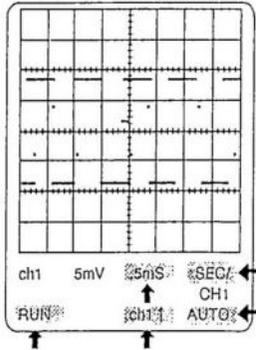
When you activate this function, the appropriate sweep rate is selected automatically to display the 4 to 5 cycles of the signal on the screen. If you are a first-time user, try this function first.



◆ Key operation



◆ Operating procedure



- Press the key and set the **AUTO RANGE** function.

The oscilloscope is set automatically as :

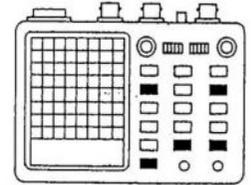
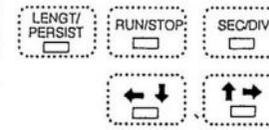
PERSIST : (OFF)
 SEC/DIV : .5mS with CAL signal
 SWEEP MODE: AUTO
 SOURCE : CH1 or CH2
 TRIG LEVEL : center with CAL signal
 DISPLAY : NORMAL other than SAVE and RECALL
 RUN/STOP : RUN

- One point Advice**
- The lower numbered trigger source will be selected at the multi-display mode.
 - The **AUTO RANGE** function is valid for the signal of 50Hz to 2 MHz frequency.
 - The **LOW F/NO TRIG** error message will be displayed when YOU apply the trigger signal of lower frequency or amplitude than the specification.
 - The **HI-FREQ** error message will be displayed when you apply the trigger signal of higher frequency than the specification.

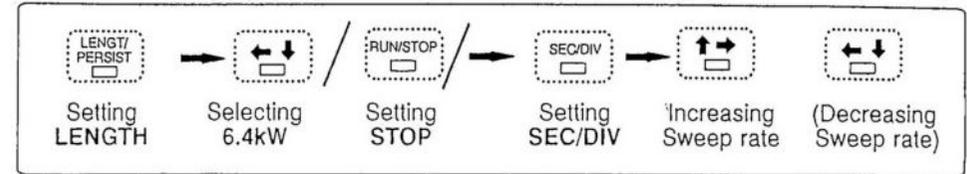
3.8 Expanding and Scrolling the Signal

MAGNIFIER

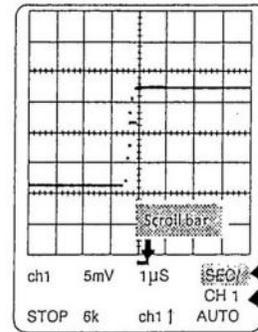
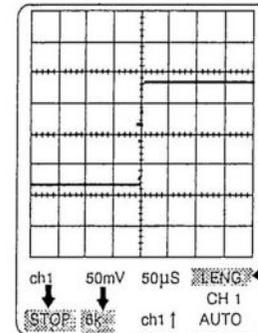
When you hold the signal in the 6.4kW memory length by setting the RUN/STOP to the STOP, you can expand the holding signal to check the detail of the signal. (to be continued)



◆ Key operation



◆ Operating procedure



- Press the key and set the **LENGTH**.
- Press the key and select the **6.4kW** memory length.
- Press the key and set the **STOP** to hold the display signal.
- Press the key and set the **SEC/DIV**.
- Press the key several times and expand the display waveform.

In this case, you will see the scroll bar in the auxiliary window below the waveform screen. The scroll bar indicates where you see on the screen in the total memory length. Therefore, the more you expand the signal, the smaller the scroll bar becomes.

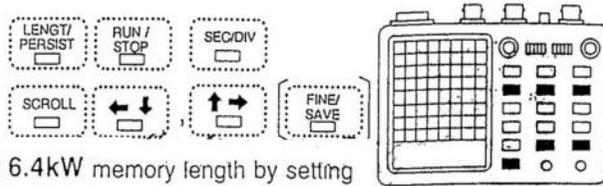
Pressing the key returns the sweep rate to the original setup.

- One point Advice**
- Pressing the key releases the magnification operation.
 - Maximum magnification is 50 times or up to 1µS/div sweep rate, whichever applicable. Therefore, no magnification is available at the 1µS/div sweep rate.

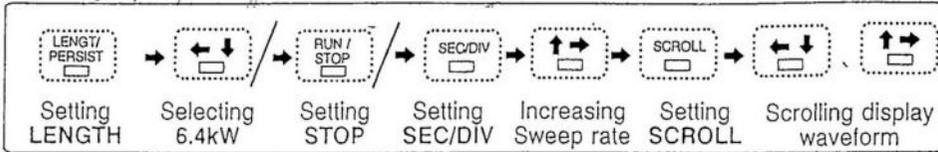
3.8 Expanding and Scrolling the Signal

SCROLL

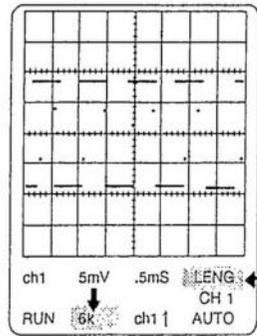
When you hold the signal in the 6.4kW memory length by setting the RUN/STOP to the STOP, you can expand and scroll the holding signal to check the detail of the signal. (continued from the previous page)



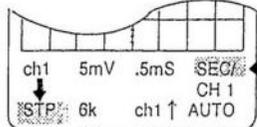
◆ Key operation



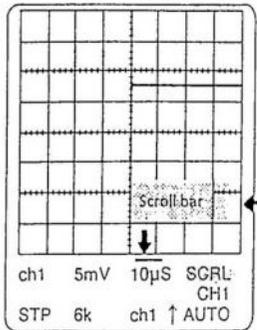
◆ Operating procedure



- Press the key and set the LENGTH.
- Press the key and select the 6.4kW memory length.
- Press the key and set the STOP to hold the display signal.
- Press the key and set the SEC/DIV.
- Press the key several times and expand the display waveform.



In this case you will see the scroll bar in the auxiliary window below the waveform screen. The scroll bar indicates where you see on the screen in the total memory length. Therefore, the more you expand the signal, the smaller the scroll bar becomes.



- Press the key and set the SCROLL.
- Press the key or the key and scroll the display waveform back and forth.



- Pressing the key releases the magnification operation.
- Maximum magnification is 50 times or up to 1µS/div sweep rate, whichever applicable. Therefore, no magnification is available at the 1µS/div sweep rate.

3.9 Selecting the Sweep Mode

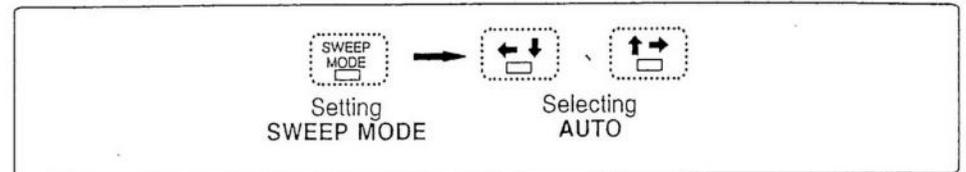
AUTO

There are three sweep modes, the AUTO, NORM, and SINGLE.

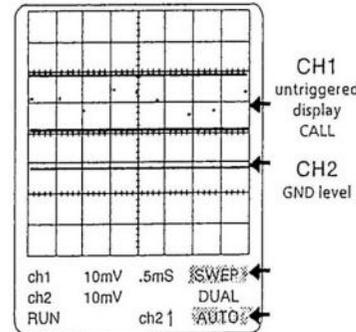
The AUTO sweep mode is advantageous for the general measurement. In the NORM sweep mode, no trace is displayed at the lack of triggering. Since the triggering frequency range in the AUTO sweep mode is limited above 50Hz, use the NORM sweep mode if your signal frequency is below 50Hz.

(continued from the previous page, and to be continued)

◆ Key operation



◆ Operating procedure



- Press the key and set the SWEEP MODE.
- Press the or the key and select the AUTO sweep mode.

The left drawing is shown under :

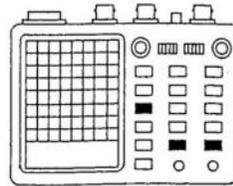
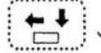
- CH1 input : CAL signal
- CH2 input : no signal
- Trigger source : CH2



- Press the key and set the STOP mode to hold the display on the screen.
- You cannot access the SWEEP MODE in the ROLL mode, since it is meaningless.

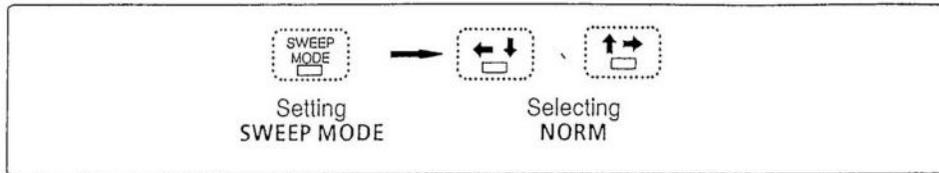
3.9 Selecting the Sweep Mode

NORM

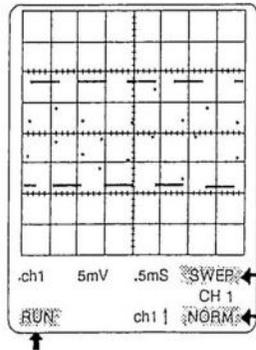


There are three sweep modes, the **AUTO**, **NORM**, or **SINGLE**. The **AUTO** sweep mode is advantageous for the general measurement. In the **NORM** sweep mode, no trace is displayed at the lack of triggering. Since the triggering frequency range in the **AUTO** sweep mode is limited above 50Hz, use the **NORM** sweep mode if your signal frequency is below 50Hz.

◆ Key operation



◆ Operating procedure



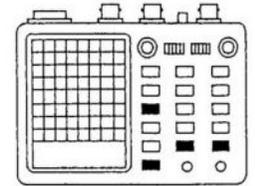
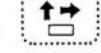
- ① Press the key and set the **SWEEP MODE**.
- ② Press the key or the and select the **NORM** sweep mode.
- ③ Press the key and select the **RUN MODE**.



- Press the key and set the **STOP** mode to hold the display on the screen.
- You cannot access the **SWEEP MODE** in the **ROLL** mode, since it is meaningless.

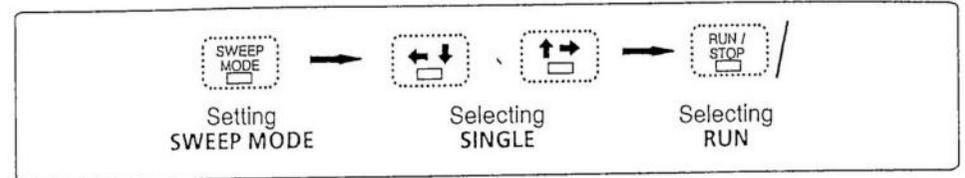
3.9 Selecting the Sweep Mode

SINGLE

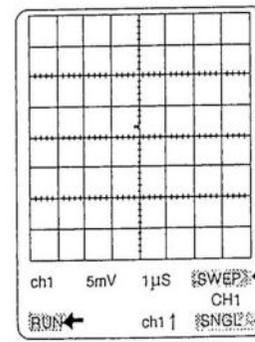


In the **SINGLE** sweep mode, the signal is captured once by triggering when the oscilloscope is ready. Until you set the oscilloscope ready again, the captured signal is not updated. Therefore, the **SINGLE** sweep mode is advantageous for capturing the single shot event. (continued from the previous page)

◆ Key operation

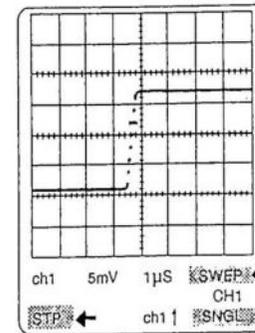


◆ Operating procedure



- ① Press the key and set the **SWEEP MODE**.
- ② Press the key or the and select the **SINGLE** sweep mode.
- ③ Press the key and select the **RUN** mode to set the oscilloscope ready.
- ④ The **CAL** signal is captured once and the message at the bottom screen turns into **STP**.

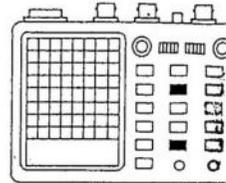
Repeat the steps 3 and 4 for the another capturing.



- You cannot access the **SWEEP MODE** in the **ROLL** mode, since it is meaningless.

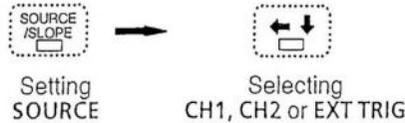
3.10 Selecting the Trigger Source

SOURCE

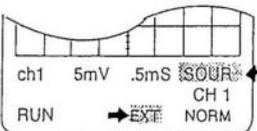
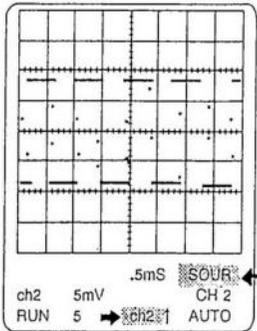
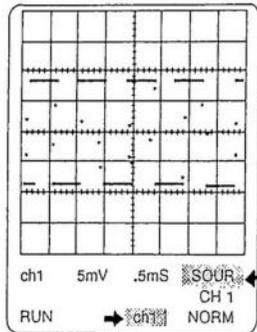


In many cases, it is necessary to trigger the oscilloscope for capturing the signal on the screen. You can select the trigger signal from the CH1, CH2 and EXT trigger sources.

◆ Key operation



◆ Operating procedure



- ① Press the key and set the **SOURCE**.
- ② Press the key and select the **CH1**, **CH2**, or **EXT** trigger signal.

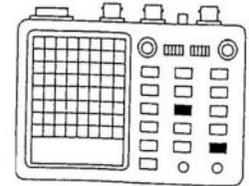
- Top drawing : **CH1** vertical input of the **CAL** signal and **CH1** internal trigger signal.
- Center drawing : **CH2** vertical input of the **CAL** signal and **CH2** internal trigger signal.
- Bottom drawing : Message of **EXT** trigger.



- When you set the **CH1** or the **CH2** vertical mode, you cannot select the non-active vertical channel as the trigger signal.
- At the **ROLL** mode, you cannot select the trigger source, since it is meaningless.

3.10 Selecting the Trigger Source

SLOPE

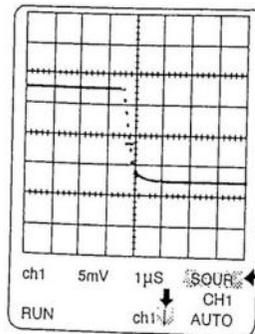
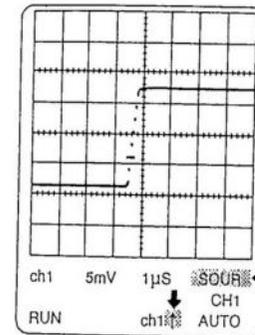


You can set the oscilloscope to capture the signal at the positive going or negative going transition.

◆ Key operation



◆ Operating procedure



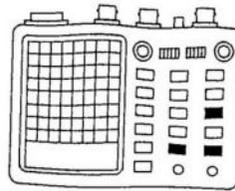
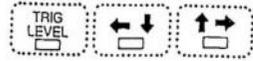
- ① Press the key and set the **SLOPE**.
- ② Press the key and select the trigger slope.
The top illustration shows the signal triggered at ↑ positive slope.
The bottom illustration shows the signal triggered at ↓ negative slope.



- At the **ROLL** mode, you cannot select the trigger source, since it is meaningless.
- Press the key and set the **RUN** mode.

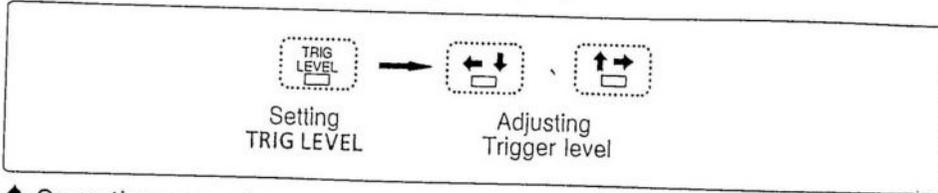
3.11 Adjusting the Trigger Level

TRIG LEVEL

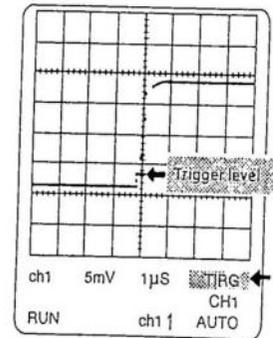


It is always necessary to adjust the **TRIG LEVEL** for capturing the signal on the screen.

◆ Key operation



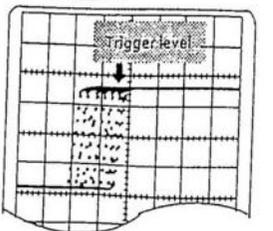
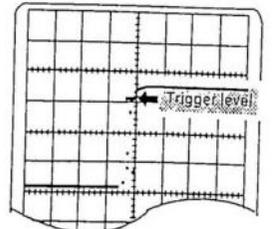
◆ Operating procedure



① Press the **TRIG LEVEL** key and set the **TRIG LEVEL** to obtain the trigger level marker on the screen.

② Press the or the key to obtain the stable display.

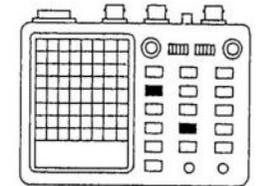
- Top drawing : Adjust the **TRIG LEVEL** close to the GND level.
- Center drawing : Adjust the **TRIG LEVEL** close to the top level of the signal.
- Bottom drawing : Adjust the **TRIG LEVEL** close to the out of the triggering.



- Though you can adjust the trigger level in the **ADD** or **SUB** mode, the trigger level marker is not displayed.
- For the **EXT** triggering, no **TRIG LEVEL** is available, i.e. the fixed trigger level for the **EXT** triggering.

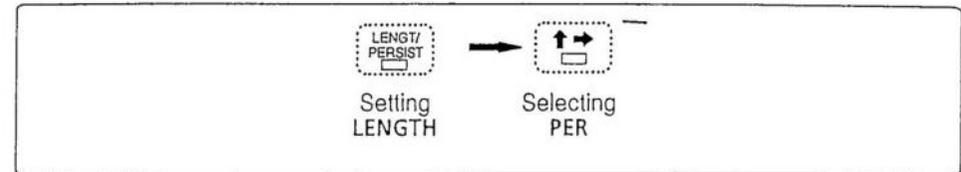
3.12 Overwriting the Waveform

PERSIST

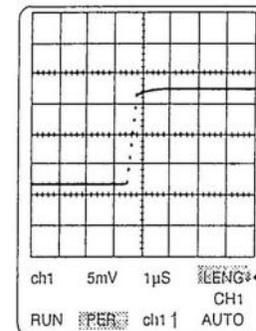


You can overwrite the waveform on the screen. When your signal is varying or has an intermittent glitch, use this function to record the changes on the screen.

◆ Key operation

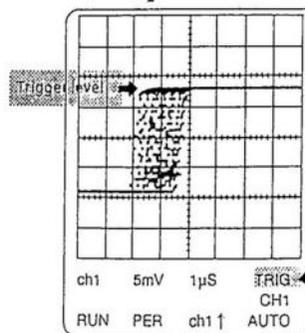


◆ Operating procedure

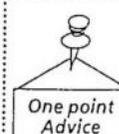


① Press the **LENGTH/PERSIST** key and set the **LENGTH**.

② Press the and select the **PERSIST** mode.



- The drawing at the left is an example showing the persistent display by adjusting the **TRIG LEVEL** to obtain the unstable display intentionally.



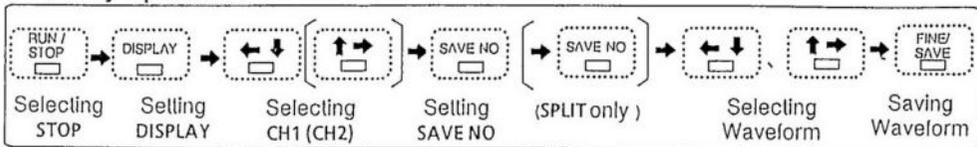
- When you press the key, the **LENGTH** (128W or 6.4kW) or the **PERSIST** mode are selected alternately.
- When you set the **ROLL** mode in 0.5S/div to 10S/div, the **PERSIST** and 6.4kW modes are not available.

3.13 Saving and Recalling the Signal

SAVE

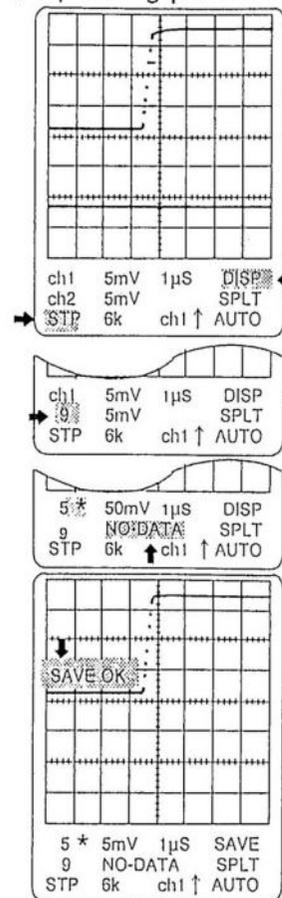
In the CH1, CH2, or SPILT of the V MODE, you can save the display waveform in the nonvolatile memory. There are 50 memories in total. You can recall the saved waveform to the display on the screen or send the data to the optional dedicated printer. (See the next page.)

◆ Key operation



◆ Operating procedure

The next procedures are for the SPLIT MODE.



One point Advice

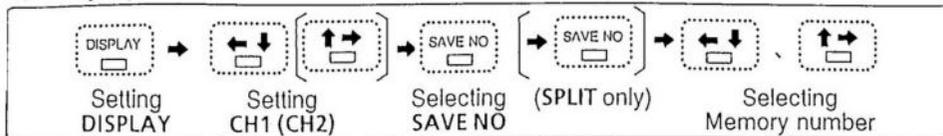
- For exiting the saving operation, see the RECALL (P. 30).
- In the PERSIST mode, only the latest waveform captured will be saved.
- In the 6.4kW LENGTH, the 128 data points out of 6.4kW will be saved.
- Saving the new waveform erases the data saved previously. Setups of VOLTS/DIV and SEC/DIV are displayed alongside the memory number.

3.13 Saving and Recalling the Signal

RECALL

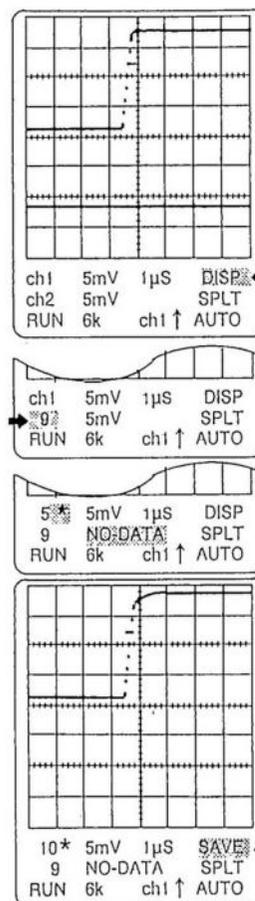
You can recall and display the saved signal from the memory, or send the saved signal to the optional dedicated printer. There are 50 memories in total. (See the previous page.)

◆ Key operation



◆ Operating procedure

The next procedures are for the SPLIT MODE.

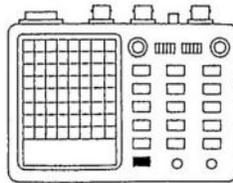


One point Advice

- For exiting the saving or recalling operation, follow the next procedure.
- Setups VOLTS/DIV and SEC/DIV are displayed alongside the memory number.
- You can activate the RECALL function in the CH1, CH2, or SPLIT vertical mode only.
- The memory addresses are the common to both vertical channels.

3.14 Holding the Signal

RUN/STOP



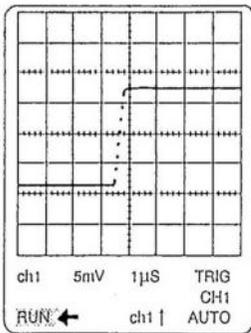
When you set the **RUN** mode, the signal on the display is updated every time the oscilloscope is triggered. To hold the signal on the display temporarily, select the **STOP** mode. You can magnify the signal after holding the signal by the **STOP**. In the **ROLL** mode, you can stop the updating signal mode and hold the display on the screen by the **STOP**.

◆ Key operation



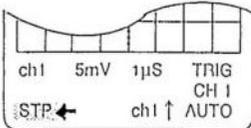
Setting
RUN or STOP

◆ Operating procedure

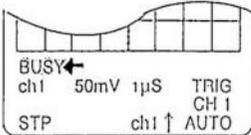


① Press the key and set the **RUN** or the **STOP** mode.

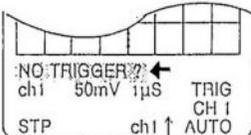
- At the **RUN** mode, the display is updated.
- At the **ROLL** mode, the display is updated regardless of the triggering.
- At the **STOP** mode, the display is fixed.



- The **BUSY** message will be displayed when you select the **STOP** mode by pressing the key.



- If the oscilloscope is not triggered at **STOP** mode, the **NO TRIGGER ?** message will be displayed after **BUSY** message.



One point Advice

SINGLE SWEEP MODE, pressing the key sets the oscilloscope ready and the **RUN** message will be displayed.

4 Specifications

Electrical Specifications

Vertical Deflection System (Y Axis)

Mode :	CH1, CH2, SPLIT, DUAL, ADD, SUB (CH1-CH2)
Deflection factor :	5mV/div to 20V/div (1-2-5 step, 12 steps)
	Accuracy : $\pm 3\%$ ± 1 LSB
Resolution :	6 bit
Frequency bandwidth :	DC to 2 MHz (-3db) at 5mV/div to 2V/div
Maximum clock rate :	16MS/S
Pulse response :	at 5mV/div to 2V/div
	Overshoot : $10\% \pm 1$ LSB
	Sag at 1kHz : $2.5\% \pm 1$ LSB
	Other distortions : $10\% \pm 1$ LSB

Input coupling :	AC, DC, GND
Input RC :	1M Ω $\pm 2\%$ // 30pF ± 5 pF without probe 10M Ω $\pm 2\%$ // 21pF ± 3 pF with probe
Maximum input voltage :	± 200 V (DC + AC peak) without probe ± 600 V (DC + AC peak) with probe
Drift at 5mV/div :	8LSB (0.5 divisions) / hour (typical) after 15 minute warm-up
Common mode rejection ratio :	CH1/CH2 : 15mVp-p signal at 5mV/div 1kHz sine-waveform : ± 5 LSB 100kHz sine-waveform : ± 9 LSB

Triggering

Source :	CH1, CH2, EXT
Coupling :	DC only
Polarity :	CH1, CH2 : Positive (\uparrow) or Negative (\downarrow) EXT TRIG : Positive (\uparrow) only

Sensitivity :

Frequency range	Internal trigger (CH1, CH2)	External trigger (EXT TRIG)
DC to 2MHz	0.5div or more	H level : +3.5V or more L level : +1.5V or less

EXT input R	: 100k Ω $\pm 30\%$
Maximum input voltage	: ± 25 V (DC + AC peak)

Horizontal Deflection System

Display memory length : 128 Words/CH
 Memory length : NORM : 128 Words/CH
 6kW : 6.4k Words/CH
 Number of memories (SAVE memories) :
 (50 display memories X 128 Words, common to CH1 and CH2)
 Sweep mode : AUTO, NORM/ROLL, SINGLE
 Sweep rate : NORM : 1 μ S/div to 0.5S/div (1-2-5 step, 18 steps)
 ROLL : 0.5S/div to 10S/div (1-2-5 step, 5 steps)
 Accuracy : $\pm 1\%$ ± 1 sampling period
 Jitter : ± 1 sampling period
 Magnification and scroll : 50 times or up to 1 μ S/div sweep rate at 6.4kW (6.4k Words/CH) only

Display

LCD : 128 x 160 dots
 One pixel : 0.6mm x 0.6mm
 Display area : Waveform display area :
 8 div x 8 div (1div = 9.6mm)
 Readout display area :
 4 rows x 16 columns

CAL Signal Output (for probe phase compensation)

Waveform shape : Square waveform
 Repetition rate : 1kHz $\pm 30\%$
 Amplitude : 150mV $\pm 30\%$

Power Supply

External DC power supply

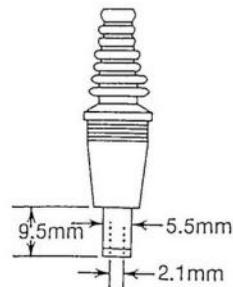
The adaptor must meet the appropriate safety requirements.

Output voltage : +4.5V

Output current : 1A

Female plug illustrated as in the right.

Polarity : 



Plug size

Battery

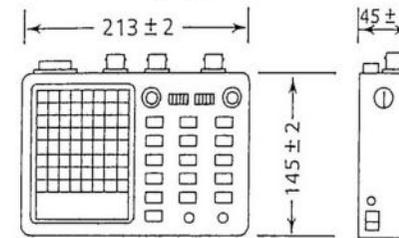
Size : Three AA-size batteries
 Battery life : About two-hour consecutive operation with alkaline batteries at 20°C.
 (See the "Precautions in Handling.")

Nonvolatile memory (SAVE memory)

Battery : Lithium battery
 Battery life : 40,000 hours approx. at room temperature

Weight and Size

Weight : 1kg approx. without accessories
 Size :



Environmental Characteristics

Operating temperature : 0°C to +40°C
 Operating humidity : 90% (relative humidity) at +29°C
 Storage temperature : -20°C to +60°C
 Altitude : Operating : 5,000 m, 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.
 Drop test : Pack the instrument for transportation and drop it from a height of 90 cm ; Seven times in total of one angle, three corners and three faces.

Accessories

Probe (SS-069) 2
 Strap 1
 Operation manual 1

Options

Logic probe DS-001
 Dedicated printer SE-3303
 Carrying case 86