HIOKI

8832 · 8833

MEMORY Hi CORDER

INSTRUCTION MANUAL

HIOKI E.E. CORPORATION

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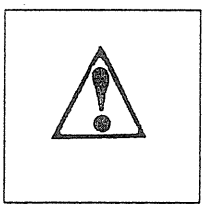

SAFETY PRECAUTIONS

- This manual contains information and precautions intended to ensure a safe operation of the unit and to keep it in a safe condition. Please read the following notes on safety before using the unit.

Safety Symbols

⚠	Refer to the related section(s) of the manual when handling a part of the unit bearing this symbol. When found in this manual, read the accompanying explanation.
⏚	Indicates a protective ground terminal.

DANGER

- To prevent electric shocks and unit damage, do not apply an AC or DC voltage over 250 V between an input unit and the main unit case or between input units. In particular, prevent voltage from large-current power lines from being applied. Otherwise, a short-circuit accident may occur.

- Do never connect the input terminal to an AC power line over 250 V or a ungrounded DC power line over 250 V.

- Be sure to insert the input plug completely to avoid the danger of an electric shock.

- Use the unit with all six input units installed. If measurement is performed with an input unit missing, you may suffer an electric shock.

- Four probes can be connected to a logic unit, but probes are not floating with respect to each other.

Notes

- To prevent unit damage, observe the ranges in the table at right forterminal inputs.

- Operating temperature and humidity ranges for this unit are 5°C to 40°C and 35% to 80%, respectively. Avoid using the unit in dusty places or where it would be exposed to direct sunlight or corrosive gas.

Input Terminals	Maximum Allowance
8932 Input	500 V DC + AC peak
TRIG IN	-5 V to +10 V
TRIG OUT	-20 V to +30 V 300 mA max. 200 mW max.

INTRODUCTION

Thank you for choosing the HIOKI 8832•8833 Memory Hi-Corder. To maximize the performance and life of the unit, please read this Instruction Manual thoroughly before use.

Notes on Use

To insure full performance and safe operation, please observe the following instructions:

Inspection

When you receive the Hi-Corder, check for any damage that may have occurred during transportation. Be sure to check all panel switches and terminals. If any damage should have occurred, or the machine does not work according to the specifications, please contact your nearest dealer.

Connection to a DC Power Supply (8833 only)

When connecting the 8833 to a DC power supply, be very careful not to reverse the polarity of the + (positive) and - (negative) lines. Reversing the polarity may result in damage to the Hi-Corder. (See 3-1.)

Before Turning Power On

Confirm that you power supply matches the Hi-Corder rating and that the correct fuse is installed in the unit. Un AC power supply is built into the 8833.

Protective Ground Terminal

Make sure the protective ground terminal is properly grounded. If your use a three-pronged plug inserted to a three-pole plug socket, however, no additional grounding is required.
Be sure to connect the ground terminal to ground even if you are runing the 8833 off a DC power supply such as batteries.
(When using the 8833 in a motor vehicle, connect the protective ground terminal to any metallic part of the vehicle's chassis.)

Recording Paper

The Hi-Corder uses the thermal recording method. Special thermal paper is required for optimum performance. Please use the specified recording paper.

Storage

When not using the Hi-Corder for a long period, raise the head up/down lever to protect the head and prevent deformation of the rubber roller.

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Storage

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Precaution on Measurement

The maximum floating voltage of the input unit is AC/DC 250 V. Always use a PT when measuring power lines over 250 V.

Using the Hi-Corder in a Motor Vehicle (8833 only)

Although the 8833 can be used with either an AC or DC power supply, it is not designed for use in a motor vehicle. If you want to use the 8833 in a motor vehicle, use a cushion or other appropriate means to protect it from vibration.

Transportation

When transporting the Hi-Corder, use the packaging materials provided. If not available, proceed as follows:

(1) Wrap the unit in a vinyl plastic sheet.
(2) Pack the inside of a corrugated cardboard box more than 7-mm thick with packaging material to a thickness of over 100 mm.
(3) Wrap the Hi-Corder in the packaging material and place it with its accessories into the box. Place some more packaging material on top, close the box and tape it securely. Tie the box externally with a cord if necessary.

Note: Always remove the RAM card when transporting the unit.
Set the head-up/down lever to the head-up position when shipping the Hi-Corder.

Others

Carefully read and observe all precautions in this manual.
In the event of abnormal operation, please read 10-2 "In Case of Trouble and Before Sending for Repair."

How to Use this Instruction Manual

This Instruction Manual is composed of the following 10 chapters and option unit, conveniently arranged for the first-time user. A figure indicating the name of each part is given at the beginning. Refer to it while you read. A simple explanation of each part's function is also included. You will find it useful when actually operating the unit.
Chapters 4 through 9 and the appendices apply both to the 8832 and 8833, although 8832 is used as the model name, read it as 8833 if you have the 8833.

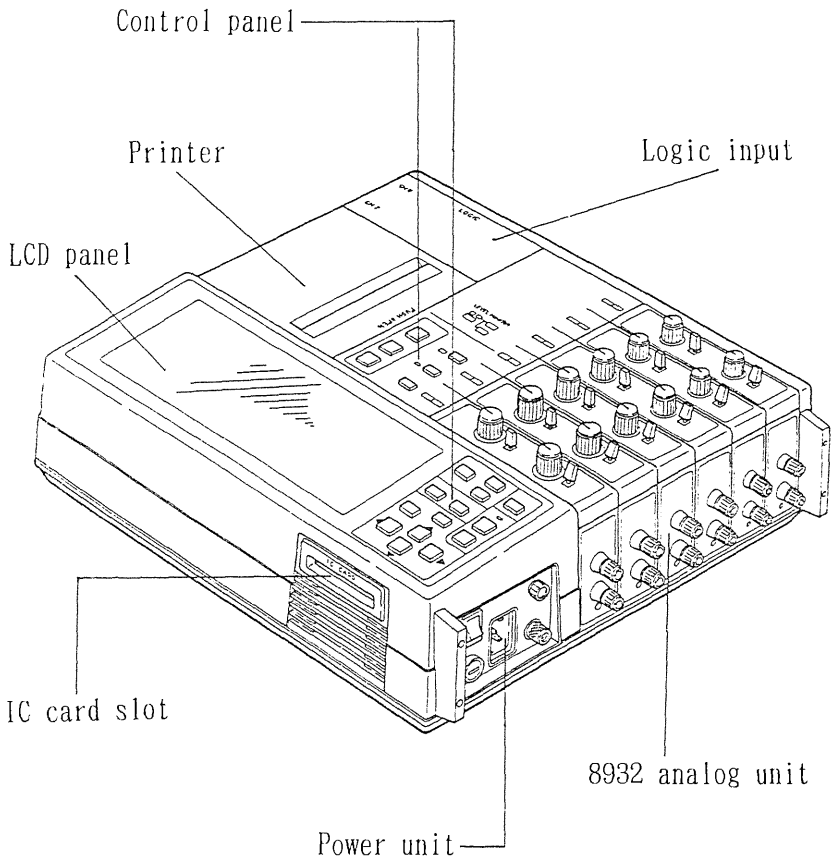
Chapter 1: An outline of the machine that will help you to use it more efficiently.
Chapter 2: Contains the unit's specifications. Refer to them when necessary.
Chapter 3: Explains on installation and preparations to be done before turning power on. Be sure to read it to ensure safe operation. It also includes recording paper and fuse handling instructions.
Chapter 4: Describes basic unit operation, using actual measurement examples. As you read, operate the unit following the examples to get a faster understanding. All basic procedures are included, so refer to this chapter if you have any problem using the unit.
Chapter 5: Input unit handling is explained. For safety reasons, be sure to check the maximum floating voltages and input voltage allowances indicated in this chapter.
Chapter 6: Contains a detailed explanation of the trigger and how to use it. Since the trigger is important to make the most of the unit's functions, be sure to read this chapter thoroughly.
Chapter 7: Describes the system menu, including instructions on system setup, time setting, scaling function setting and self-check.
Chapter 8: Explains how to use the IC (RAM) card. Read it after getting acquainted with basic operation procedures in Chapter 4.
Chapter 9: Refers to the waveform judgement function. Since this is an auxiliary function, read Chapter 4 to master basic operation first.
Chapter 10: Maintenance and service hints are given. Be sure to read this chapter in order to extend unit's life. Also refer to it in case the unit does not work as expected.

Explanations are given for using input units other than the 8932 analog unit and the 8933 logic unit. To ensure safe operation, please read these explanations carefully before using option units.

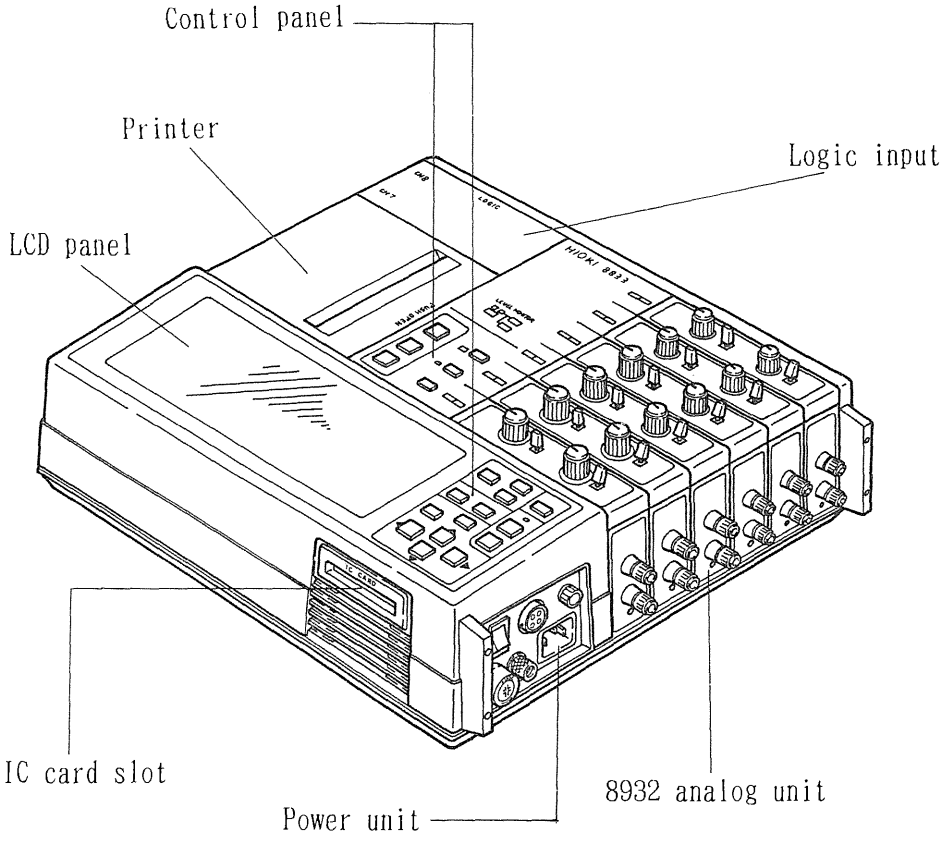
Appendices: Include instructions on how to deal with error messages, an explanation of terms used in this manual, etc.

PART NAMES AND FUNCTIONS

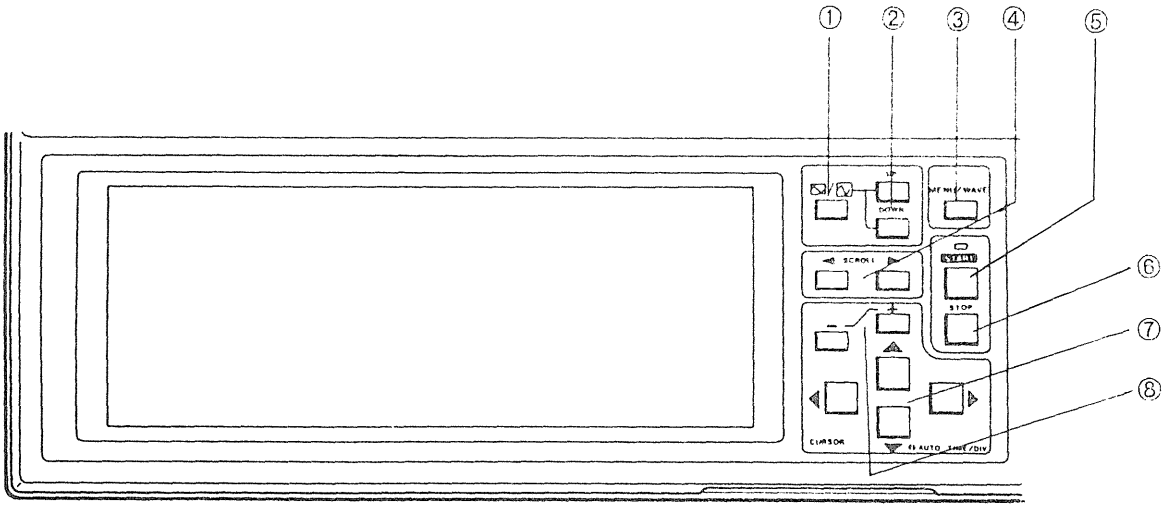
8832



8833



[Control Panel]



① Display Reduction Key: Reduces waveform display to 1/2 in the voltage axis (vertical) direction.

② UP & DOWN Keys: When waveform display is not reduced, use these keys to scroll waveform display in the voltage axis direction.
In addition, the keys change the input level monitor display, if pressed simultaneously.

③ MENU/WAVE Key: Used to switch between MENU and WAVE display modes.

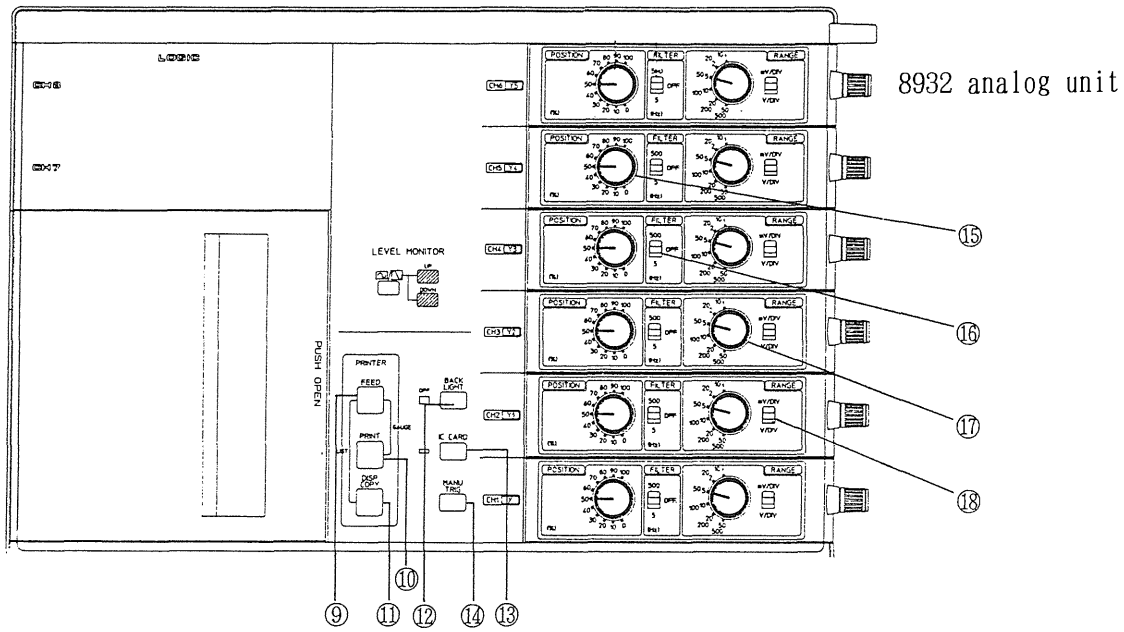
④ SCROLL Keys: Scroll the waveform display in the time axis (horizontal) direction.

⑤ START Key: Starts measurement.

⑥ STOP Key: Stops measurement and printing. Also releases error messages.

⑦ CURSOR Keys: Move the cursor to select measurement conditions on the LCD.

⑧ + & - Keys: Change the value of the parameter indicated by the cursor. Also move the waveform cursor.



⑨ **FEED Key:** Feeds recording paper into the unit as long as it is pressed down.

⑩ **PRINT Key:** Reprints a waveform stored in memory. Cannot be used in the recorder function mode.

⑪ **DISP COPY:** Prints on recording paper whatever is displayed on the LCD.

⑫ **BACK LIGHT Key:** Turns the LCD EL backlight out. Press any key to turn it on again.

⑬ **IC CARD Key:** Switches the LCD to the IC card mode, allowing for IC card operation. Press it after inserting the IC card.

⑭ **MANU TRIG Key:** When pressed with the manual trigger set, the trigger signal is delivered and the trigger is applied.

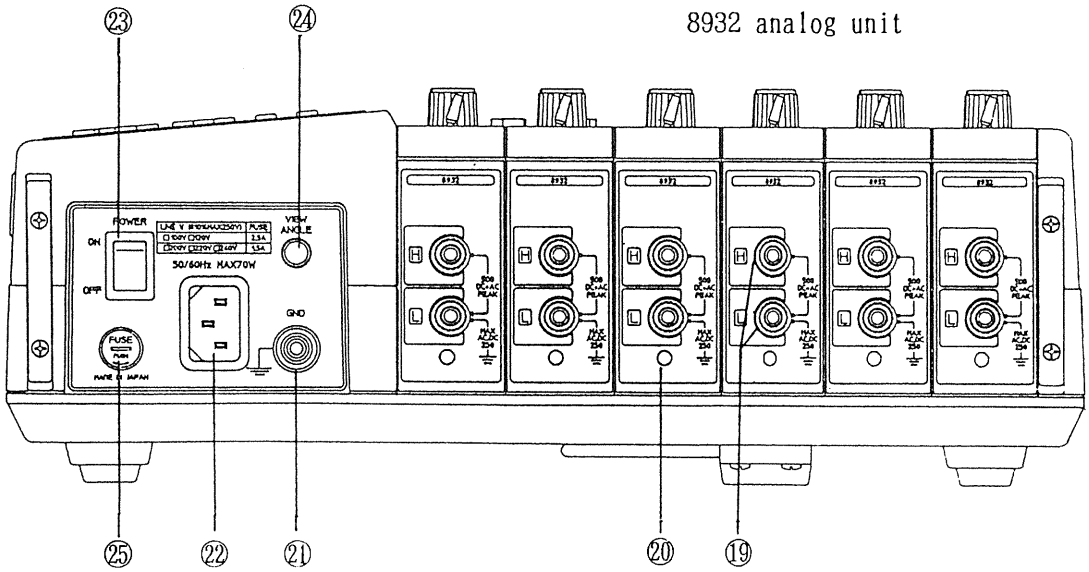
⑮ **POSITION Knobs:** Select the zero position among 11 settings, placed at 10% intervals (8932 analog unit).

⑯ **FILTER Switches:** Make the input signal pass through a low-pass filter. Three settings are provided: 5 Hz, 500 Hz and OFF (8932 analog unit).

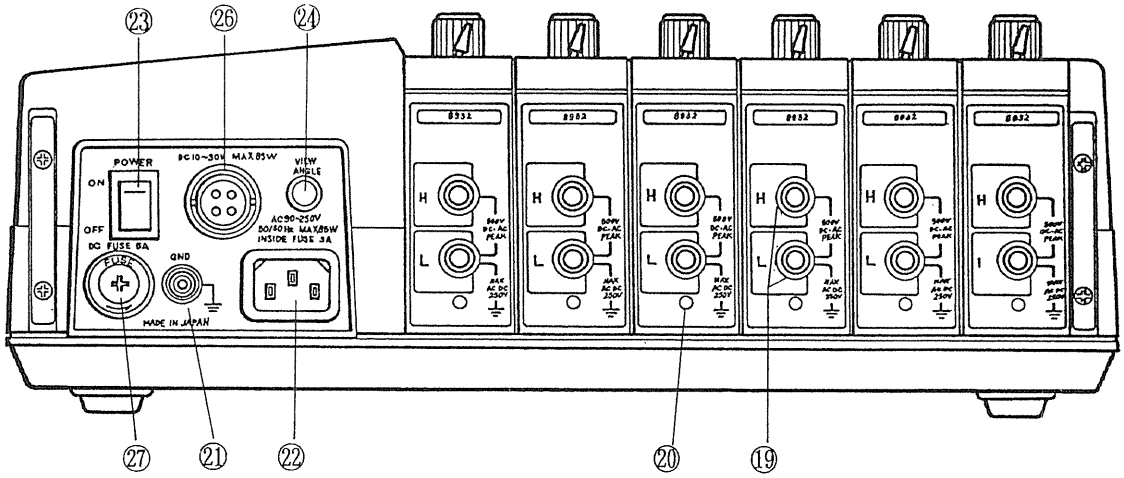
⑰ **RANGE Knobs:** Select the input unit measurement range among 12 settings. Use them in combination with ⑱ (8932 analog unit).

⑱ **Range Selectors:** Select measurement range units between mV/DIV and V/DIV (8932 analog unit).

8832



8833



⑲ Analog Input Terminals: Analog unit input terminals. Unbalanced (8932 analog unit).
[H] : High-level input
[L] : Low-level input

⑳ Zero Position Fine Adjustment Trimmer: Turn it using a small screwdriver (8932 analog unit).

㉑ Protective Ground Terminal (GND): Grounds the case. Make sure to connect it to a proper ground to ensure safe and stable operation.

㉒ AC Power Connector: Connect the provided AC power cord to this connector. This is a 3-terminal connector with ground.

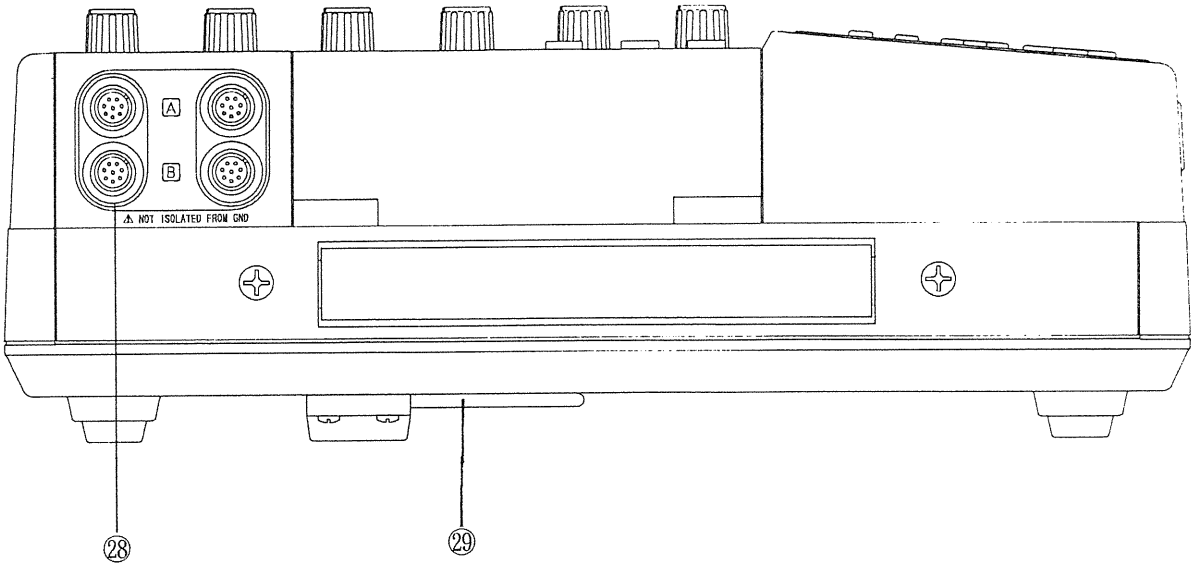
㉓ POWER Switch: Turns power on and off. (With the 8833, this switch only controls AC power. The DC power cord switch is used for DC power.)

㉔ VIEW ANGLE Adjustment Knob: Use it to adjusts the LCD viewing angle.

㉕ FUSE Holder: Holds the fuse. (8832 only)

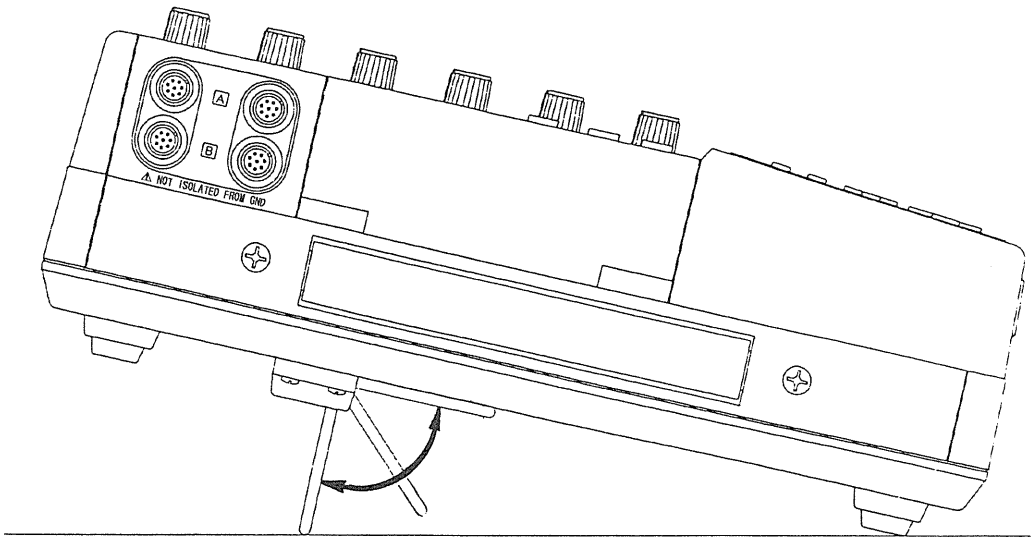
㉖ DC power Connector: Connect the provided DC power cord to this connector. Pay attention to polarity when using a DC power supply.
When connecting the unit to a DC power supply, be very careful not to reverse the polarity of the power supply lines. (See 3-1.)

㉗ FUSE Holder: Holds a fuse for the DC power supply. (8833 only) (The fuse for the AC power supply is built into the unit.)

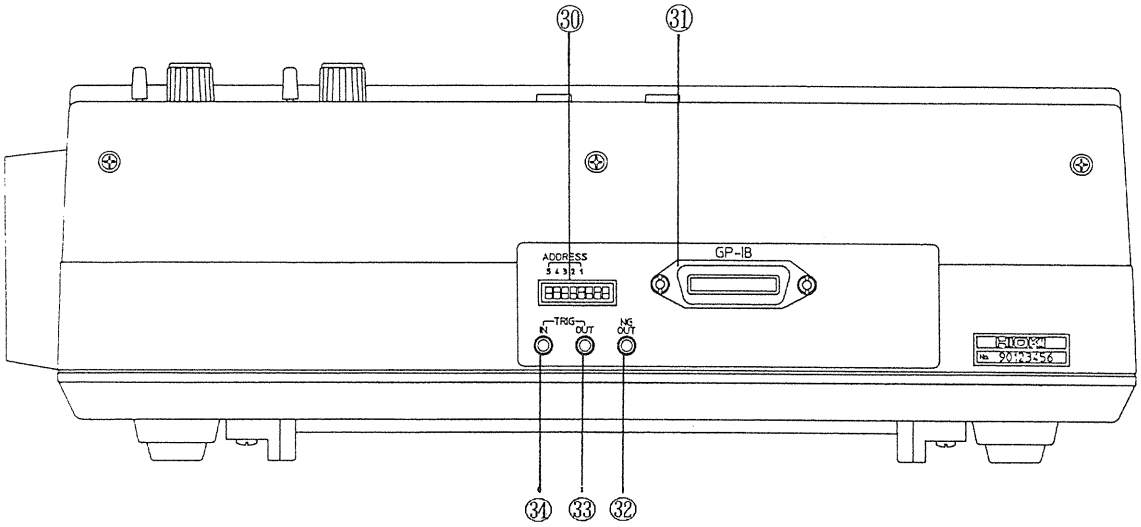


㉘ **Logic Probe Terminals:** Logic unit input terminals for exclusive use with the optional logic probes. Up to four probes can be connected (CH7, CH8)

㉙ **Stand:** Use this stand to tilt up the 8832.



Stand in upright position



㉚ GP-IB DIP Switch: DIP switch for the GP-IB interface (option to be specified when ordering).

㉛ GP-IB Connector: To connect the GP-IB interface cable (option to be specified when ordering).

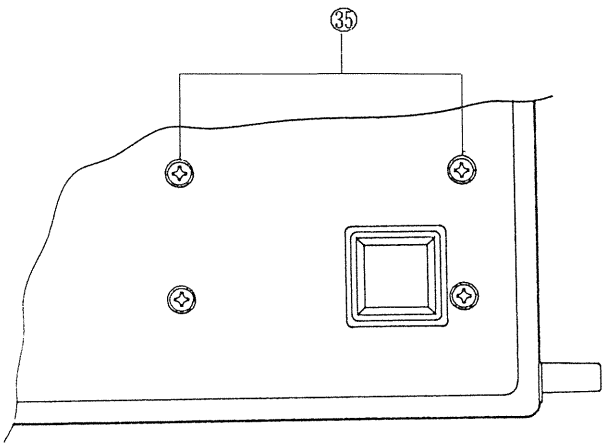
㉜ NG Output Terminal: Delivers a signal (active low, pulse width approx. 18 ms or more) when the result of waveform evaluation is NG .

㉝ TRIG OUT Jack: Delivers a signal when the trigger is applied. (active low, pulse width approx. 1.5 ms)

㉞ TRIG IN Jack: Trigger is applied when the external trigger source is selected and this jack is short-circuited or it receives a rising edge of approx. 2.5 V (active low).

㉟ Fixing Screws: Secure the input units.

[bottom panel]



CHAPTER 1

OUTLINE

1 — 1 Product Outline

The compact 8832 Memory Hi-Corder is a new type of waveform recorder that integrates observation and recording functions. Two input systems, logic and analog, are provided, making the unit applicable to a wide range of phenomena from low to high speeds.
The 8833 uses a dual power supply system for AC and DC, allowing a wider range of applications.

Major Features of the 8832 and 8833

(1) Wide LCD for clear waveform display
This unit uses a 640 × 200 dot LCD (Liquid Crystal Display), adding waveform observation to conventional recorder functions. Furthermore, waveform display reduction/enlargement, cursor readout, partial printing and analysis functions are provided.

(2) Four functions to meet every measurement need
Recorder function for lengthy and continuous real-time recording, memory recorder function to securely catch transient and other high-speed phenomena, and high-speed XY recorder and continuous XY recorder functions for XY composition of the above phenomena.

(3) Powerful trigger functions
Digital trigger circuits are used, allowing trigger level to be specified in 1% steps. Trigger slope, trigger filter and other convenient functions are also provided.

(4) High-speed sampling and large memory capacity
A maximum sampling speed of 500 kS/s (500 ksample/s) and a maximum memory capacity of 125 kword (1-2 channel), for securely capturing sporadic phenomena.

(5) Easy-to-use control panel
Measurement conditions can be easily set while looking at the LCD. Operation keys are few, making setting easy.

(6) Selectable input channel nember
The 6-channel plug-in input unit system allows for free selection of analog units.

(7) Floating input units
Analog input units are floating, each connected to an independent potential point.

(8) Logic input unit is included as standard equipment
A 16-channel logic input unit is included as standard equipment. The input unit is integral to the main chassis.

(9) Convenient RAM cards
RAM cards can be used for external storage of waveforms and measurement parameters.

(10) GP-IB, RS-232C interface (option to be specified when ordering)
A GP-IB, RS-232C interface can be installed as an option (to be specified when ordering). This makes data I/O and remote control through a computer possible.

(11) Waveform evaluation function

The unit checks whether the signal is within a reference area and delivers a GO/NG signal accordingly. The reference area can be easily specified by setting vertical and horizontal allowances from a reference waveform.

(12) Scaling function

By setting the physical quantity and unit name for the input signal, the measured input voltage value can be converted to the desired units.

Exclusive features of the 8833 only

(13) AC/DC dual power supply.

(14) Universal power supply system allows AC power supply voltages from 90 to 250V (50/60 Hz) or DC power supply voltages from 10 to 30V to be used without switching.

(15) If both an AC power supply and batteries are connected, data recording is not interrupted if an AC power failure occurs. The 8833 uses AC power under normal conditions, then switches to the battery when an AC power failure occurs. (The 8833 can not charge external batteries.)

1 — 2 System Operation

- This unit has a built-in 8-bit microprocessor which controls the whole system.

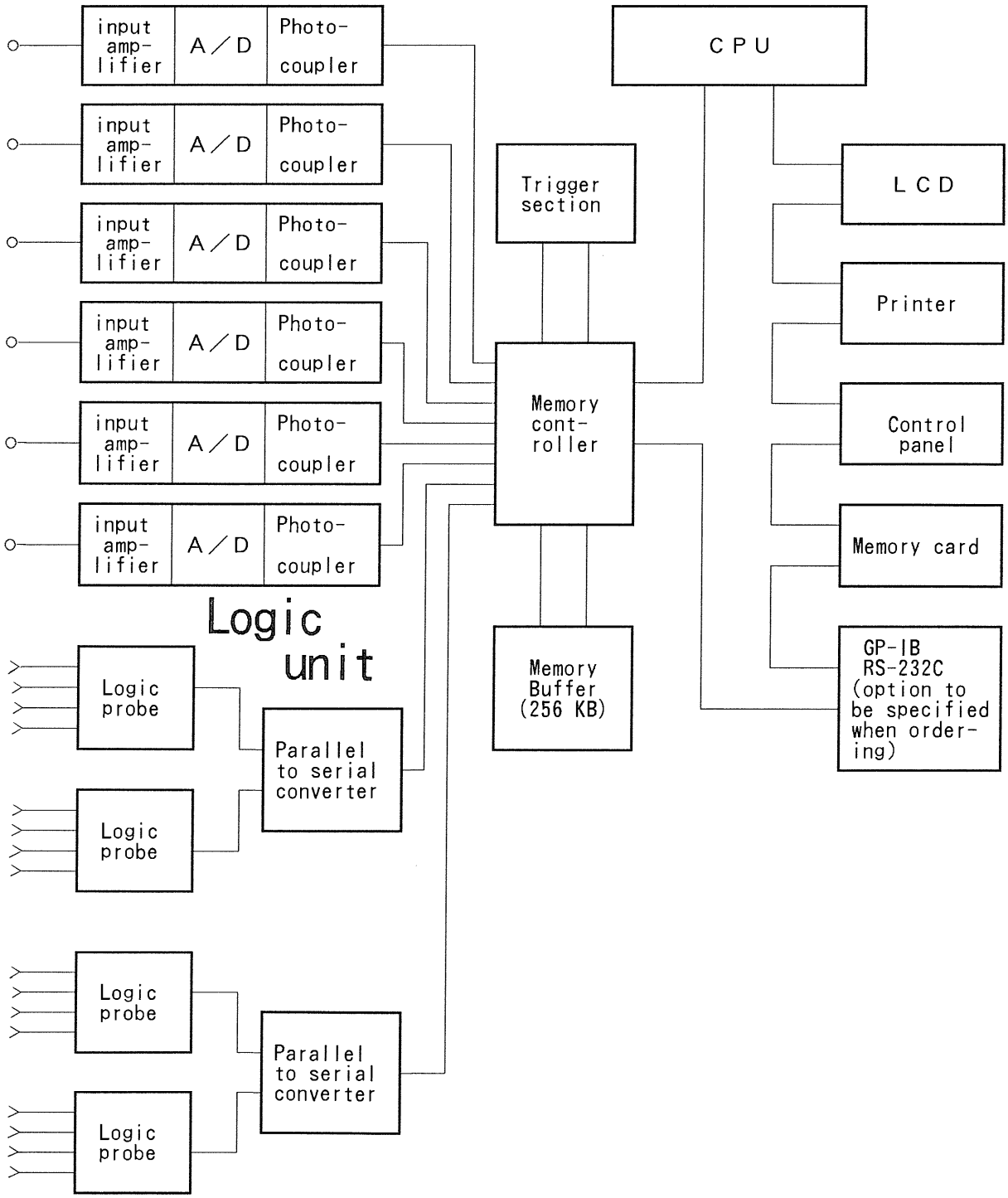
- Each input unit is provided with an 8-bit high-speed A/D converter, connected to the main unit through a photocoupler. A separate power source is used for each channel, ensuring total electrical insulation from the main unit.

- A/D converted data are stored in the 256-kword RAM by the memory controller.

- This unit uses digital trigger circuits. When internal triggering is used, the signal converted to digital is compared to the preset value and the trigger signal generated accordingly.

- Measurement data stored in the memory are processed by the CPU, then displayed on the LCD and output to the graphics printer. Data can also be output to a RAM card, RS-232C interface and the GP-IB interface (option to be specified when ordering).

Analog unit


input amp-lifier
A／D
Photo-coupler
input amp-lifier
A／D
Photo-coupler
input amp-lifier
A／D
Photo-coupler
input amp-lifier
A／D
Photo-coupler
input amp-lifier
A／D
Photo-coupler
input amp-lifier
A／D
Photo-coupler
Logic unit
Logic probe
Logic probe
Logic probe
Logic probe
Parallel to serial converter
Parallel to serial converter
CPU
Trigger section
Memory cont-roller
Memory Buffer (256 KB)
LCD
Printer
Control panel
Memory card
GP-IB
RS-232C
(option to be specified when order-ing)

CHAPTER 2

SPECIFICATIONS

2－1 Main Unit General Specifications

〔Basic Specifications〕

Measurement functions:	REC	Recorder
	MEM	Memory recorder
	XY_{MEM}	High-speed XY recorder
	XY_{CONT}	Continuous XY recorder
Maximum number of channels (MAX):	Six analog channels and 16 logic channels Note: 8 logic channels correspond to 1 analog channel.	
Memory capacity:	8 bits×125 kword/channel (when using 1 or 2 channel) 8 bits× 60 kword/channel (when using 3 or 4 channels) 8 bits× 30 kword/channel (when using 5 or 8 channels)	
Maximum sampling speed:	500 kS/s	
Input system:	Plug-in input units	
Time axis accuracy:	±0.01% (relative error between readings and actual times)	
Clock functions:	Calendar with automatic adjustment for leap years 24-hour display clock	
Maximum clock accuracy:	50 ppm (25 ℃)	
Backup battery life:	8 years (reference value at 25℃). For the clock, unit settings and waveform datas.	
Operation environment:	Temperature 5℃ to 40℃ Humidity 35% to 80% (no condensation)	
Accuracy assurance environment:	Temperature 23℃ ±5℃ Humidity 35% to 80% (no condensation)	
Storage environment:	Temperature -10℃ to 50℃ Humidity 10% to 70% (no condensation)	
Insulation resistance and dielectric strength:	100 MΩ minimum/DC 500 V, AC 1.5 kV/1 minute (between case and AC power supply) 100 MΩ minimum/DC 500 V, AC 1.5 kV/1 minute (between input unit and case) 100 MΩ minimum/DC 500 V, AC 1.5 kV/1 minute (between two input units) 100 MΩ minimum/DC 500 V, AC 500 V/1 minute (between case and DC power supply; 8833 only)	
Shock resistance :	30G in each of X, Y, and Z directions (when not operating)	
Rated vibration resistance:	Frequency-Sweep at the rate of about 1 octave/minute over the range from 10Hz to 55Hz and back again. Amplitude-0.3mm for 30 minutes in each of X, Y, and Z directions (When not operating)	

Power Requirements: 8832···AC 100 V ±10% 50/60 Hz (optionally 120, 200, 220 or 240V ±10% specified when ordering)
8833···AC/DC universal power spply; AC 90-250 V, DC 10-30 W
When both AC and DC power sources are connected the AC power is. If an AC power failure occurs (or if the AC input voltage drops below 60 V), the AC power is automatically disconnected and the DC power is used.

Power consumption: 8832···70 W max. (approx. 26 W during normal recording)
8833···85 W max. (AC/DC power supply, approx. 33 W during normal recording)

Dimensions: Approx. 342 H × 340 W ×105 D (mm) (not including protrusions)

Weight: 8832···Approx. 6 kg (main unit only)
8833···Approx. 5.5 kg (main unit only)

〔Recorder Section〕

Recording method: Thermal printing with thermal line head

Recording paper: 110mm × 30m roll type thermal recording paper

Recording width: (total) 104.2 mm (624 dots)
(waveform section) 83.8 mm f.s.

Scale: 1 DIV = 8.35 mm (50 dots)

Paper feed system: Stepping motor drive

Recording speed: 1.2 cm/s max.

Paper feed accuracy: ±3% (25℃, 60%)

〔Display Section〕

Display device: Blue mode LCD (640 × 200 dots) with EL backlight

Display resolution: Waveform section 504 × 200 dots (recorder, memory recorder)
256 × 200 dots (high-speed XY recorder, continuous XY recorder)
Text section 80 characters × 25 lines

Dot pitch: 0.33 (vertical) × 0.396 (horizontal) mm

〔Others〕

Standard accessories:

Power cord	1
DC power cord	1 (8833 only)
Recording paper (roll type)	1
Protective cover	1
Roll paper attachment	2
Spare fuse	1
8832: power supply 100/120 V	: 2.5 A/250 V, 5.2 mm dia. × 20 mm
power supply 200, 220, 240 V	: 1.5 A/250 V, 5.2 mm dia. × 20 mm
8833: DC power supply 10-30 V	: 8 A/250 V, 6.4 mm dia. × 30 mm
Instruction manual	1

Options:	8932 analog unit
	8934 analog unit (DC/RMS type)
	9508 blank panel
	9506 GP-IB interface (option to be specified when ordering)
	9507 RS-232C interface (option to be specified when ordering)
Optional accessories:	9221 recording paper (in 10-roll sets)
	9303 PT
	9305 Trigger cord
	9306 Logic probe
	9307 line logic probe
	9308 line dip detector
	9366 Case
	9084 Case (for the accessories)
	9527 RAM card
	9151-01 GP-IB connector cable (1m)
	9151-02 GP-IB connector cable (2m)
	9151-04 GP-IB connector cable (4m)
	220H chart takeup reel
	9534 ROM card (FFT Calculation) see note 1
	9535 ROM card (Calculation) see note 1
	Note 1: ROM card is compatible with version 2.00 and higher.

2 − 2 Input Unit Specifications

(1) 8932 Analog Unit (at 23℃± 5℃) Accuracy assurance period: 6 months

Input method:	Unbalanced input (input and output mutually insulated)
Measurement ranges:	10, 20, 50, 100, 200, 500 mV/DIV
	1, 2, 5, 10, 20, 50 V/DIV
DC amplitude accuracy:	±1% f.s.
Zero position adjustment:	11 settings, placed at 10% intervals on the 100% recording width, and fine adjustment
Zero position accuracy:	±1% f.s.
Frequency characteristic:	DC to 200 kHz (-3 dB)
Input RC:	1 MΩ ±1% (mV/DIV); approx. 30 pF (V/DIV); approx. 25 pF at 100 kHz
Low-pass filter:	Cutoff frequency approx. 5Hz, approx. 500Hz, and OFF setting
A/D conversion resolution:	8 bits
Maximum sampling speed:	500kS/s (sampling interval 2 μs)
Permissible input voltage:	500V (DC + AC peak) Continuous
Maximum floating voltage:	AC/DC 250 V (between input unit and case, and between input units)

Insulation resistance and dielectric strength: 100 MΩ minimum/DC 500 V, AC 1.5 kV/1 minute (between input unit and case, and between input units)

Common mode masking ratio: 80dB min. (source impedance 100Ω max. at 50 or 60 Hz)

Temperature characteristic: ±0.1% f.s./ ℃

Input terminals: Two

Dimensions and weight: Approx. 34 H × 124 W × 82 D (mm) (excluding protrusions); approx. 220g

Accessories: 9177 input cord
Fixing screws of input unit 2

2 − 3 Trigger Section

Triggering method: Digital comparison

Trigger modes: Memory recorder, high-speed XY recorder ···Single, repeat, auto
Recorder·····Single, repeat
Continuous XY recorder·····Single

Trigger source: OFF, CH1, CH2, CH3, CH4, CH5, CH6, CH7, CH8, EXT, MANU, TIMER (free running when OFF)

Trigger slope: Analog input··· rise, fall
Logic input ··· condition match
EXT input ····· fall

Trigger level: Analog input··· digitally set between 0% and 100% (1% steps)
EXT ····· approx. 2.5 V or terminal short-circuit

Trigger level setting accuracy: ±0.4% f.s. (f.s. = 100%)

Logic input conditions: 1, 0 and OFF pattern settings
AND/OR within the logic input

Pre-trigger: 0, 5, 25, 50, 75, 95, 100, -95%
(memory recorder, high-speed XY recorder)

Trigger timing: Start, stop (recorder, continuous XY recorder)

Trigger filter: OFF, 0.1, 0.2, 0.3, 0.6, 1.3, 2.6 DIV
(memory recorder, high-speed XY recorder)
OFF, ON (recorder)

Wait-less mode: Provided (memory recorder, high-speed XY recorder)

Trigger output: Open collector (with 5-V output; active low)
Pulse width approx. 1.5 ms

Trigger I/O terminals: 3.5-mm-dia. minijacks

2 − 4 Recorder Function (REC)

Time axis:	1 s/DIV to 50 min./DIV; 1-2-5 steps, 12 ranges
Time axis resolution:	50 dots/DIV at 1 s/DIV; 100 dots/DIV at other settings
Sampling rate:	Constant regardless of time axis (high-speed sampling)
	1 channel ···110 μs 5 channel ···170 μs
	2 channels···130 μs 6 channel ···190 μs
	3 channels···140 μs 7 channel ···200 μs
	4 channels···160 μs 8 channel ···200 μs
	(for both dot and line displays)
	Note: 8 logic channels correspond to 1 analog channel.
Recording length:	20, 40, 80, 160, 300, 600 DIV, CONT
Printing format:	Single, dual, quad
Interpolation function:	Provided, dot/line display
Waveform scroll:	Possible in both vertical and horizontal direction
Printing functions:	OFF, ON (selects between printer and LCD output)

2 − 5 Memory Recorder Function (MEM)

Time axis:	100 μs/DIV to 5 s/DIV; 1-2-5 steps, 15 ranges
Time axis resolution:	50 dots/DIV
Sampling rate:	1/50 of time axis
Recording length:	20, 40, 80, 160, 300, 600 (5 or 8 channels), 1200 (3 or 4 channels),
	2500 (1 or 2 channel) DIV
	Note: 8 logic channels correspond to 1 analog channel.
Printing format:	Single, dual, quad
Interpolation function:	Provided, dot/line/smooth display
Waveform enlargement and compression rates (time axis direction):	
	×1/100, ×1/50, ×1/20, ×1/10, ×1/5, ×1/2
	×1, ×2, ×4, ×8
Waveform scroll:	Possible in both vertical and horizontal directions
Auto-printing:	OFF, ON
Manual printing:	Supported
Partial printing:	Prints the portion after cursor A or between cursors A and B

2 − 6 High-speed X-Y Recorder Function (XY_{MEM})

X channel: Channel 1 (only for analog input unit)
Y channel: Channels 2 to 6 (only for analog input unit)
Effective recording area: 83.8 mm × 83.8 mm (10 DIV × 10 DIV)
X/Y axis resolution: 25 dots/DIV
Sampling rate: 2 μs to 100 ms
Recording length: 20, 40, 80, 160, 300, 600 (Y axis, 4-5 channels), 1200 (Y axis, 1-2 channels) DIV
Interpolation function: Provided, dot/line display
Waveform scroll: Possible in vertical direction
Auto-printing: OFF, ON
Manual printing: Supported

2 − 7 Continuous X-Y Recorder Function (XY_{CONT})

X channel: Same as XY_{MEM}
Y channel: Same as XY_{MEM}
Effective recording area: Same as XY_{MEM}
X/Y axis resolution: Same as XY_{MEM}
Sampling rate:

	Dot display	Line display
1 channel	60 μs	170 μs to 6 ms
2 channels	70 μs	230 μs to 10 ms
3 channels	80 μs	300 μs to 14 ms
4 channels	90 μs	360 μs to 19 ms
5 channels	100 μs	430 μs to 23 ms

Recording time: Infinite
Interpolation function: Provided, dot/line display
Waveform scroll: Possible in vertical direction
Superposed printing: Supported
Monitor function: Provided (LCD)

2 — 8 Auxiliary Functions

Message printing: Function, channel(s) used, input range, zero position, trigger conditions, trigger time, No. of divs., etc.

Recording line designation: Independent for each channel
Analog recording··· wide, slim (only printer output), OFF
Logic recording ··· A + B (8 channels), A (4 channels), B (4 channels), OFF

Auto-list gage: OFF, ON

Squared pattern designation:OFF, NORMAL, FINE (only for printing)

Time axis automatic setting:Possible in memory recorder and high-speed XY recorder modes

X-Y and T-Y conversion: Possible between the memory recorder and the high-speed XY recorder

Start condition backup: OFF, ON

Cursor measurement functions: Time difference, frequency and potential difference between A and B cursors. Potential and elapsed time from trigger for A cursor. Cursor readout (memory recorder)

Display reduction: Normal, reduced (1/2 in vertical direction) ···In normal mode, 8 DIV are displayed among 10 DIV f.s. The remaining 2 DIV can be observed by scrolling.

Scaling function: This function can be set to each channel.

Channel marker function: OFF ON (for printing output only)

Input level monitor function:Provided

Waveform evaluation: Supported for channel 1 analog waveforms in memory recorder mode (recording length 600 DIV or less)

- Evaluation method: GO/NG evaluation based on upper/lower limits comparison
- Evaluation area setting:By designation of vertical and horizontal margins around reference waveform
- Evaluation modes: 1 - GO if the entire waveform is in the area
  2 - GO if at least some part of the waveform is in the area
  3 - GO if the entire waveform is outside the area
  4 - GO if at least some part of the waveform is outside the area
- Stop modes: GO stop, NG stop, GO and NG stop
- Evaluation output: NG evaluation result output to 3.5-mm-dia. minijack ···Open collector output (with 5-V output, active low, pulse width 18 ms or more)
- Evaluation time: Approx. 30 ms (20-DIV evaluation; waveform input time excluded)

RAM card: External storage for set parameters, waveform data and evaluation area data

- Applicable RAM cards: JEIDA standard, 68 pins, 64 kbytes to 4 Mbytes
- Auto-setup function: Set parameters and evaluation area data stored in the RAM card are automatically loaded when power is turned on.

Auto-save function: Provided

GP-IB (option to be specified when ordering): Electrical and mechanical specifications meet IEEE 488-1978 standards

RS-232C (option to be specified when ordering): Electrical specifications meet EIA RS-232C standards.
Supports waveform data read/write, input unit settings readout and main unit remote control

Message input function: 20 char. maximum (only printed on the chart)
Comments of up to 10 characters can be input for each channel (only printed on the chart)

2 − 9 Additional Data

Memory Recorder and High-speed XY Recorder Functions (XY_{MEM} function between brackets)

TIME/DIV	Sampling Interval	Maximum Recording Time		
		1-2ch ※1 (Y axis 1)	3-4ch ※2 (Y axis 2-3)	5-8ch ※3 (Y axis 4-5)
100μs/DIV	2μs	250 ms	120 ms	60 ms
200	4	500	240	120
500	10	1.25 s	600	300
1ms/DIV	20	2.50	1.20 s	600
2	40	5.00	2.40	1.20 s
5	100	12.5	6.00	3.00
10	200	25.0	12.0	6.00
20	400	50.0	24.0	12.0
50	1ms	125	60.0	30.0
100	2	250	120	60.0
200	4	500	240	120
500	10	1250	600	300
1 s /DIV	20	2500	1200	600
2	40	5000	2400	1200
5	100	12500	6000	3000

Time axis resolution is 1/50 (per DIV)

※1 Recording length 2500 DIV

※2 Recording length 1200 DIV

※3 Recording length 600 DIV

Note: 8 logic channels correspond to 1 analog channel.

Recorder Function

Time/DIV	Chart Speed	Time Axis Resolution
1 s/DIV	501 mm/min	1/50 DIV
2	250.5	1/100 DIV
5	100.2	
10	50.1	
20	25.1	
50	10.0	
1 min/DIV	501 mm/h	
2	250.5	
5	100.2	
10	50.1	
20	25.1	
50	10.0	

Recorder Function Sampling Speed

No. of Channels Used	Sampling Speed	Sampling Interval
1	9.09 kS/s	110 μs
2	7.69 kS/s	130 μs
3	7.12 kS/s	140 μs
4	6.25 kS/s	160 μs
5	5.88 kS/s	170 μs
6	5.26 kS/s	190 μs
7	5.00 kS/s	200 μs
8	5.00 kS/s	200 μs

Note: 8 logic channels correspond to 1 analog channel.

Continuous XY Recorder Function

	Dot		Line
No. of Channels Used	Sampling Speed	Sampling Interval	Sampling Interval Range
1	16.67 kS/s	60 μs	170 μs ~ 6 ms
2	14.29 kS/s	70 μs	230 μs ~ 10 ms
3	12.50 kS/s	80 μs	300 μs ~ 14 ms
4	11.11 kS/s	90 μs	360 μs ~ 19 ms
5	10.00 kS/s	100 μs	430 μs ~ 23 ms

Note: When line interpolation is used, the sampling interval is not constant.

CHAPTER 3

INSTALLATION AND PREPARATION

3 − 1 Notes on Installation

(1) Main Power Supply and Fuse

The type of power on which this unit can operate is indicated on the side panel. Be sure to check the power supply voltage. The fuse rating is also marked on the side panel. Be sure to use a fuse of the specified current rating.

① 8832

LINE VOLTAGE (±10%) 250V MAX 50/60Hz			FUSE	SIZE
☐ 100V	☐ 120V		2.5A/250V	5.2(dia.)×20mm
☐ 200V	☐ 220V	☐ 240V	1.5A/250V	5.2(dia.)×20mm

CAUTION

Specify the line voltage at time of order. Note that the maximum applicable voltage is 250V for the 240V type.

② 8833

	FUSE	SIZE
AC 90 ～ 250V 50/60Hz	3.0A/250V (built-in)	5.2(dia.)×20mm
DC 10 ～ 30V	8.0A/250V	6.4(dia.)×30mm

- Universal AC/DC power supply system allows switches operation over a wide range of input voltage.
- When both AC and DC power sources are connected, the AC power is used. If an AC power failure occurs (or if the AC input voltage drops below 60V), the AC power is automatically disconnected and the DC power is used.

CAUTION

The 8833 has no external battery charging function.
Never apply voltages outside of the specified range.
Operating the unit on such voltages may damage the unit. If the DC input voltage drops below approx. 9.5 V, the DC power is automatically disconnected to protect the unit.

Effective battery-powered operating time (typical value at normal temperature)

Battery:12V 36 Ah fully charged

8833 with four 8932's (1 to 6ch) and GP-IB installed

Operating condition	Printer not operating	Printer operating	
		Entire waveform section printed in black with recorder function set to 1s/DIV	0.2Hz sine wave printed with recorder function set to 1st/DIV
Usable time	Approx. 9 hours	Approx. 5 hours	Approx. 7 hours

Note: Actual performance will vary greatly from values indicated in this table according to the number times the battery has been recharged and the charge state.

Usable time varies in proportion to battery capacity. For a given capacity, a 24V battery will last about 1.5 times as long as a 12V battery.

(2) Power Cord

- Use only the power cord provided with the unit.
- When using DC power with the 8833, use only the provided DC power cord.

CAUTION (8833 only)

- When connecting the DC power cord to a DC power supply, be sure to connect the red wire to the "+" side and the black wire to the "−" side.
- Reversing the power cord polarity may damage the unit.
- When using an extension with the DC power cord, use wire with a rating at least equal to that of the provided cord.

(3) Protective Grounding

If a grounded power outlet is not available, be sure to ground the unit properly. Be sure to ground the 8833 properly even when using DC power. (When using the 8833 in a motor vehicle, connect the protective ground terminal to any metallic part of the vehicle's chassis.)

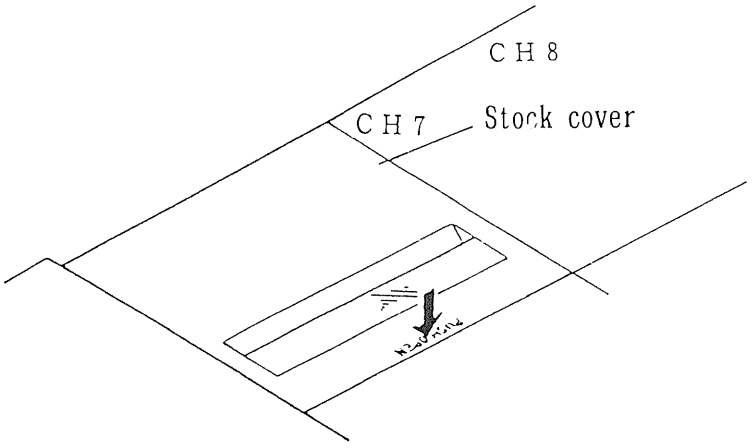
(4) Environmental Conditions

Temperature and humidity ranges for operation of this unit are 5℃ to 40℃ and 35% to 80%. Avoid locations exposed to direct sunlight, large amounts of dust, or corrosive gases.

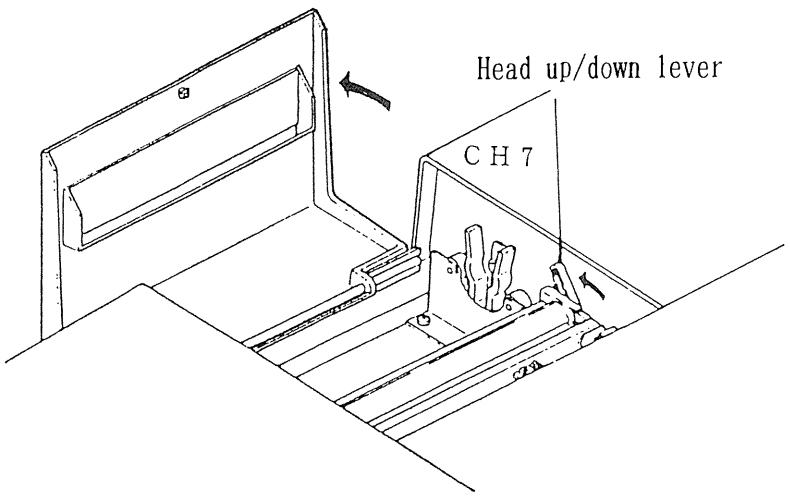
Although the 8833 can be used with either an AC or DC power supply, it is not designed for use in a motor vehicle. If you want to use the 8833 in a motor vehicle, use a cushion or other appropriate means to protect it from vibration.

3 − 2 Loading the Recording Paper

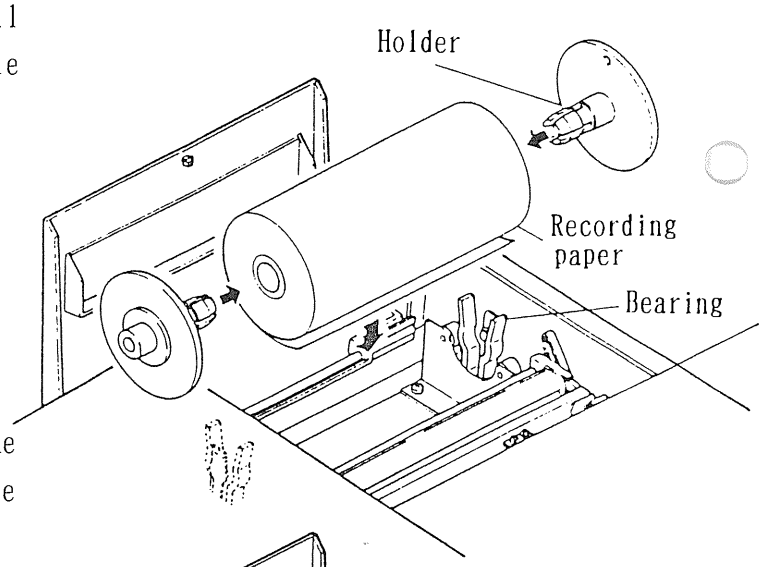
① Push the stock cover to open.



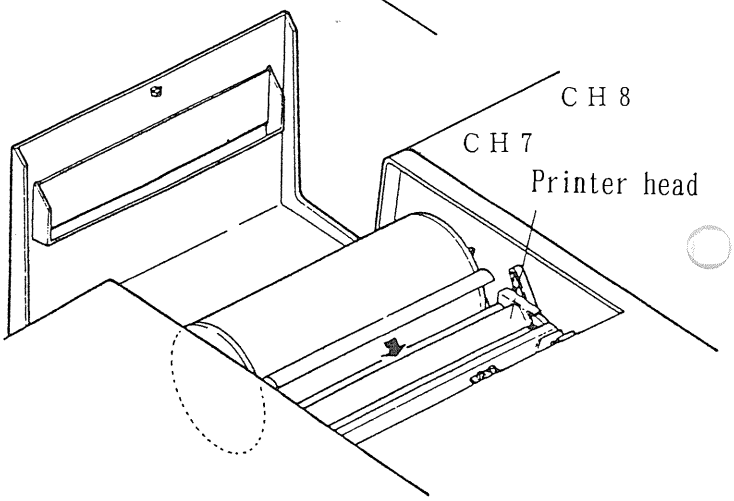
② Raise the head up/down lever.



③ Insert the holders into the paper roll core and place the paper onto the bearings.

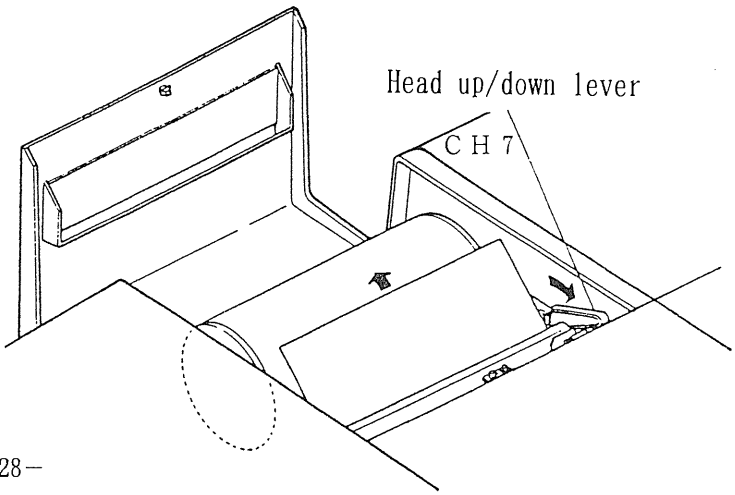


④ Insert the paper end from above into the printer slot, then pull it out from the other side.



⑤ Pull the paper out 10 cm or more and straighten it. If the paper does not come out smoothly, push the head up/down lever down and press the FEED key to feed paper in.

Note: Make sure that the paper is aligned with the roller, otherwise a paper jam may occur.

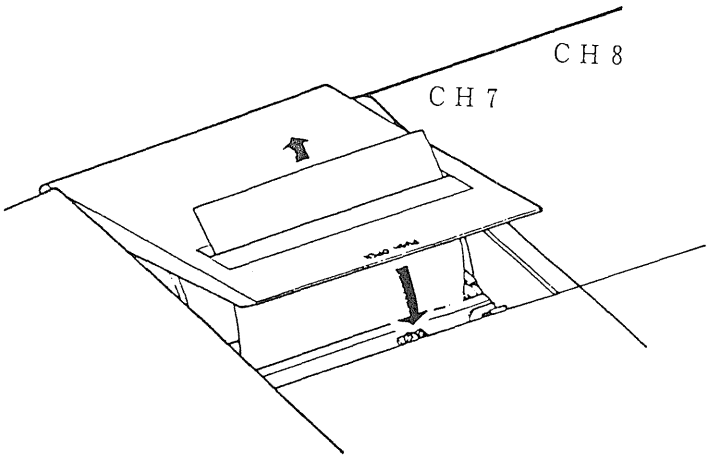


⑥ Push the head up/down lever down.

⑦ Pull paper out of the stock cover slot and close the cover. This completes the procedure.

Note 1: When the device is transported or stored for a lengthy period, make sure that the paper roll is kept in the head-up position. The roller may deform if it is continuously pressed against the head, causing irregular printing.

Note 2: Be sure to observe the proper paper position. Otherwise, no waveforms will be printed.



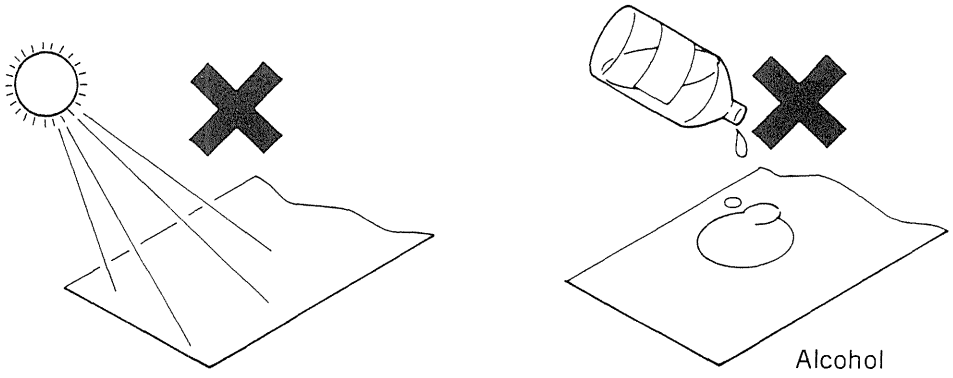
3 – 3 Recording Paper Handling

- Usually, storage conditions do not affect blank thermal paper rolls. However, if paper is to be stored for a long time, do so at temperature of 40℃ or lower. The paper is not adversely affected as long as it is stored at low temperature.
- If the paper is exposed to strong light for a long period, it may discolor. Therefore, do not expose the paper to a strong light with its wrapping removed.

Data Storage

Since recording paper is heat-sensitive, pay attention to the following when handling paper on which data have been recorded:

- Do not expose paper to direct sunlight.
- Store the paper at a maximum temperature of 40℃ and a maximum humidity of 90%.
- It is recommended that copies of important data be made for storage.
- The thermal paper may be discolored when put in contact to volatile organic solvents such as those based on alcohol, ether or ketone.
- When the thermal paper absorbs organic solvents such as those based on alcohol, ether or ketone, it may lose its color, resulting in the recorded data fading away. Soft vinyl chloride films and adhesive tapes such as cellophane tape contain these organic solvents.
- Do not place the thermal paper on wet diazo copy paper.



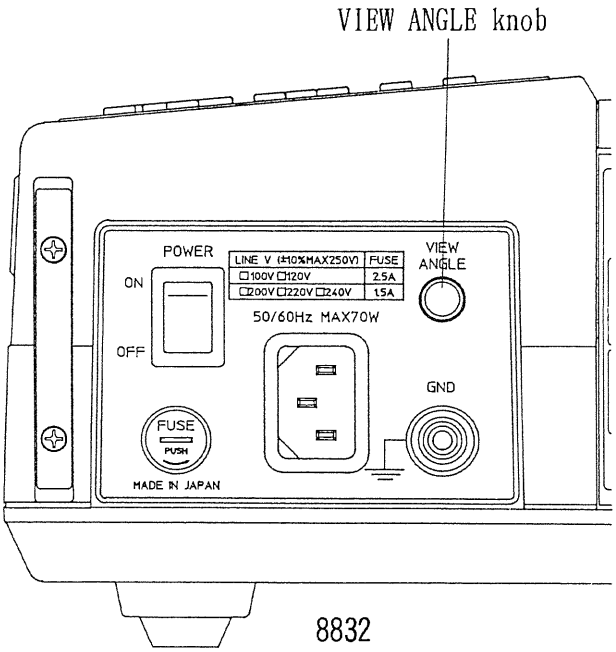
3 — 4 Notes on Measurement

⚠ WARNING

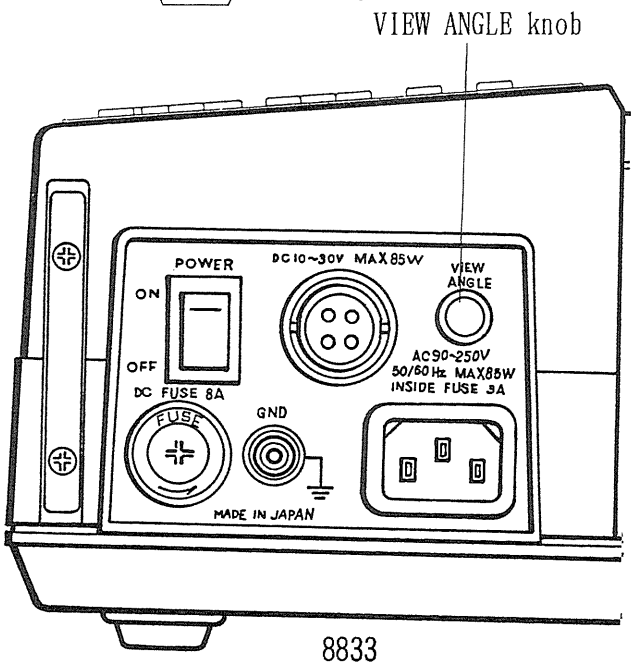
- The maximum permissible input voltage for the input terminals of the 8932 analog unit is 500 V (AC+DC peak). Take care to avoid voltage levels above this limit.
- The maximum input unit floating voltage is 250 V AC/DC. Avoid voltages over this limit between channels or between a channel and the main unit.
- The logic input uses the same common side as the unit itself.
- Always use a PT for measurement of AC power lines over 250 V.

3 — 5 LCD Viewing Angle Adjustment

Use the VIEW ANGLE knob on the right side panel of the main unit to adjust the LCD to the optimum viewing angle.



8832



8833

CHAPTER 4

OPERATION

4 − 1 Getting Started

4 − 1 − 1 Power On

(1) Turn the POWER switch ON. The current settings will be displayed on the LCD, and the unit will be ready for operation.

(2) Settings are stored in memory when power is turned off, so there is no need to reset the unit.

- System Reset

  Turn the POWER switch ON while pressing the STOP key to initialize the unit to the factory settings.

4 − 1 − 2 The LCD Panel

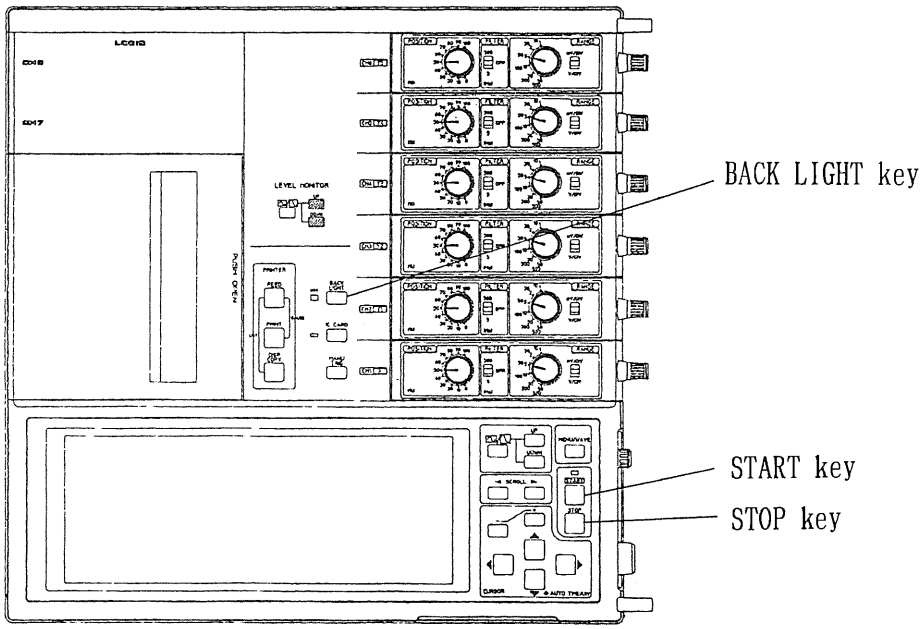
The LCD of this unit is equipped with an EL backlight, allowing for waveform observation even in dark places. Pressing any key will turn the backlight on.

⚠ CAUTION

To extend EL backlight life, turn it out when not using the LCD.

4 − 1 − 3 Start Condition Back up

In case power supply is interrupted during recording (LED above the START key lit), recording can be restarted immediately when power supply is restored. This function is convenient when power is temporarily cut due to power failures, etc. Refer to 4-1-3 Start Key Backup for setting instructions.



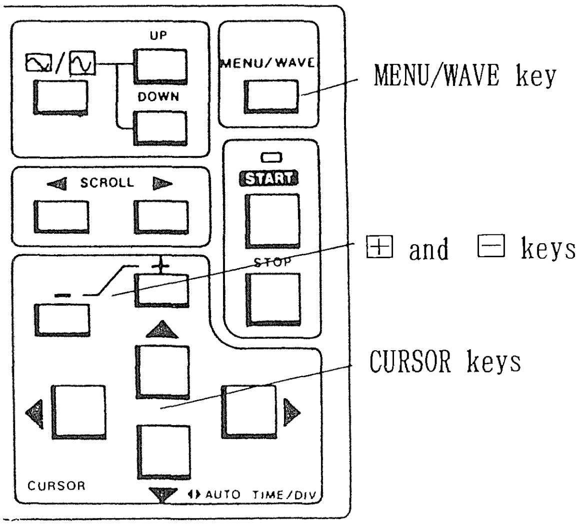
4 − 1 − 4 Display Modes and Setting

The 8832 is provided with two display modes, the MENU and WAVE modes. The MENU mode is used for setting the various parameters, and the WAVE mode for actual wave monitoring. However, inputting comments and scaling should be done using the WAVE display.

Both the MENU and WAVE modes have four common functions. In addition, various parameters are set using the MANU and WAVE displays.

To switch between the MENU and WAVE modes, press the MENU/WAVE key.

Switching between functions and setting of displayed parameters are performed by moving the cursor. This is done with the CURSOR keys.



Changing Functions

```
   MENU        ** RECORDER **                                          '90-11-02 10:00:00
*******STATUS*********************TRIGGER*********************PRINT*************
*                            *                           *                        *
*   time/div:       1s       *   mode:        SINGLE     *   ch8:          OFF    *
*                            *                           *   ch7:          OFF    *
*                            *   source:         CH1     *   ch6:          OFF    *
*                            *                           *   ch5:          OFF    *
*   shot:        20DIV       *     level:        50%     *   ch4:          OFF    *
*                            *                           *   ch3:          OFF    *
*                            *     slope:          ↑     *   ch2:          OFF    *
*                            *                           *   ch1:         WIDE    *
*   printer:       OFF       *     filter:       OFF     *                        *
*                            *                           *                        *
*                            *                           *   dot-line:    LINE    *
*                            *   timing:       START     *                        *
*                            *                           *                        *
*                            *                           *   format:    SINGLE    *
*                            *                           *                        *
**********************************************************************************
RECORDER MEMORY XYmem XYcont SYSTEM
```

Using the CURSOR key, move the cursor to the function indication. The selection line shows the available functions. Use the ⊞ and ⊟ keys to move the auxiliary cursor to the desired function.

If an Error Occurs

- Check the error message.
- Press the STOP key.
- Remove the cause of the error.

(refer to Appendix 1. Error Messages)

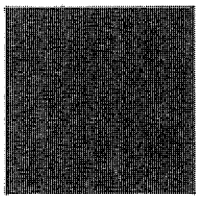
4－1－5　Input Level Monitor Function

Description and operating procedure

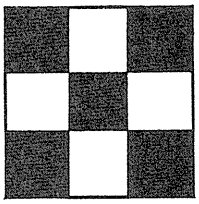
- Monitoring of the input level is possible on the LCD.
- Each channel, from CH1 to CH8, can be displayed.
- CH7 and CH8 display logic levels. HI levels are displayed as ■, and changing levels are displayed as ▩ (checker mark).
- A 128 segment full scale display (resolution 1/128 f.s.) is provided with a high-speed update rate of 15 times/second.

Operating procedure

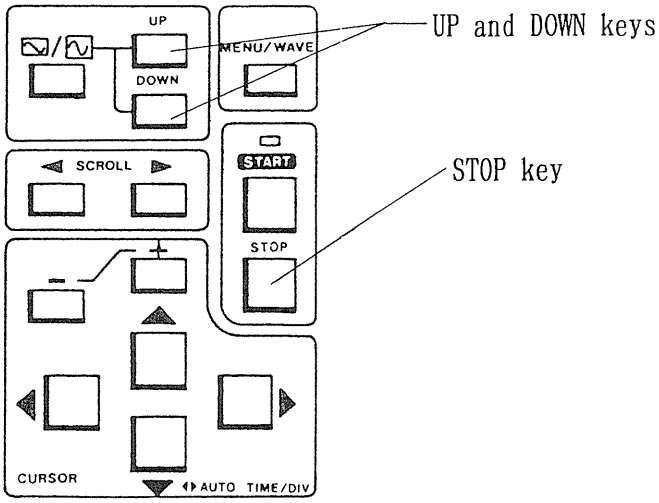
Press both the UP and DOWN keys together to change the LCD to input level monitor mode. The former display is restored by pressing the STOP key.

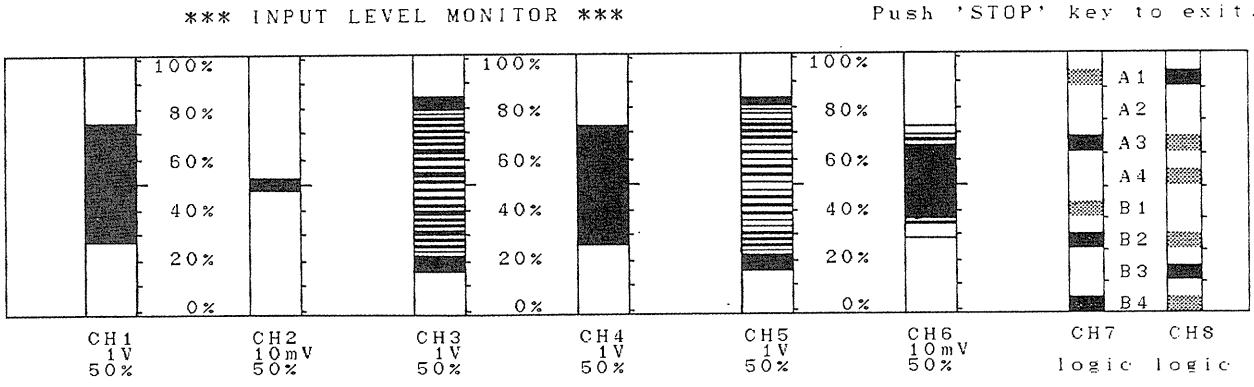


HI levels



checker mark



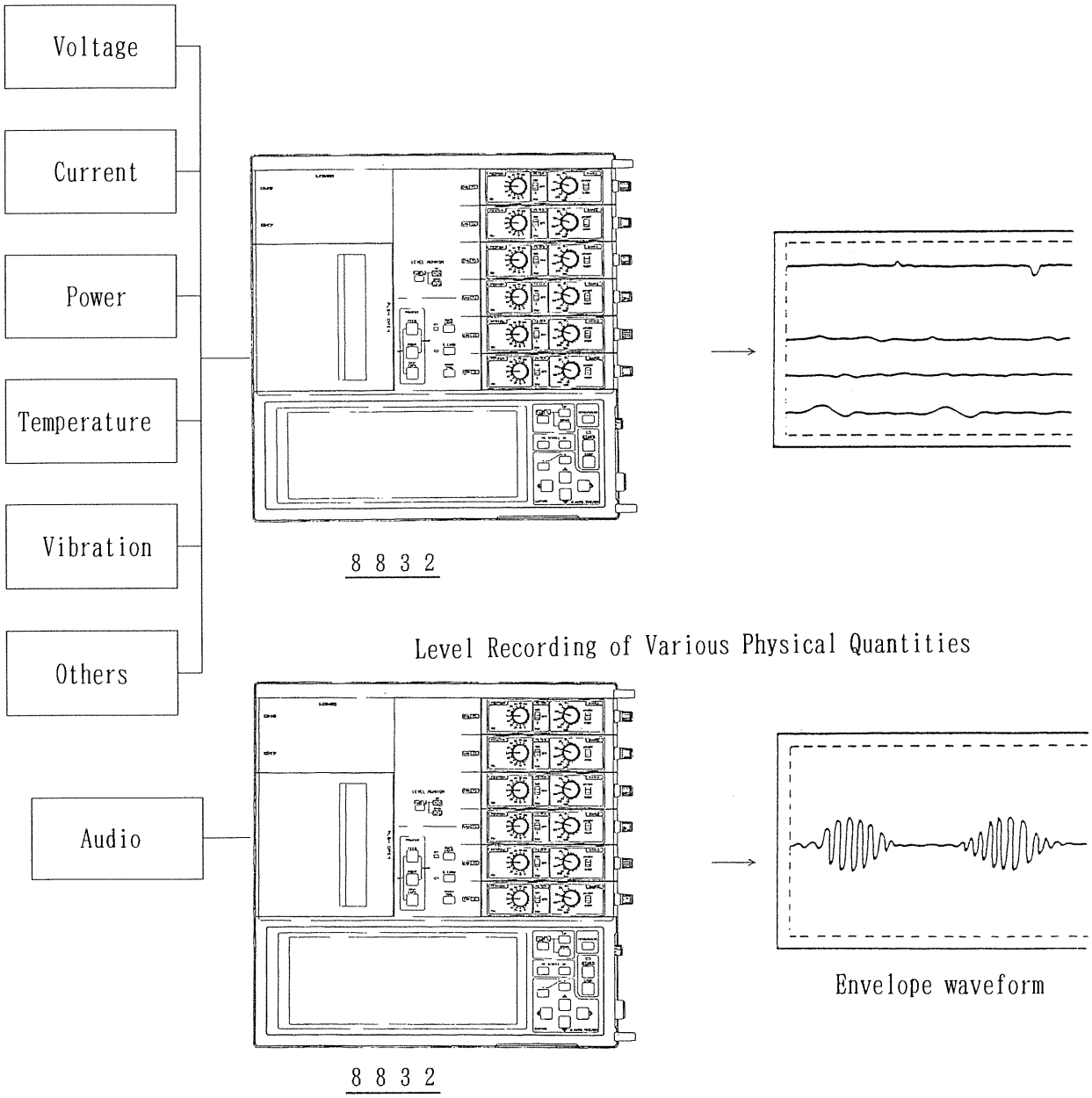


input level monitor

4 — 2 Using the Recorder Function

4 — 2 — 1 Features of the Recorder Function

(1) Continuous recording in real time.
(2) Data from all input channels are recorded on the same time axis. Signals can be recorded overlapped, helping to observe their mutual relationship.
(3) Charting rate can be adjusted in 12 steps from 1 s/DIV to 50 min./DIV.
(4) High-speed sampling:
Sampling is performed at intervals of 110μs minimum and 200μs maximum, allowing for envelope observation.
(5) At charting rates of 2 s/DIV to 50 min./DIV, a smooth printout close to an analog waveform can be obtained.
(6) In addition to real-time continuous recording, scrolling of wavefroms up to 80 DIV including the dosplayed picture is possible.

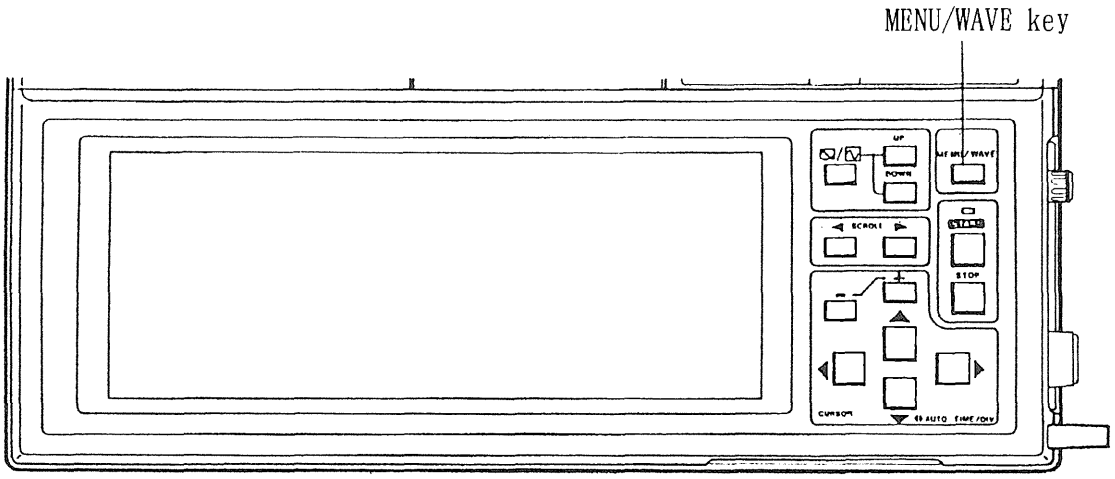


Level Recording of Various Physical Quantities

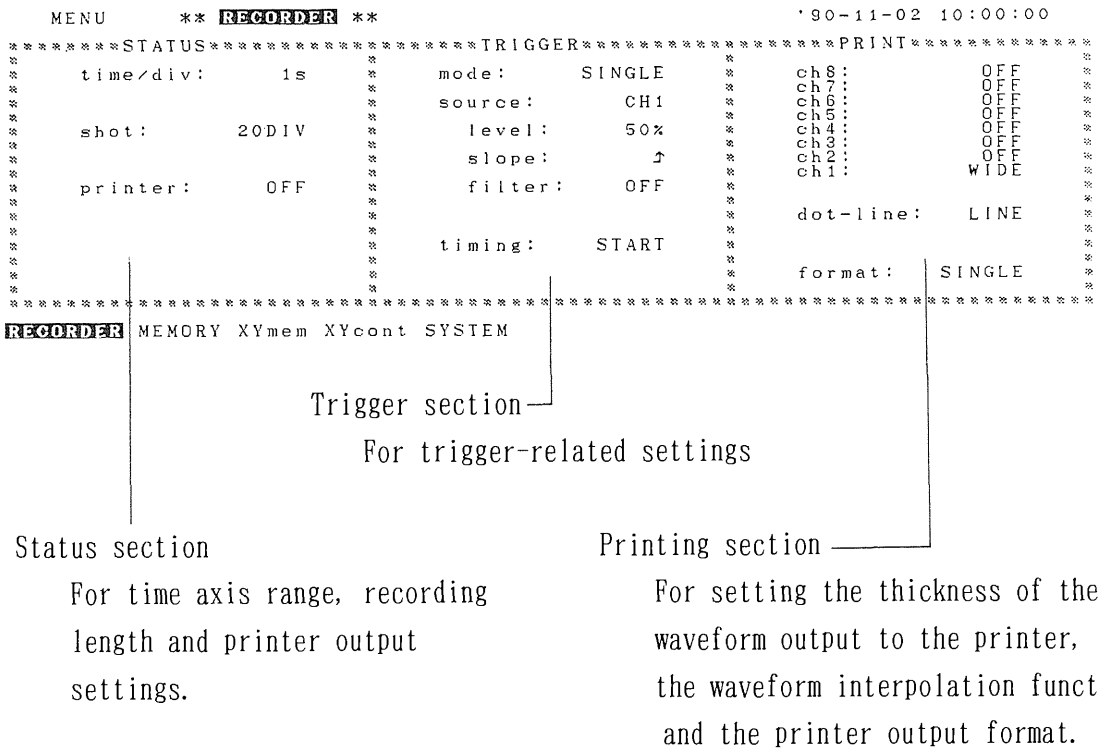
Envelope waveform

4 — 2 — 2 The MENU Display

The MENU and WAVE display modes are switched alternately by pressing the MENU/WAVE key.



MENU Display



① Status Section

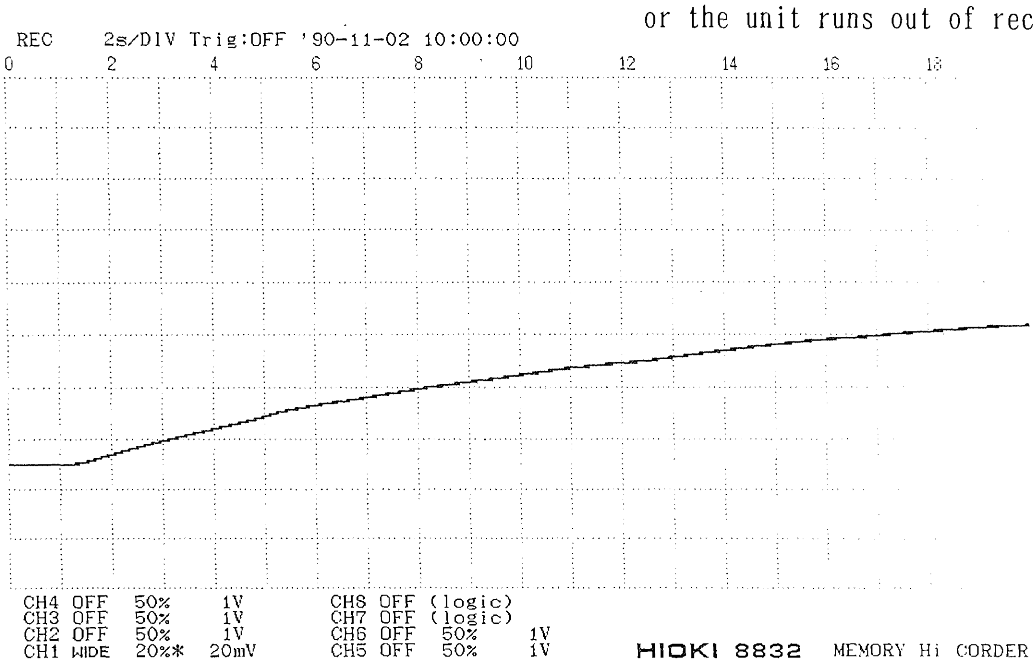
```
※※※※※※※※STATUS※※※※※※※※※※※※
※                              ※
※    time/div:        1s      ※
※                              ※
※    shot:          20DIV     ※
※                              ※
※    printer:        OFF      ※
※                              ※
※※※※※※※※※※※※※※※※※※※※※※※※
```

time/div

Indicates the amount of time equivalent to 1 division (1 square on the recording paper) in the time axis direction.
It can be changed in 12 steps from 1 s to 50 s/DIV, and from 1 min. to 50 min./DIV (1-2-5 steps).

shot

Indicates the recording paper length used per recording operation. It can be set to 20, 40, 80, 160, 300, 600 divisions and CONT.
Since 1 division corresponds to 1 square on the paper, when selecting 20 DIV recording will be performed on 20 squares, and likewise for the other settings.
If the CONT setting is selected, recording will continue until the STOP key is pressed or the unit runs out of recording paper.



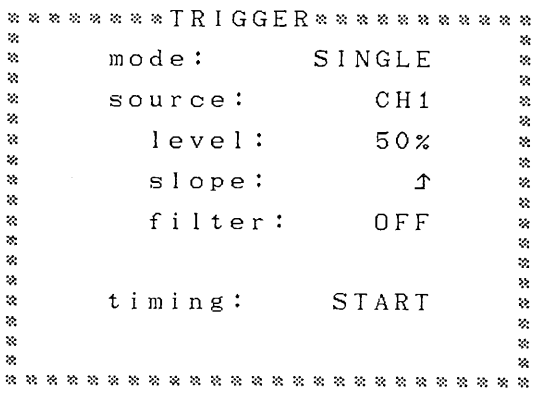
printer

Indicates printer output.

〔ON〕…The waveform is output to the printer, and not displayed on the LCD (WAVE mode).

〔OFF〕…The waveform is not output to the printer, only displayed on the LCD (WAVE mode).

② Trigger Section (see 6. USING THE TRIGGER FUNCTION for details on trigger operation)



mode

Indicates the trigger mode.

〔SINGLE〕 ···The trigger signal is valid onlyonce after pressing the START key.

〔REPEAT〕 ···Triggering is applied continuously.

source

Indicates the signal type that triggers the recording operation.

〔OFF 〕 ···The trigger function does not work. Recording will start immediately when the START key is pressed.

〔CH1 〕 to 〔CH8 〕 ···Operation is triggered by the signals input through channels 1 to 8, respectively.

〔EXT 〕 ···Recording starts when the EXT IN terminal is short-circuited or an approx. 2.5-V falling signal is input to it.

〔MANU〕 ···Operation is triggered manually by pressing the MANU TRIG key.

〔TIMER 〕 ···Triggering at desired interval is possible after a starting time is set.

level

Indicates trigger level in 1% steps from 0% to 100% of the full chart.

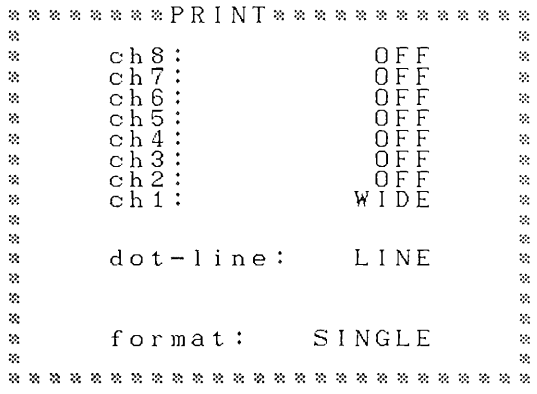
slope

Indicates in which direction should the input signal cross the trigger level to start recording.

〔↑〕 ···Recording triggered when the signal crosses the level upwards.

〔↓〕 ···Recording triggered when the signal crosses the level downwards.

③ Printing Section



filter

Indicates the status of the filter used to prevent trigger misoperation due to chattering.

〔 ON 〕…Trigger filter is applied

〔 OFF〕…Trigger filter is not applied

timing

Indicates trigger timing.

〔START 〕…Recording starts at the trigger point.

〔 STOP 〕…Recording stops at the trigger point.

ch1 to ch8

(analog unit channels)(ch1 to ch6)

Indicates whether the waveform is displayed on the LCD (WAVE mode) or not, and the thickness of the waveform output to the printer.

	OFF	SLIM	WIDE
WAVE display	Not displayed	Displayed	Displayed
Printer	Not output	Output in thin lines	Output in thick lines

Note: Line thickness cannot be specified for waveforms displayed on the LCD.

REC

```
※※※※※※※PRINT※※※※※※※※※※※※※
※                                  ※
※     ch8:          A&Bch         ※
※     ch7:          A&Bch         ※
※     ch6:            OFF         ※
※     ch5:            OFF         ※
※     ch4:            OFF         ※
※     ch3:            OFF         ※
※     ch2:            OFF         ※
※     ch1:           WIDE         ※
※                                  ※
※     dot-line:      LINE         ※
※                                  ※
※                                  ※
※     format:      SINGLE         ※
※                                  ※
※※※※※※※※※※※※※※※※※※※※※※※※※
```

(logic input channels)(ch7 to ch8)

For logic unit channels, this section indicates channel switching between the A and B probes.

〔OFF 〕…Logic input waveforms are not output.

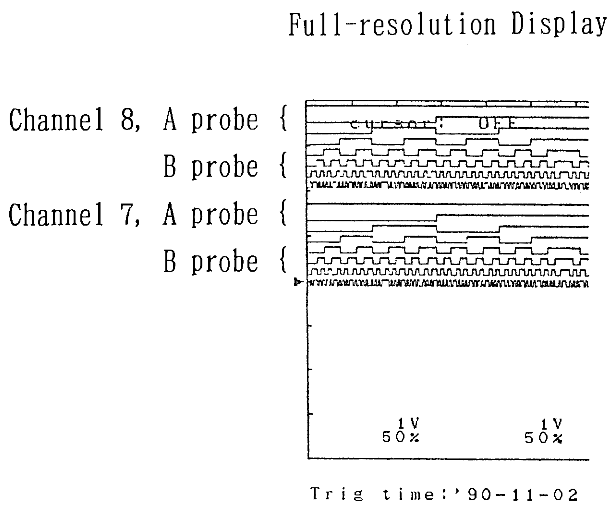
〔Ach 〕…Only A probe channels are output.

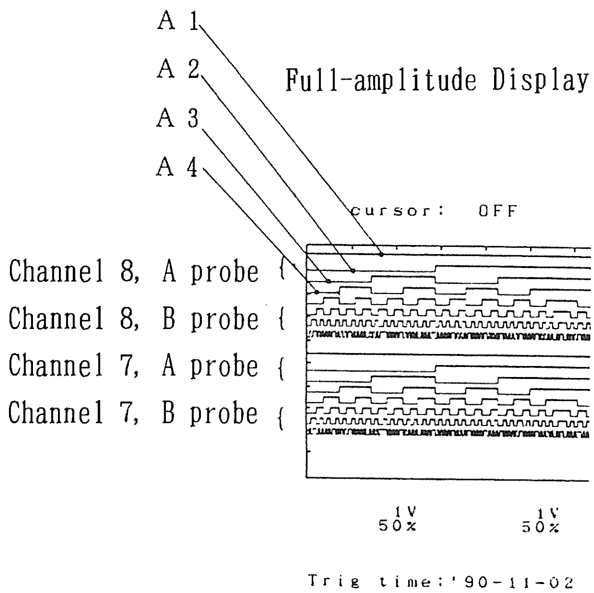
〔Bch 〕…Only B probe channels are output.

〔A&Bch 〕…Both A and B probe channels are output (all 8 channels).

Note: Line interpolation is always applied to logic input waveforms, regardless of the dot-line setting.

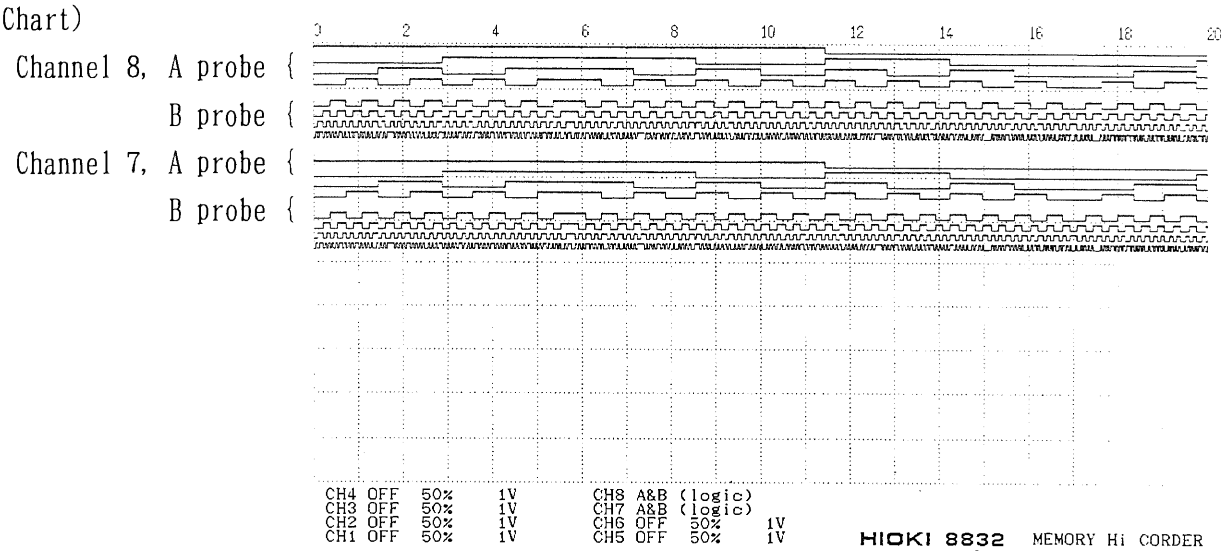
(LCD)





Note: Channel 1 and 2 logic waveforms from the B probe do not appear on the full-amplitude display.

(Chart)



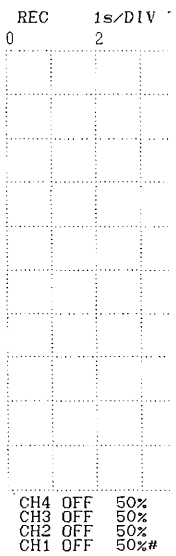
```
※※※※※※※PRINT※※※※※※※※※※※※※
※                                  ※
※      ch8:            OFF         ※
※      ch7:            OFF         ※
※      ch6:            OFF         ※
※      ch5:            OFF         ※
※      ch4:            OFF         ※
※      ch3:            OFF         ※
※      ch2:            OFF         ※
※      ch1:           WIDE         ※
※                                  ※
※                                  ※
※      dot-line:      LINE         ※
※                                  ※
※                                  ※
※                                  ※
※      format:      SINGLE         ※
※                                  ※
※※※※※※※※※※※※※※※※※※※※※※※※
```

dot-line

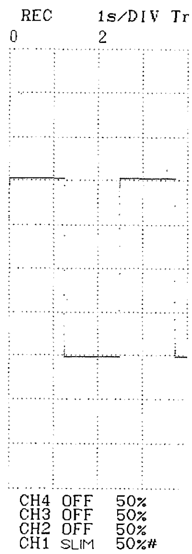
Indicates interpolation of waveforms displayed on the LCD and output to the printer.

〔DOT 〕…Line interpolation is not applied. Sampled points are displayed and output as they are.

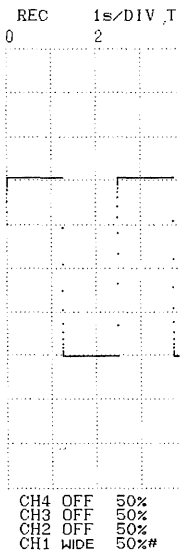
〔LINE〕…Line interpolation is applied. Sampled points are connected with straight lines for display and output.



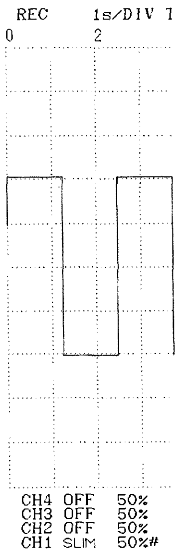
OFF



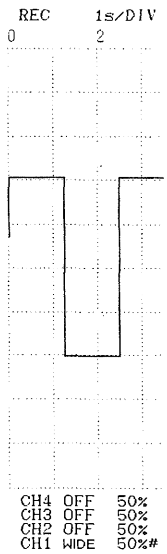
SLIM DOT



WIDE DOT



SLIM LINE



WIDE LINE

```
※※※※※※※PRINT※※※※※※※※※※※※
※                                ※
※     ch8:          OFF          ※
※     ch7:          OFF          ※
※     ch6:          OFF          ※
※     ch5:          OFF          ※
※     ch4:          OFF          ※
※     ch3:          OFF          ※
※     ch2:          OFF          ※
※     ch1:         WIDE          ※
※                                ※
※     dot-line:    LINE          ※
※                                ※
※                                ※
※     format:    SINGLE          ※
※                                ※
※※※※※※※※※※※※※※※※※※※※※※※※※
```

format

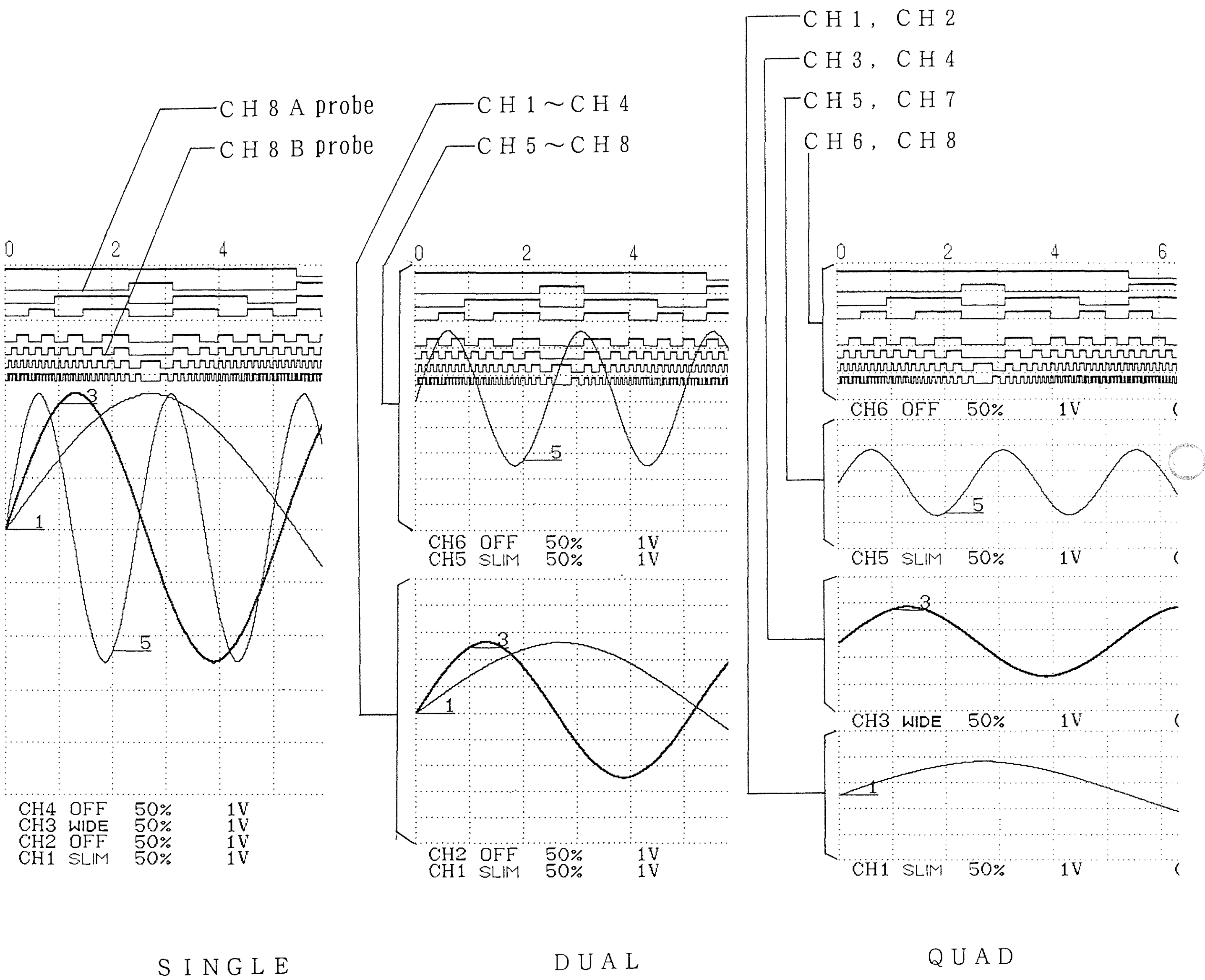
Indicates the printing format.

〔SINGLE〕 ···Waveforms from channel 1 to channel 8 are all recorded on the same time axis.

〔 DUAL 〕 ···Waveforms from channels 1 to 4 are recorded on the lower time axis, and waveforms from channels 5 to 8 on the upper time axis.

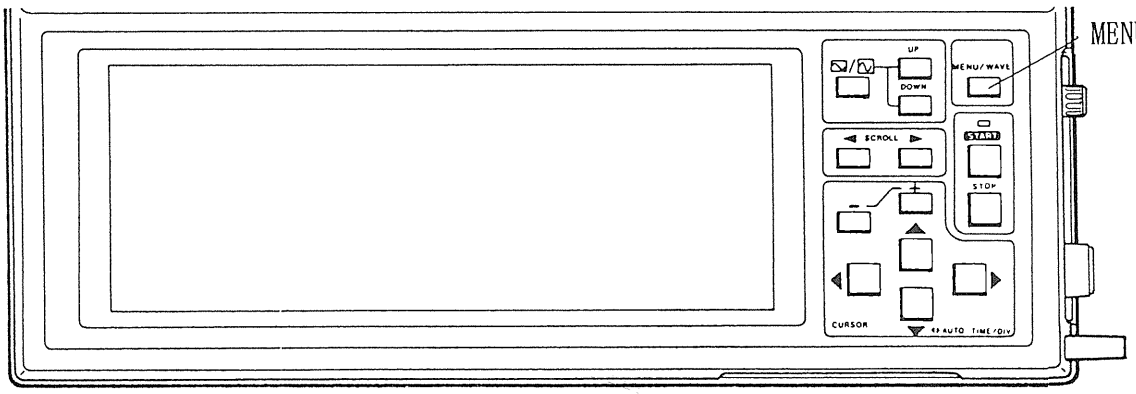
〔 QUAD 〕 ···Waveforms are divided to four groups with, channels 1 and 2, channels 3 and 4, channels 5 and 7, and channels 6 and 8, recorded separately on the different time axes.

Note: All waveforms are always displayed together on the LCD.



4 — 2 — 3 The WAVE Display

Press the MENU/WAVE key to change the display mode from MENU to WAVE.

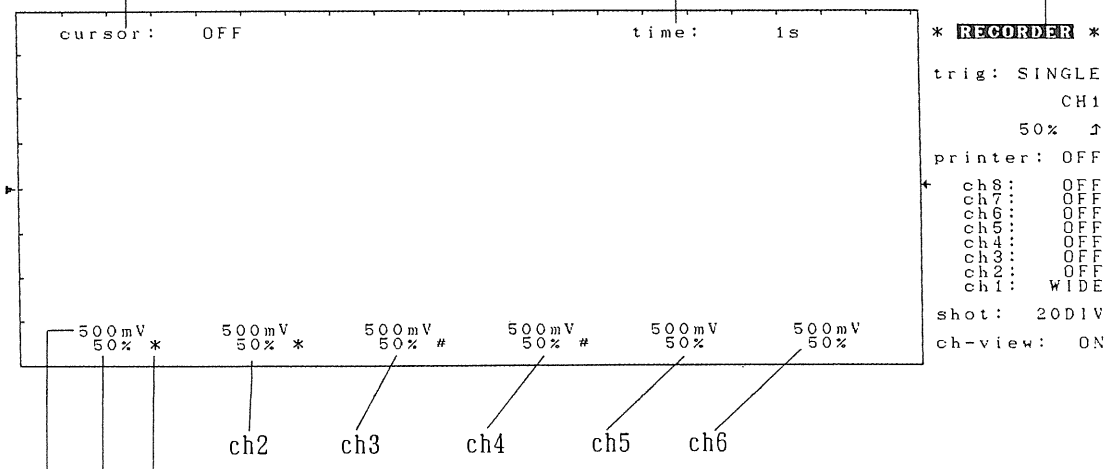


WAVE display

cursor: Line cursor setting.
For details, refer to 4-2-5 Using the Line Cursors.

time: Time axis setting

Function setting



ch2 ch3 ch4 ch5 ch6

Analog unit

Indicates input unit filtering
* 5 Hz
# 500 Hz

Indicates the unit zero position

Indicates unit range

trig: Trigger conditions setting. For details, refer to Chapter 6. USING THE TRIGGER FUNCTION.

printer: To select whether to send the waveform to the printer or to the LCD.
ch1 to ch8: Printing style setting for each channel.

shot: Indicates recording length.

ch-view: When set to [ON], the condition of each unit during operation is displayed at the bottom of the LCD.

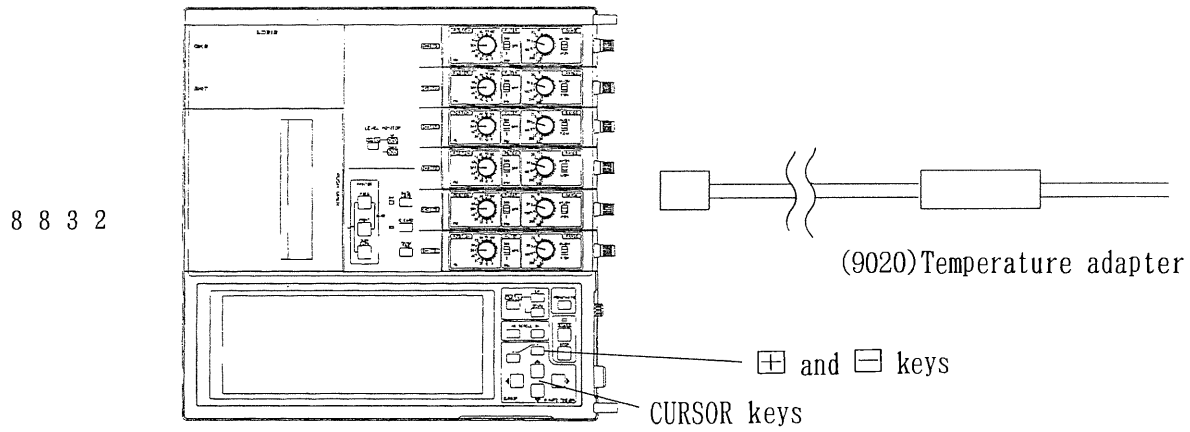
REC

4－2－4 Recorder Operation Example

Recording temperature fluctuations using a temperature adapter.

Connection

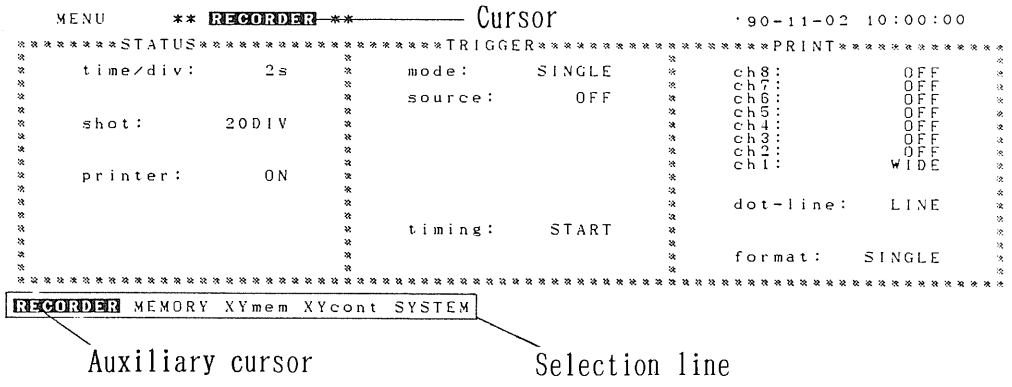
Connect the temperature adapter to the input terminal of the 8932 analog unit (channel 1) mounted into the 8832.



8832 Setting

(1) MENU Display Setting

Set the MENU display mode.



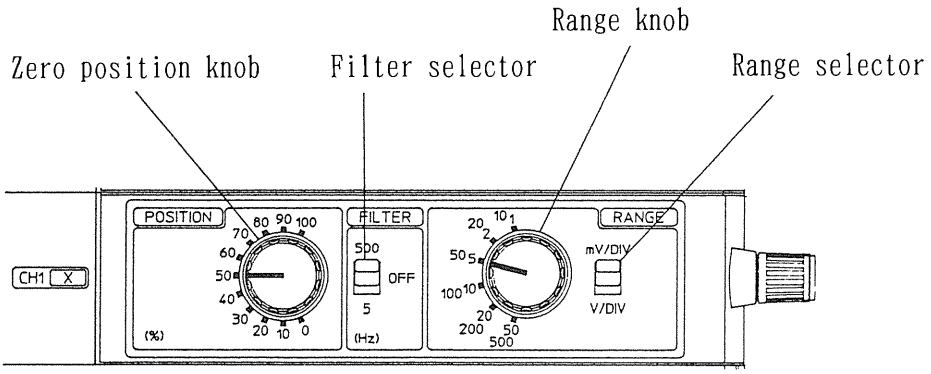
①Function Selection

Using the CURSOR key, move the cursor to the function indication. The selection line will show the available functions. Use the ⊞ and ⊟ keys to move the auxiliary cursor to the RECORDER position.

②Various Settings

Change settings to match the above figure. First, use the CURSOR keys to place the cursor on the desired parameter. The selection line will shows the available settings. Use the ⊞ and ⊟ keys to move the auxiliary cursor to the desired setting. If the "printer" indication is set to ON, the waveform will only be sent to the printer.

(2) Input Unit Setting



①RANGE Setting

Set the range selector to the mV/DIV (green) position, and the range knob to the 50 (green) position. This sets a measurement range of 20 mV/DIV (the 9020 temperature adapter output is 1 mV/℃. When using this adapter, 1 division on the chart corresponds to 20℃).

②POSITION Setting

Set the Zero POSITION knob to 20%.

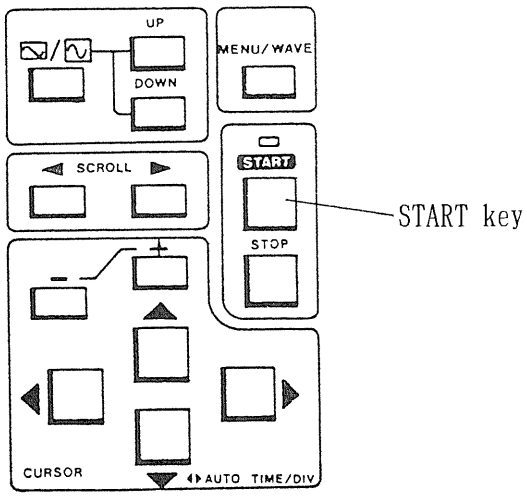
③FILTER Setting

Set the FILTER selector to 5 H to remove noise components.

This completes the setting procedure. For details on the input units, refer to Chapter 5. USING THE INPUT UNIT.

(3) Measurement

Press the START key



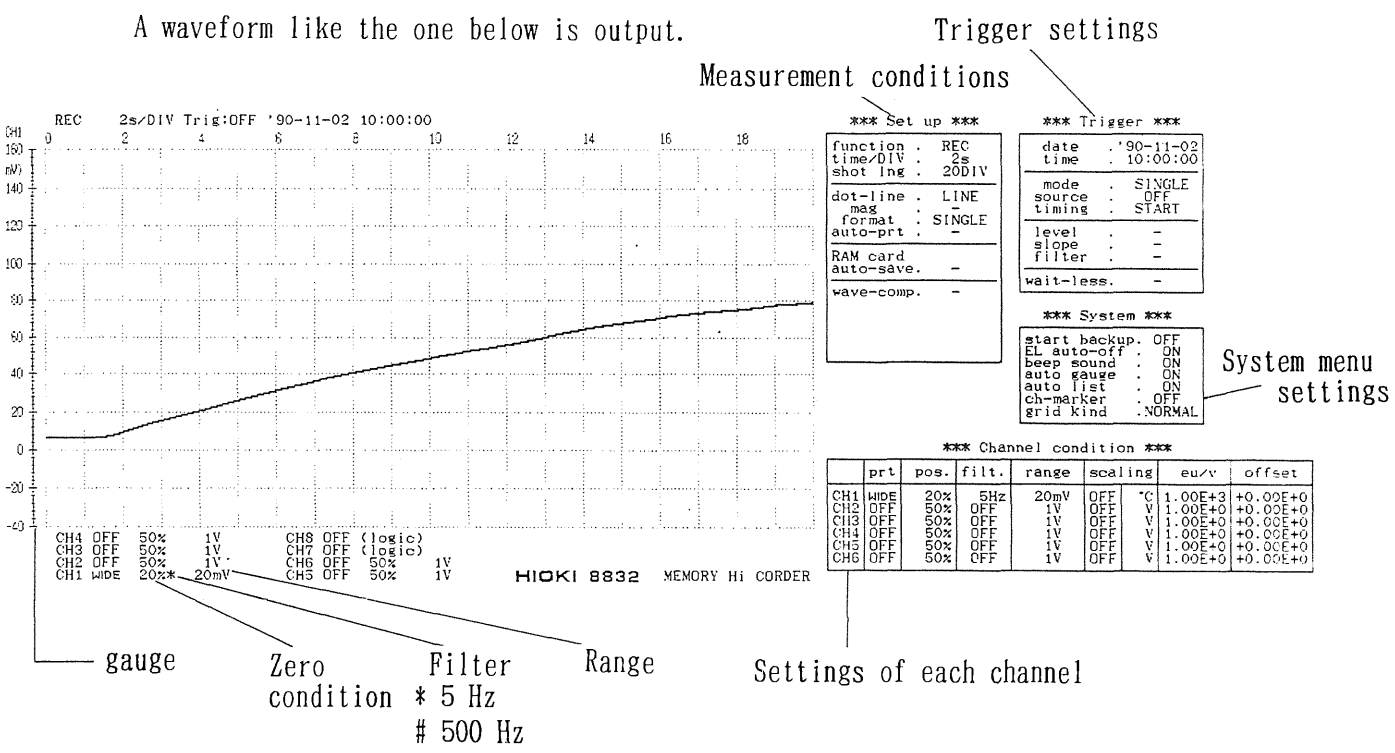
If an Error Occurs

- Check the error message.
- Press the STOP key.
- Remove the cause of the error.

(refer to Appendix 1. Error Messages)

REC

A waveform like the one below is output.



To print the gauge and the lists along with the waveform as in the illustration, set the "auto list" and "auto gauge" indications to ON.

- List Printing

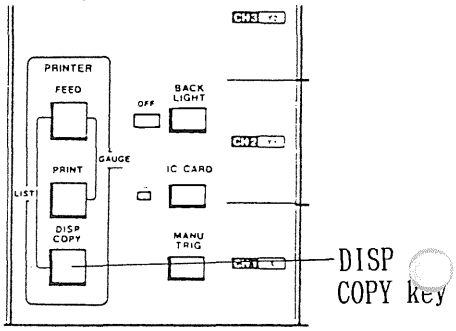
  To print only the lists, press the FEED and DISP COPY keys simultaneously.

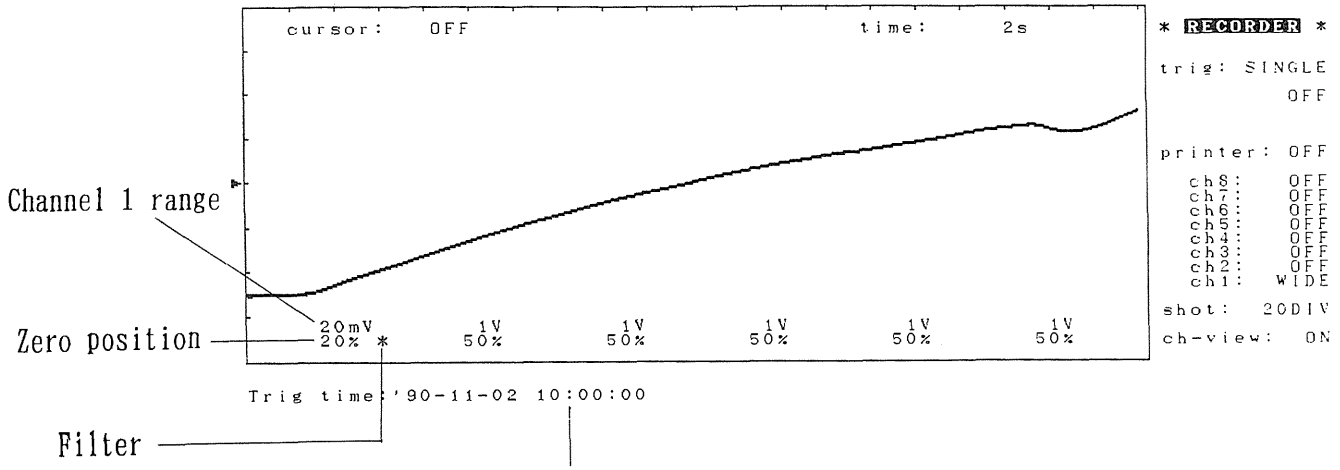
- Gauge Printing

  To print only the gauge, press the FEED and PRINT keys simultaneously.

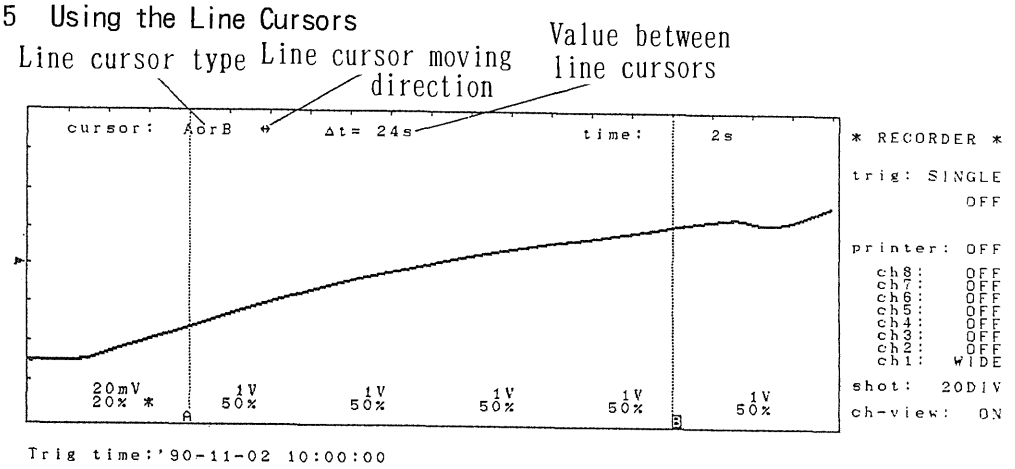
- Waveform Display on the LCD

  In the WAVE display mode, set the "printer" indication to OFF. The waveform will only bedisplayed on the LCD. If you want to keep a record of the displayed waveform, press the DISP COPY key.





4 − 2 − 5 Using the Line Cursors



In the recorder mode, line cursors can move in the vertical and horizontal directions.

In the WAVE display mode, select the line cursor type.

cursor: [OFF] No line cursor is displayed.

[A] Only the [A] cursor is displayed.

[A or B] Both the [A] and [B] cursors are displayed, but only one of them can be moved at a time.

[A & B] Both the [A] and [B] cursors are displayed, and they can be moved together.

Select the line cursor moving direction.

[↕] Vertical (voltage axis) direction.

[↔] Horizontal (time axis) direction.

The value between line cursors is displayed.

[△t=] Displayed for the [↔] line cursor. If only the A cursor is used, the time from the left edge of the screen to the cursor position is displayed. If both cursors are used, the time difference from the A cursor to the B cursor is displayed. Switching to [△f=] is possible with [+] [-] keys.

[△f=] Displayed for the [↔] line cursor. If only the A cursor is used, frequency is displayed taking the time from the left edge of the screen to the cursor position as a cycle. If both cursors are used, frequency is displayed taking the time difference from the A cursor to the B cursor as a cycle. Switching to [△t=] is possible with [+] [-] keys.

[△v=] Displayed for the [↕] line cursor. The voltage is displayed for the output channel of smaller number (e.g. when only channels 2 and 3 are used for SLIM output, or channel 2 voltage is displayed for WIDE output). If only the A cursor is used, voltage from the zero position to the cursor is displayed. If both cursors are used, voltage from the A cursor to the B cursor is displayed.

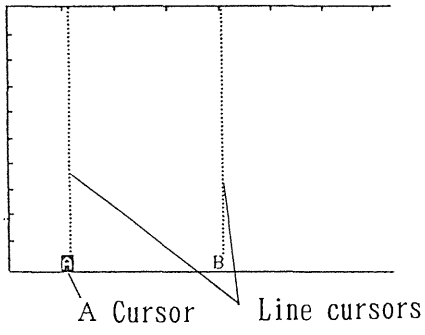
REC

● Moving the Line Cursors

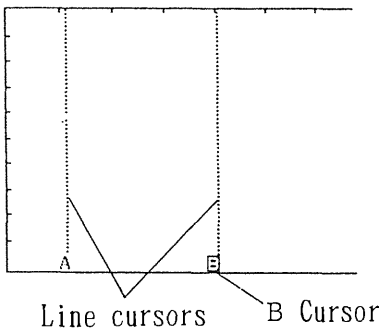
① Using the CURSOR keys, place the main cursor in the position shown in the figure.

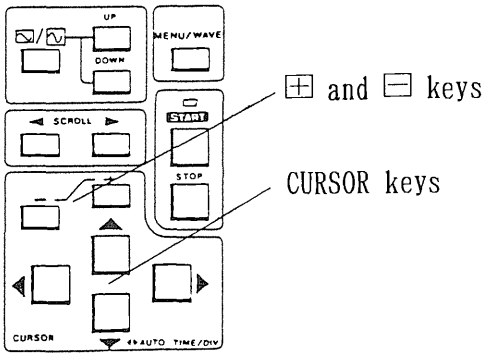
[↔] Cursors

"A" Cursor



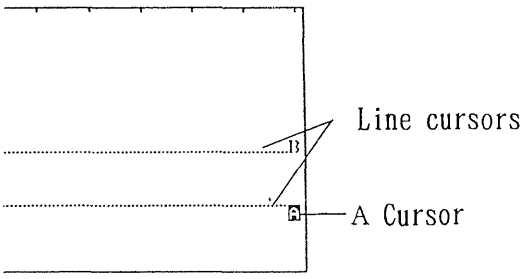
"B" Cursor



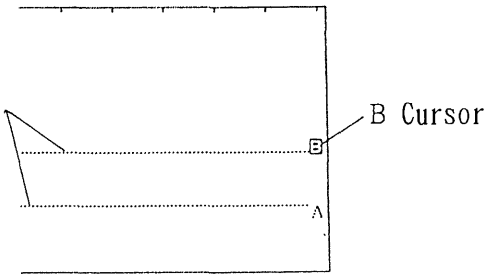


[↕] Cursors

"A" Cursor



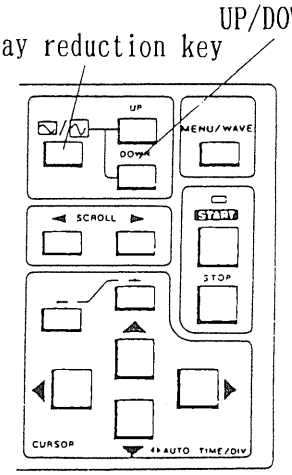
"B" Cursor



② Move the line cursors with the ⊞ and ⊟ keys.

Note: Line cursors cannot be moved during the recording operation.

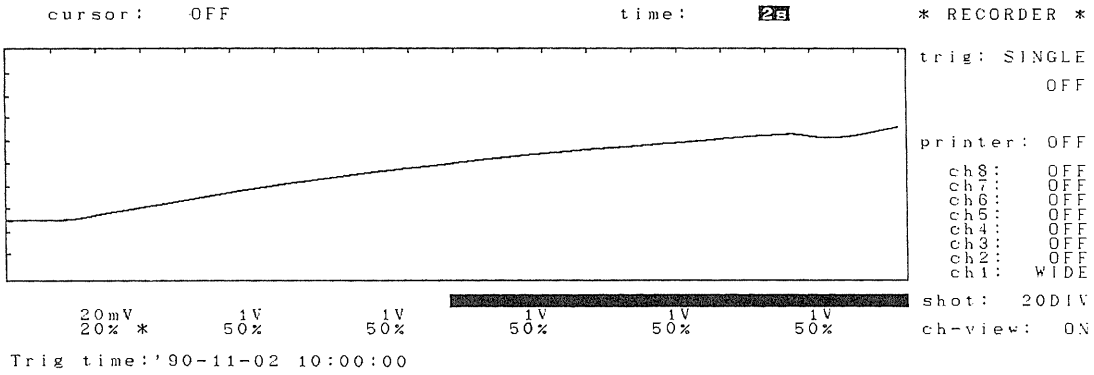
4－2－6 Vertical Axis of the WAVE Display



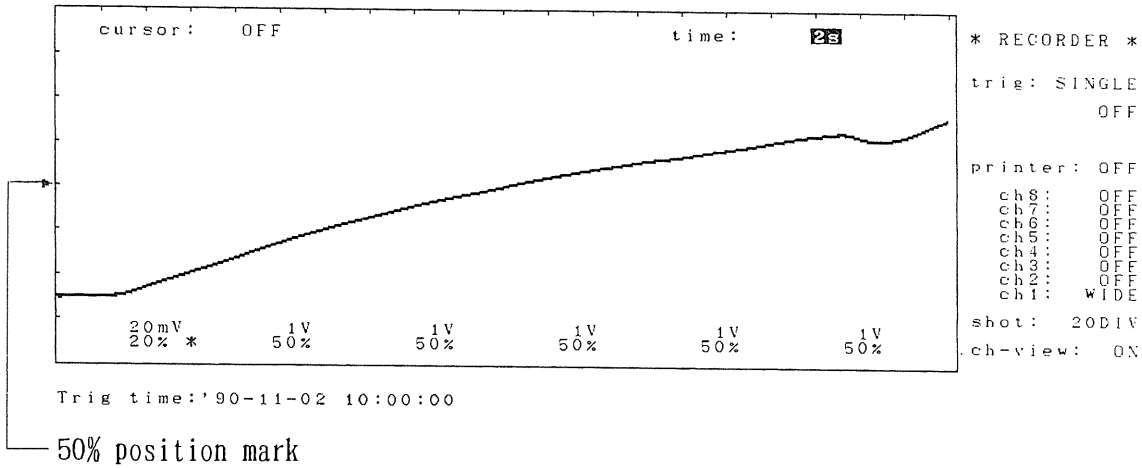
Vertical scaling of the waveform display in the WAVE mode can be selected between two settings. Switching between these is performed by pressing the display reduction key.

Note: Switching is not possible during the startup operation.

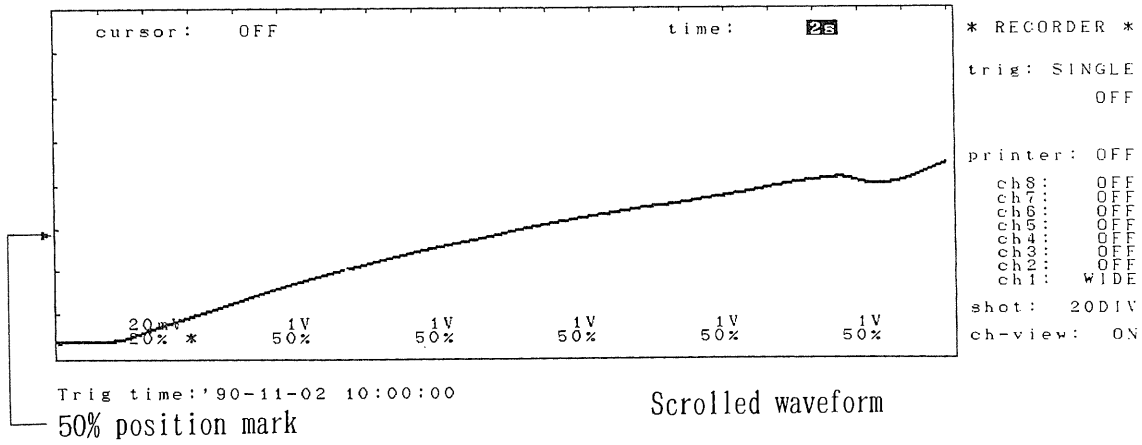
● Full-amplitude Display: The whole amplitude of the waveform is displayed at once on the LCD.
Resolution is reduced by half.



● Full-resolution Display: Approx. 78% (200/256) of the waveform amplitude is displayed on the LCD, at the full A/D resolution.



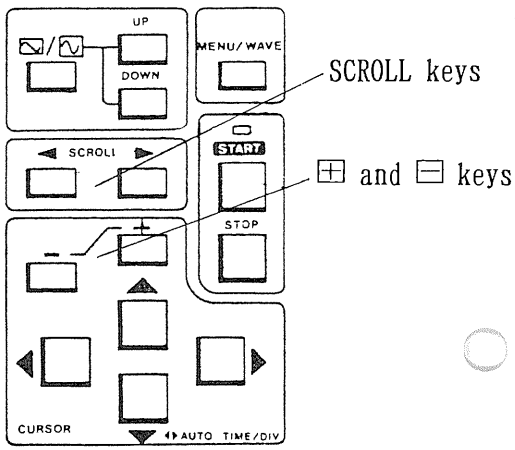
● In the full-resolution mode, the waveform can be scrolled vertically on the LCD with the UP and DOWN keys.



REC

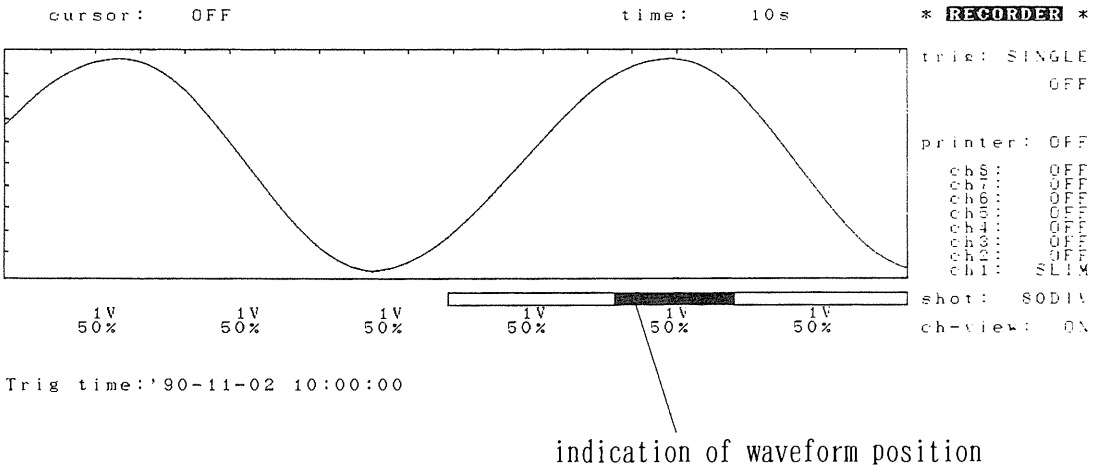
4 — 2 — 7 Reverse scroll

In addition to real-time continuous recording, scrolling of waveforms up to 80 DIV including the dosplayed picture is possible. (Waveforms which have already been recorded scroll by on the display (LCD))
The signal waveforms on the display screen can be scrolled to the right on left by pressing the SCROLL keys.
When the vertical axis (voltage axis) is set to the full amplitude display, an indication of the position in the recorded waveform appears under the display screen. The displayed portion of the recording is shown in black.



The waveform automatically scrolls to the left if the [-] key is pressed while the ◀ SCROLL key is held down.

Automatic scrolling to the right is possible if the [+] key is pressed while the ▶ SCROLL key is held down. Automatic scrolling stops when the STOP key is pressed. The scroll function can be used with both the full amplitude and complete resolution displays.

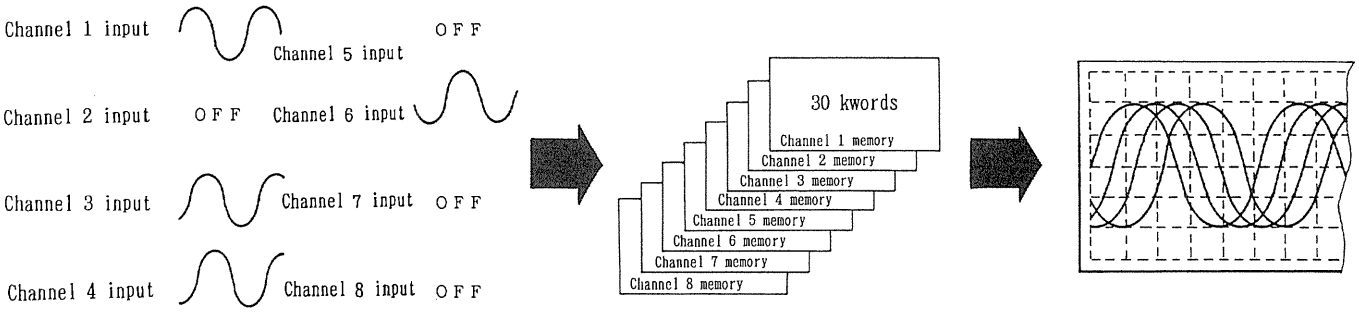


Note: When the entire waveform recording is contained within the display screen, the waveform does not scroll.

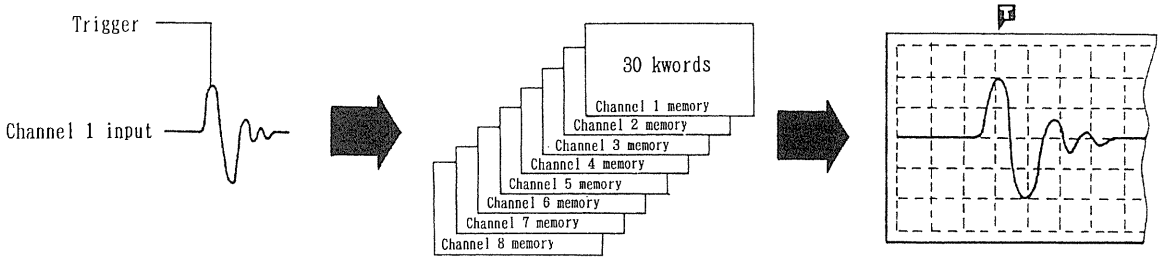
4 — 3 Using the Memory Recorder Function

4 — 3 — 1 Features of the Memory Recorder Function

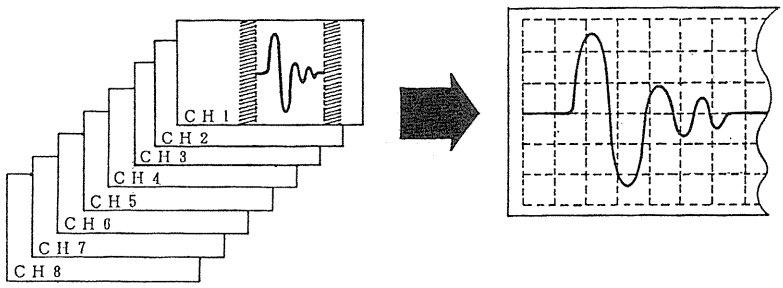
(1) Input signals are first stored in memory, then displayed and recorded.
(2) Data from all input channels are recorded on the same time axis. Signals can be recorded overlapped, helping to observe their mutual relationship.
(3) The time axis can be adjusted in 15 steps from 100 μs/DIV to 5 s/DIV.
(4) Maximum memory capacity (recording length) is 125 kword (equivalent to 2500 div.) when using 1-2 channel, 60 kword (equivalent to 1200 div.) when using 3-4 channels, and 30 kword (equivalent to 600 div.) when using 5 to 8 channels.
(5) The pre-trigger function allows for observing the signal before the trigger point. It can be set to 0, 5, 25, 50, 75, 95, 100 and -95%.
(6) Reduced and enlarged display and recording are possible. Scaling in the time axis direction can be set to ×1/100, ×1/50, ×1/20, ×1/10, ×1/5, ×1/2, ×1, ×2, ×4 and ×8.
(7) Partial printing
The desired waveform section can be selected from stored data for printing.
(8) Repeated printing
A stored waveform can be printed as many times as required.
(9) Waveform scrolling
Waveforms can be scrolled horizontally with the SCROLL keys.
(10) Waveform evaluation function for detecting abnormal waveforms.
(11) Conversion to an XY composite waveform is possible.



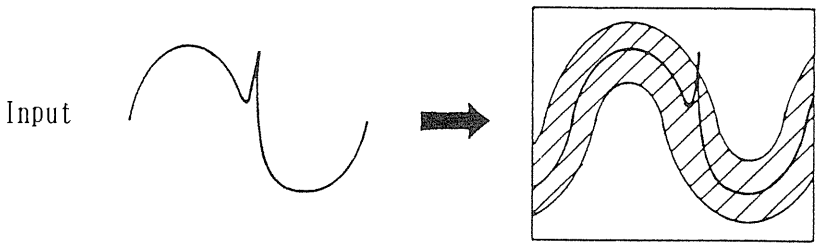
8-channel Simultaneous Recording



Pre-trigger Recording Using the Trigger Delay Function



Partial Printing of Stored Data

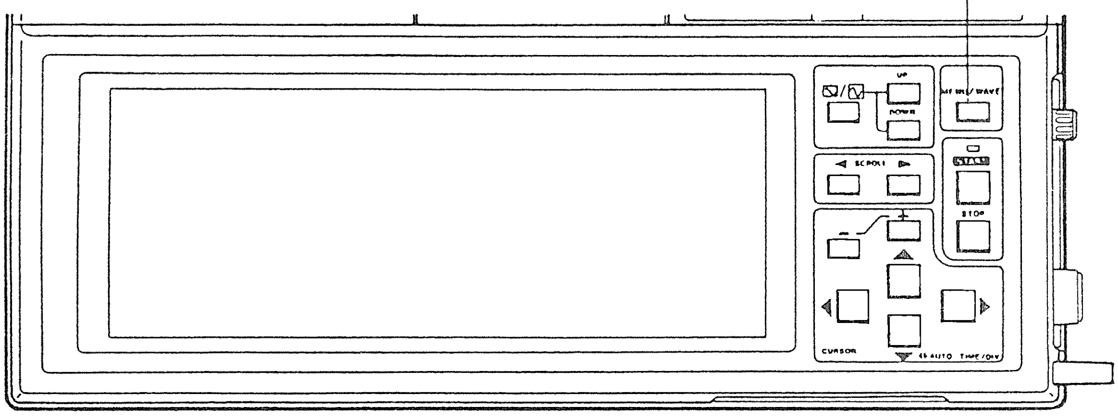


Abnormal Waveform Detection Using the Waveform Evaluation Function

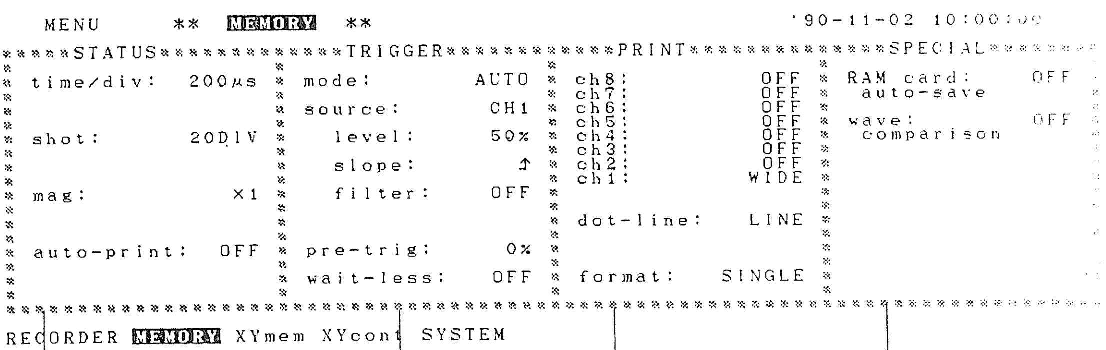
4 − 3 − 2 The MENU Display

The MENU and WAVE display modes are switched alternately by pressing the MENU/WAVE key.

MENU/WAVE key



MENU Display



Trigger section
For trigger-related settings

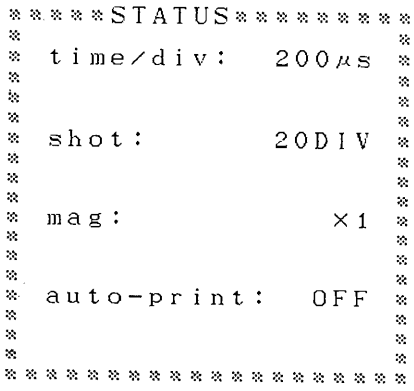
Status section
For setting time axis range, recording length, waveform enlargement and reduction on the LCD (time axis direction) and printer output ON/OFF.

Special Section
For RAM card automatic save function and waveform evaluation function setting.

Printing section
For setting the thickness of the waveform output to the printer, the waveform in terpolation function, the printer output format and whether the waveform is displayed or not on the LCD (WAVE mode).

MEM

①Status Section



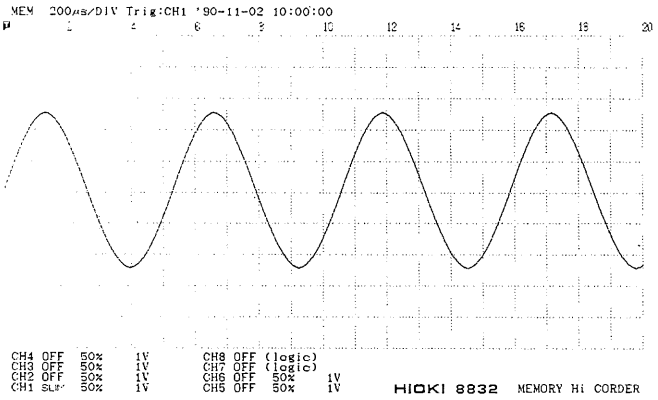
time/div

Indicates the amount of time equivalent to 1 division (1 square on the recording paper) in the time axis direction.

It can be changed in 15 steps from 100 μs fs to 5 s/DIV(1-2-5 steps). For automatic time axis setting, refer to section 4.3.9.

shot

Indicates the recording paper length used per recording operation. It can be set to 20, 40, 80, 160, 300, 600, 1200 and 2500 divisions (see note below).



× 1

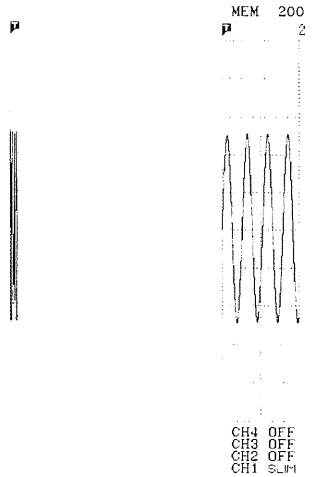
Since 1 division corresponds to 1 squareon the paper, when selecting 20 DIV recording will be performed on 20 squares, and likewise for the other settings.

Note: • When 1200 DIV is selected, only waveforms from four channels can be recorded.

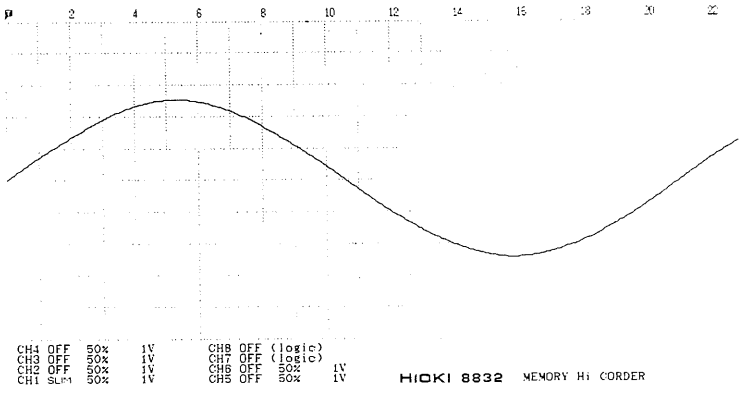
• When 2500 DIV is selected, only the waveform from two channel can be recorded.

mag

Indicates enlargement or reduction of the waveform display on the time axis. It can be set to ×1/100, ×1/50, ×1/20, ×1/10, ×1/5, ×1/2, ×1, ×2, ×4 and ×8.



× 1／100　　× 1／10



× 4

auto-print

Indicates whether the waveform is to be output not only to the LCD but also to the printer when the START key is pressed.

②Trigger Section (see 6. USING THE TRIGGER FUNCTION for details on trigger operation)

```
*****TRIGGER********
*                  *
*  mode:      AUTO *
*                  *
*  source:     CH1 *
*                  *
*    level:    50% *
*                  *
*    slope:      ↑ *
*                  *
*    filter:   OFF *
*                  *
*                  *
*                  *
*  pre-trig:    0% *
*                  *
*  wait-less:  OFF *
*                  *
********************
```

mode

Indicates the trigger mode.

[SINGLE]…The trigger signal is valid only once after pressing the START key.

[REPEAT]…Triggering is applied continuously.

[AUTO]…Same as [REPEAT], however, recording automatically starts even if triggering does not after approximately 1 second has elapsed.

Note: The waveform may not remain in the memory if the STOP key is pressed during continuous triggering on a recording length of 600 DIV.

source

Indicates the signal type that triggers the recording operation.

[OFF]…The trigger function does not work. Recording will start immediately when the START key is pressed.

[CH1] to [CH8]…Operation is triggered by the signals input through channels 1 to 8, respectively.

[EXT]…Recording starts when the EXT IN terminal is short-circuited or an approx. 2.5-V falling signal is input to it.

[MANU]…Operation is triggered manually by pressing the MANU TRIG key.

[TIMER]…Triggering at desired interval is possible after a starting time is set.

level

Indicates trigger level in 1% steps from 0% to 100% of the full chart.

slope

Indicates in which direction should the input signal cross the trigger level to start recording.

[↑]…Recording triggered when the signal crosses the level upwards.

[↓]…Recording triggered when the signal crosses the level downwards.

filter

Indicates the trigger filter type. 7 settings are available: OFF, 0.1, 0.2, 0.3, 0.6, 1.3 and 2.6 DIV.

pre-trig

Indicates the amount of data to be recorded before the trigger point as a percentage of total recording length. It can be set to 0, 5, 25, 50, 75, 95, 100 and -95%.

wait-less

Indicates the (ON/OFF) status of the wait-less mode.

③Printing Section

```
********PRINT**************
*                         *
*      ch8:          OFF  *
*      ch7:          OFF  *
*      ch6:          OFF  *
*      ch5:          OFF  *
*      ch4:          OFF  *
*      ch3:          OFF  *
*      ch2:          OFF  *
*      ch1:         WIDE  *
*                         *
*      dot-line:    LINE  *
*                         *
*      format:    SINGLE   *
*                         *
***************************
```

ch1 to ch8

(analog unit channels)(ch1 to ch6)

Indicates whether the waveform is displayed on the LCD (WAVE mode) or not, and the thickness of the waveform output to the printer.

	OFF	SLIM	WIDE
WAVE display	Not displayed	Displayed	Displayed
Printer	Not output	Output in thin lines	Output in thick lines

Note: Line thickness cannot be specified for waveforms displayed on the LCD.

```
********PRINT**************
*                         *
*      ch8:         A&Bch  *
*      ch7:         A&Bch  *
*      ch6:           OFF  *
*      ch5:           OFF  *
*      ch4:           OFF  *
*      ch3:           OFF  *
*      ch2:           OFF  *
*      ch1:          WIDE  *
*                         *
*      dot-line:    LINE  *
*                         *
*      format:    SINGLE   *
*                         *
***************************
```

(logic input channels)

For logic input channels, this section indicates channel switching between the A and B probes.

[OFF]…Logic input waveforms are not output.

[Ach]…Only A probe channels are output.

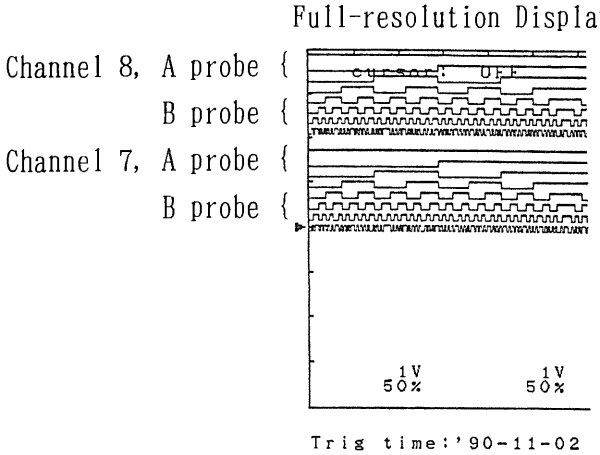
[Bch]…Only B probe channels are output.

[A&Bch]…Both A and B probe channels are output (all 8 channels).

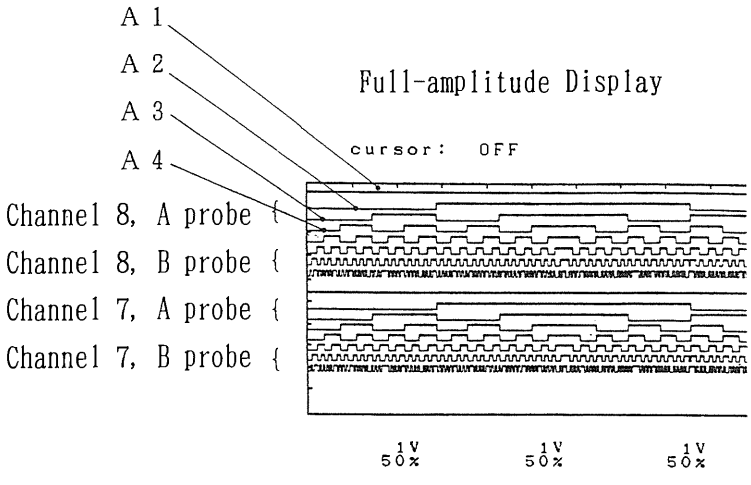
Note: Line interpolation is always applied to logic unit waveforms, regardless of the dot-line setting.

(LCD)

Full-resolution Display

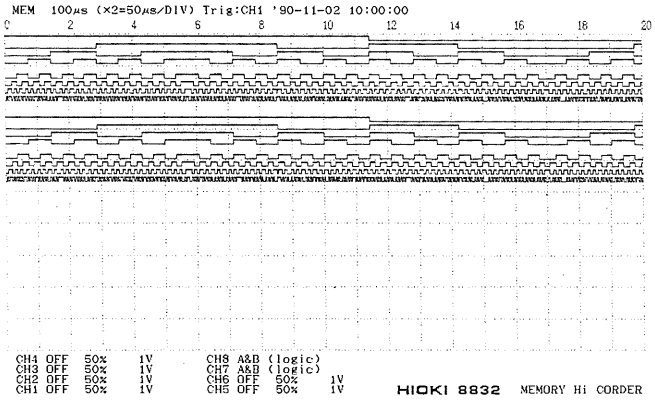


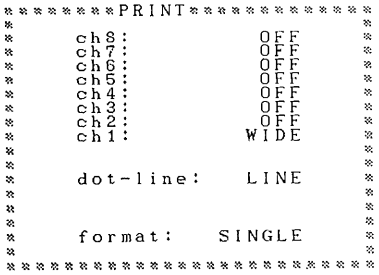
Full-amplitude Display



(Chart)

Channel 8, A probe {
B probe {
Channel 7, A probe {
B probe {





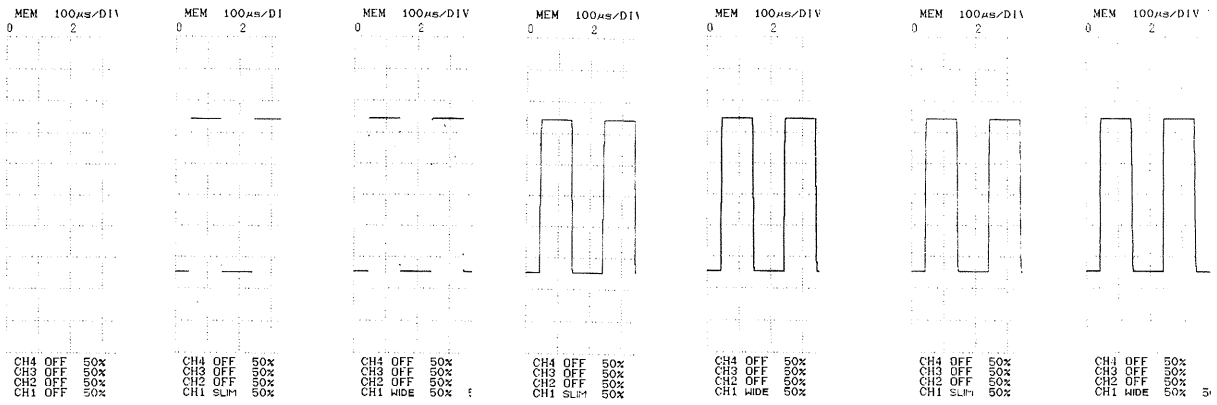
dot-line

Indicates interpolation of waveforms displayed on the LCD and output to the printer.

[DOT]···Line interpolation is not applied. Sampled points are displayed and output as they are.

[LINE]···Line interpolation is applied. Sampled points are connected with straight lines for display and output.

[SMOOTH]···A smoother waveform than in the [LINE] mode is output to the printer. The waveform displayed on the LCD, however, is the same as in [LINE] mode.



MEM

```
*******PRINT*************
*                        *
*    ch8:        OFF     *
*    ch7:        OFF     *
*    ch6:        OFF     *
*    ch5:        OFF     *
*    ch4:        OFF     *
*    ch3:        OFF     *
*    ch2:        OFF     *
*    ch1:       WIDE     *
*                        *
*    dot-line:   LINE    *
*                        *
*    format:   SINGLE    *
*                        *
**************************
```

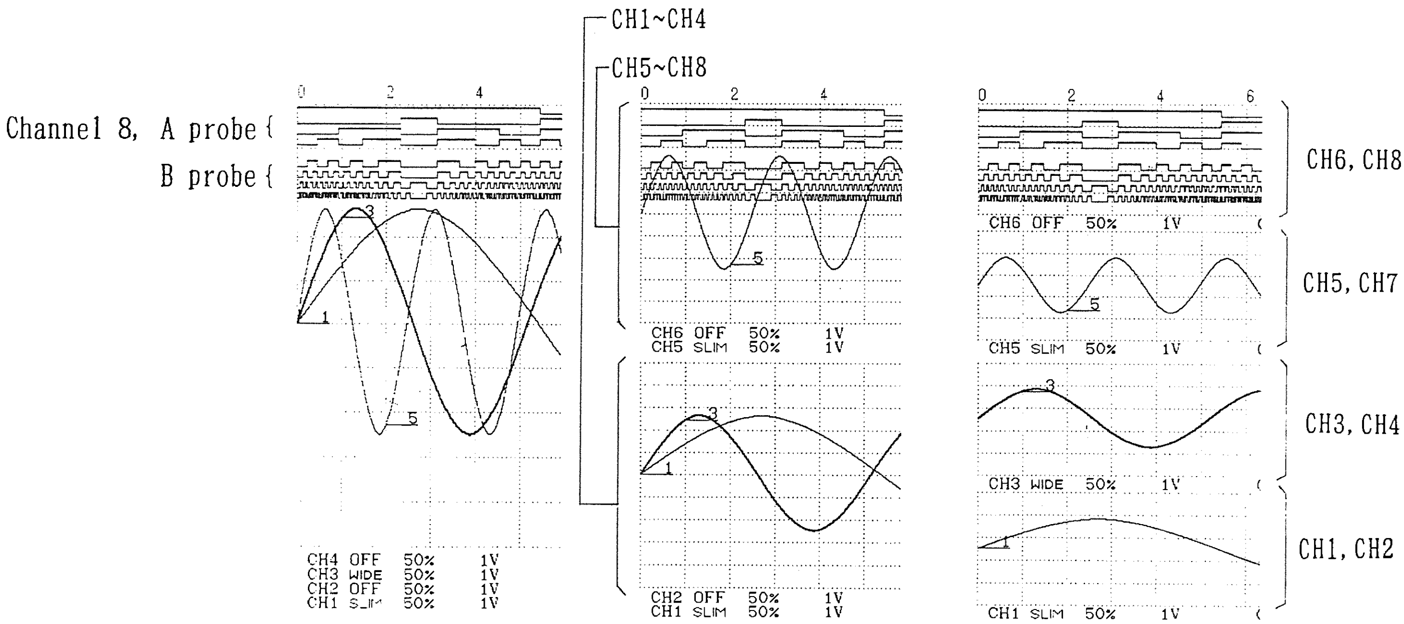
format

Indicates the printing format (the WAVE display is not affected).

[SINGLE]···Waveforms from channel 1 to channel 8 are all recorded on the same time axis.

[DUAL]···Waveforms from channels 1 and 4 are recorded on the lower time axis, and waveforms from channels 5 and 8 on the upper time axis.

[QUAD] ···Waveforms are divided to four groups with, channels 1 and 2, channels 3 and 4, channels 5 and 7, and channels 6 and 8, recorded separately, on the different time axes.



SINGLE DUAL QUAD

④Special Section

```
*****SPECIAL********
*                  *
*  RAM card:   OFF *
*   auto-save      *
*                  *
*  wave:     MODE1 *
*   comparison     *
*                  *
*      up= 0.40DIV *
*                  *
*    down= 0.40DIV *
*                  *
*   right= 0.40DIV *
*                  *
*    left= 0.40DIV *
*                  *
*  stop-mode:   GO *
*                  *
********************
```

RAM card auto save

Indicates the (ON/OFF) status of the RAM automatic save function. For details, refer to 8-7. Automatic Save Function.

[ON]···waveform data are saved in the RAM card after the recording operation.

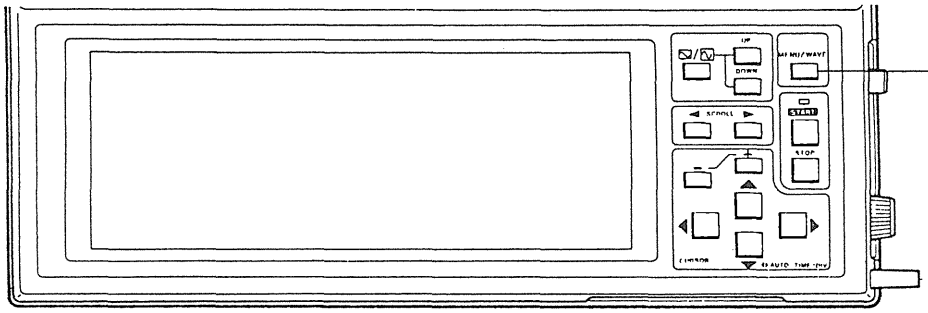
[OFF]···No data are saved on the RAM card.

wave comparison

Indicates waveform evaluation mode and settings. For details, refer to Chapter 9. USING THE WAVEFORM JUDGEMENT FUNCTION.

4 — 3 — 3 The WAVE Display

Press the MENU/WAVE key to change the display mode from MENU to WAVE.



WAVE display

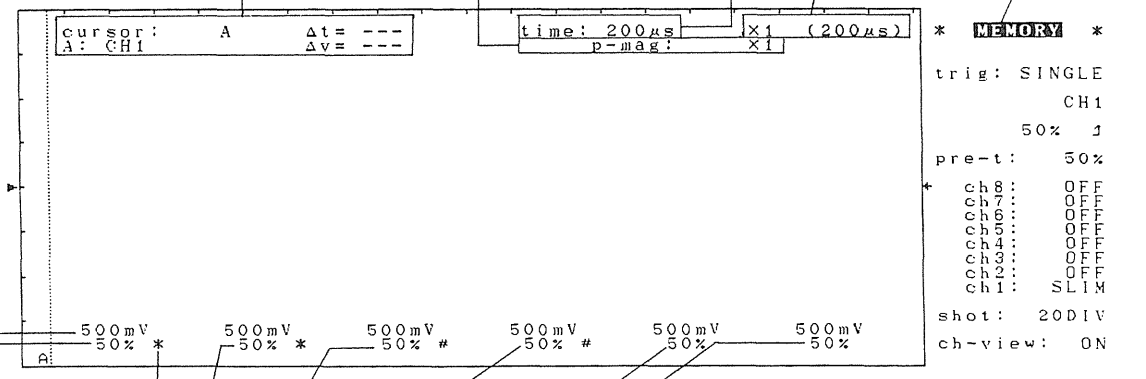
cursor: Line cursor setting.
For details, refer to 4.3.5.
Using the Line Cursors.

time: Time axis setting (time/div.)

Function setting

Horizontal scaling setting

p-mag: Indicates chart scaling when line cursor setting is used.



ch2
ch3
ch4
ch5
ch6

Analog unit

Indicates input unit filtering
* 5 Hz
# 500 Hz

Indicates the unit zero position

Indicates unit range

trig: Trigger conditions setting. Refer to Chapter 6. USING THE TRIGGER FUNCTION for details.

pre-t: Pre-trigger setting.

ch1 to ch8: Printing style setting for each channel.

shot: Indicates recording length.

ch-view: When set to [ON], the condition of each unit during operation is displayed at the bottom of the LCD.

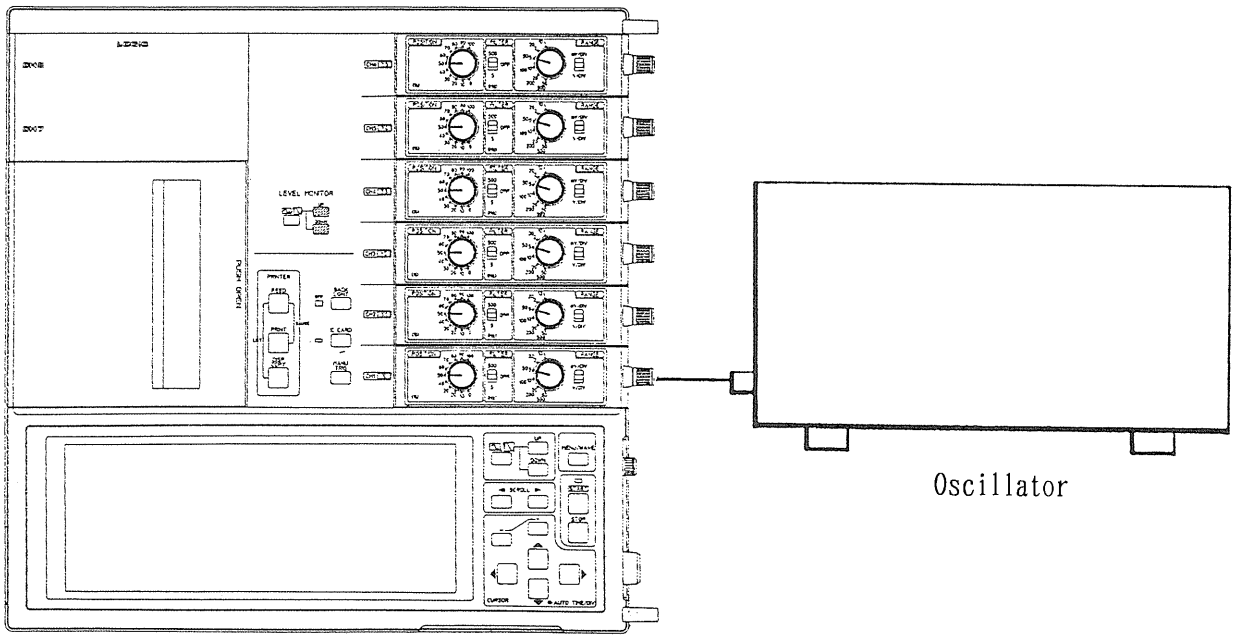
MEM

4 — 3 — 4 Memory Recorder Operation Example

Recording a sine wave input from an oscillator.

Connection

Connect the oscillator to the 8832 channel 1 (analog unit) input terminal.



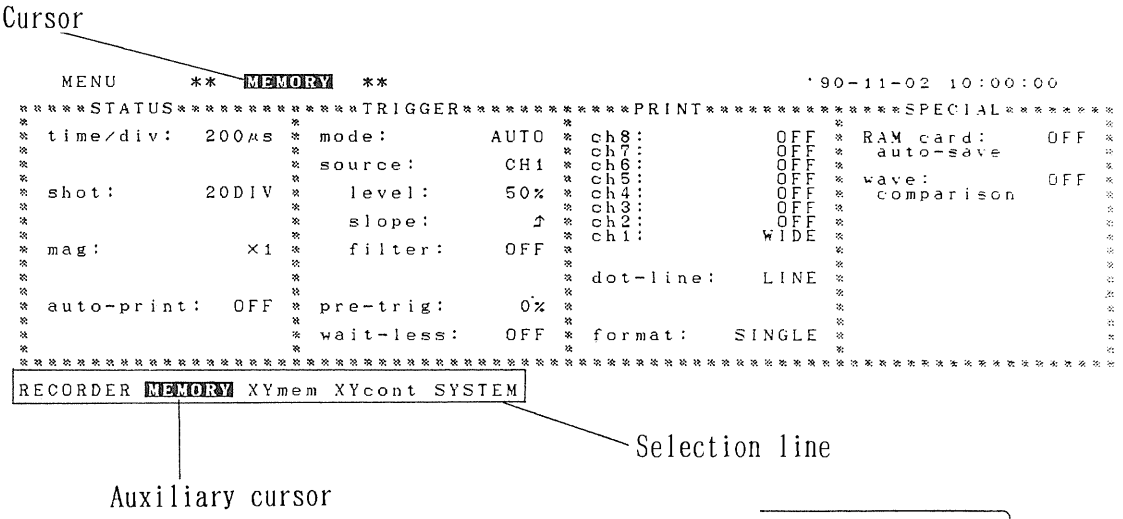
8 8 3 2

Oscillator Setting

Adjust the oscillator so as to generate a 1-kHz, 3-Vp-p sine wave.

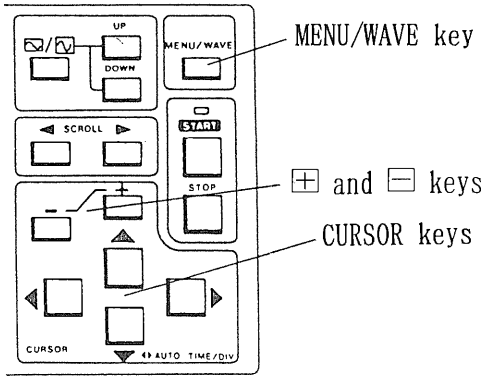
(1) MENU Display Setting

Set the MENU display mode with the MENU/WAVE key.



①Function Selection

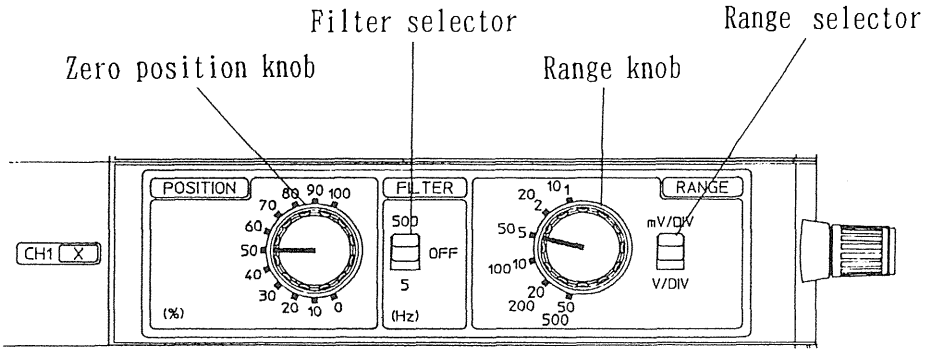
Using the ▲ CURSOR key, move the cursor to the function indication. The selection line will show the available functions. Use the ⊞ and ⊟ keys to move the auxiliary cursor to the MEMORY position.



②Various Settings

Change settings to match the above figure. First, use the CURSOR keys to place the cursor on the desired parameter. The selection line will shows the available settings. Use the ⊞ and ⊟ keys to move the auxiliary cursor to the desired setting. If the "printer" indication is set to ON, the waveform will only be sent to the printer.

(2) Input Unit Setting



①RANGE Setting

Set the range selector to the mV/DIV (green) position, and the range knob to the 500 position. This sets a measurement range of 500 mV/DIV

②FILTER Setting

Set the FILTER selector to OFF.

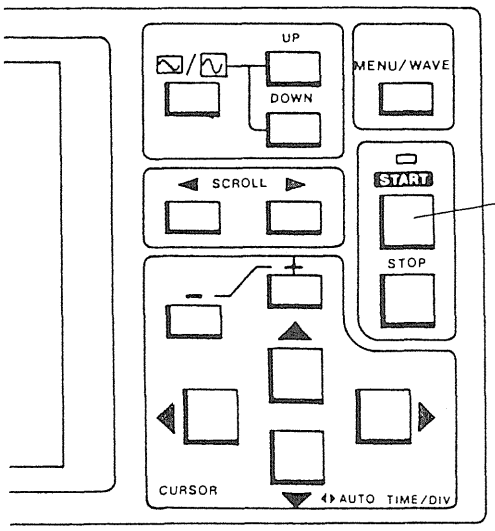
③POSITION Setting

Set the Zero POSITION knob to 50%.

This completes the setting procedure. For details on the input units, refer to Chapter 5. USING THE INPUT UNIT.

(3) Measurement

Press the START key.



START key

If an Error Occurs

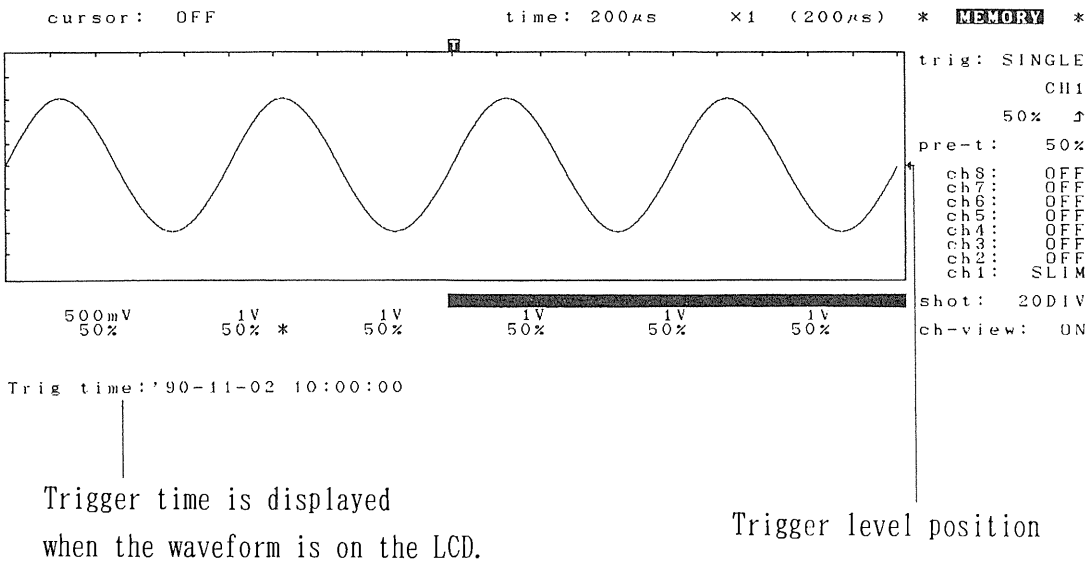
- Check the error message.
- Press the STOP key.
- Remove the cause of the error.

(refer to Appendix 1. Error Messages)

A waveform like the one shown below will be output.

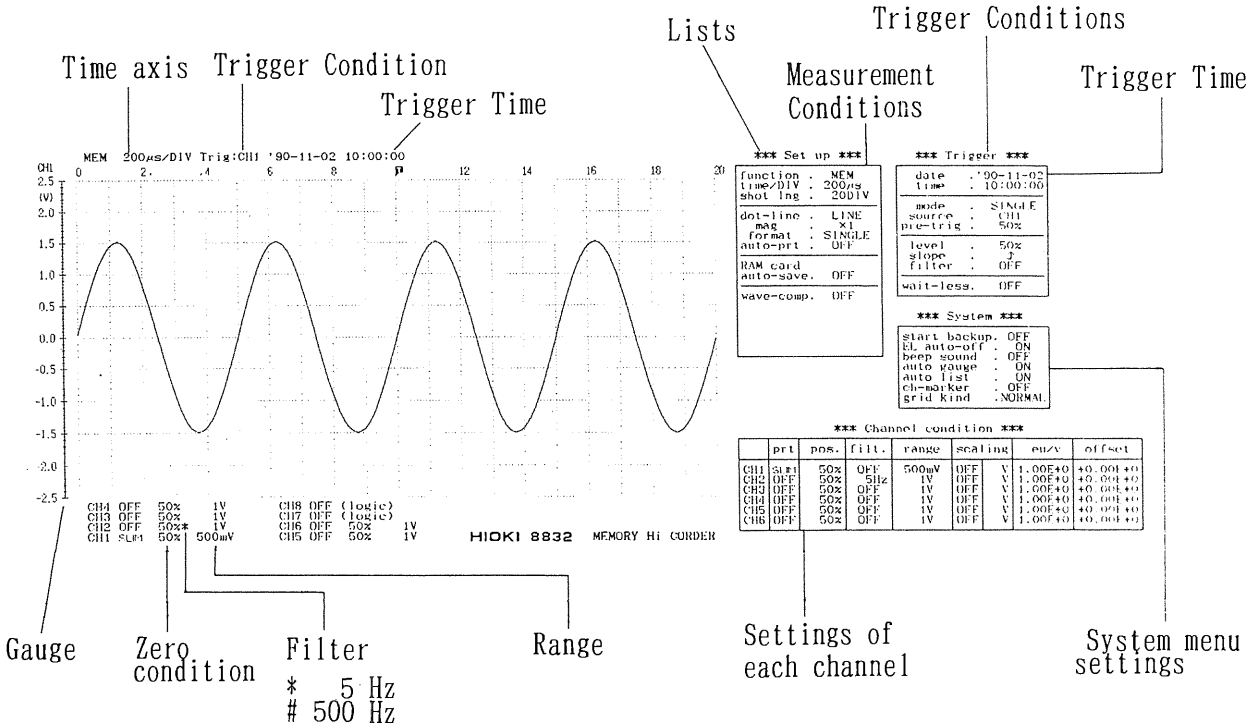
WAVE display

- Press the DISP COPY key to get a hard copy of the display.



Chart

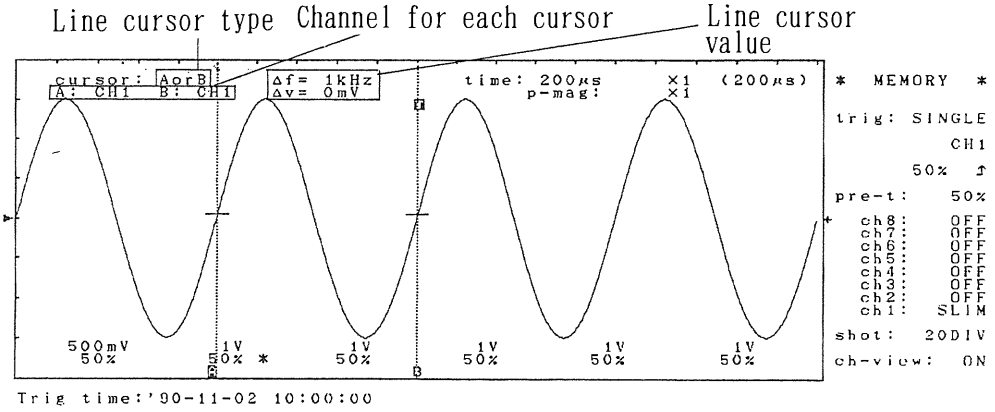
Press the PRINT key, and the waveform stored in memory will be printed out.



- To print only the lists, press the FEED and DISP COPY keys simultaneously.
- To print only the gauge, press the FEED and PRINT keys simultaneously.

MEM

4－3－5 Using the Line Cursors



In the memory recorder mode, line cursors move horizontally to trace the waveform.

In the WAVE display mode, select the line cursor type.

cursor: [OFF] No line cursor is displayed.

[A] Only the [A] cursor is displayed.

[A or B] Both the [A] and [B] cursors are displayed, but only one of them can be moved at a time.

[A & B] Both the [A] and [B] cursors are displayed, and they can be moved together.

Select the channel to be traced by the line cursor "A".

A: [CH1] Cursor "A" traces the channel 1 waveform. Printing style can be selected between SLIM and WIDE.

Select the channel to be traced by the line cursor "B" (only valid in the [AorB] and [A&B] modes).

B: [CH1] Cursor "B" traces the channel 1 waveform. Printing style can be selected between SLIM and WIDE.

The value indicated by the line cursors is displayed.

[△t=] If only the A cursor is used, the time from the trigger point is displayed. If both cursors are used, the time difference from the A cursor to the B cursor is displayed. Switching to [△f=] is possible with [+] [-] keys.

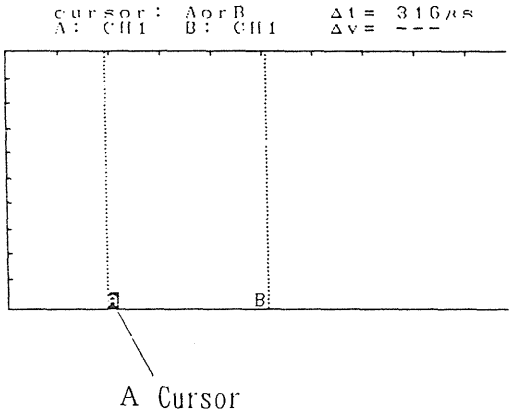
[△f=] If only the A cursor is used, frequency is displayed taking the time from the trigger point as a cycle. If both cursors are used, frequency is displayed taking the time difference from the A cursor to the B cursor as a cycle. Switching to [△t=] is possible with [+] [-] keys.

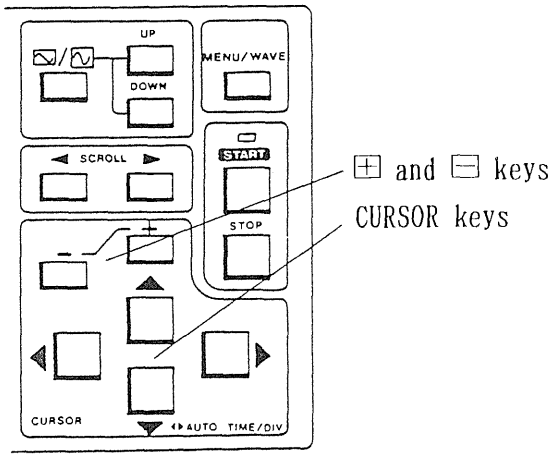
[△v=] When only the A cursor is used, the potential is displayed. When both cursors are used, the voltage between them is displayed.

● Moving the Line Cursors

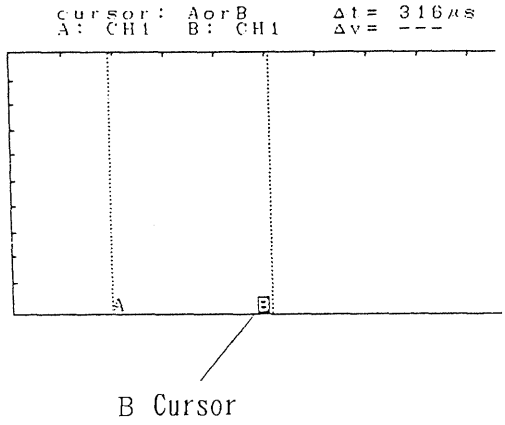
① Using the CURSOR keys, place the main cursor in the position shown in the figure.

"A" Cursor





"B" Cursor

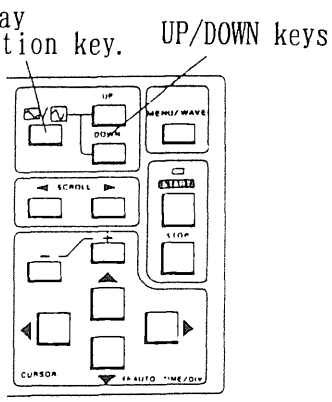


② Move the line cursors with the ⊞ and ⊟ keys.

Note: Line cursors cannot be moved during the recording operation.

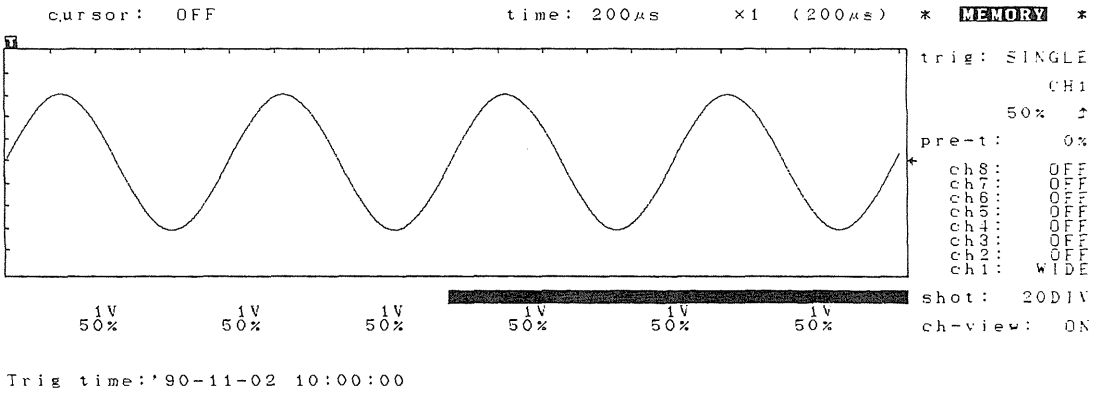
MEM

4－3－6 On the Vertical Axis of the WAVE Display

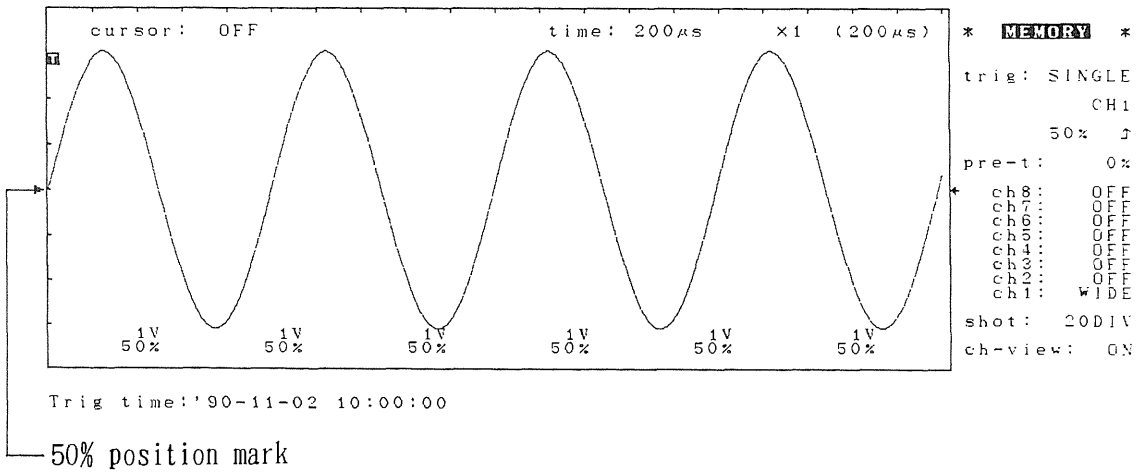


Vertical scaling of the waveform display in the WAVE mode can be selected between two settings. Switching between these is performed by pressing the display reduction key.

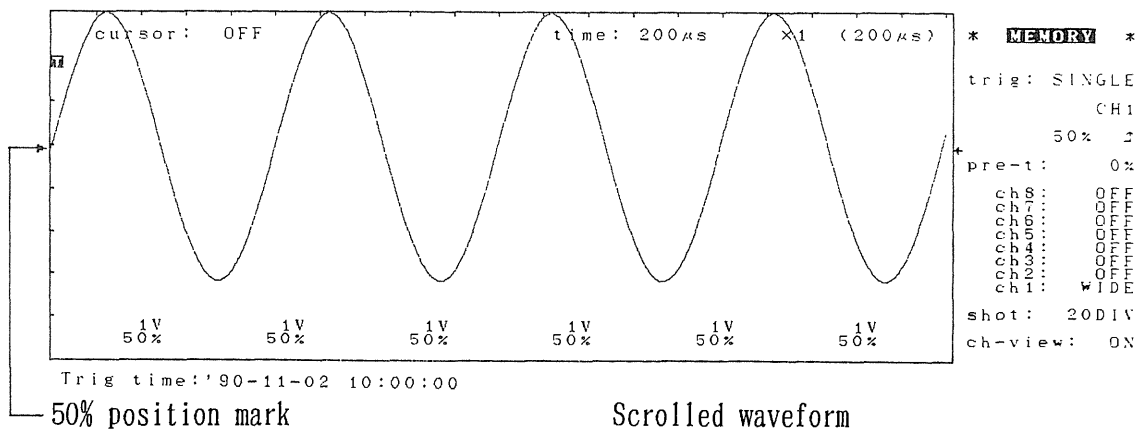
- Full-amplitude Display: The whole amplitude of the waveform is displayed at once on the LCD. Resolution is reduced by half.



- Full-resolution Display: Approx. 78% (200/256) of the waveform amplitude is displayed on the LCD, at the full A/D resolution.



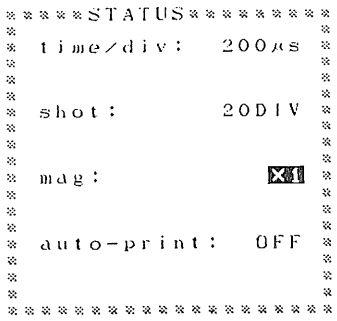
- In the full-resolution mode, the waveform can be scrolled vertically on the LCD with the UP and DOWN keys.

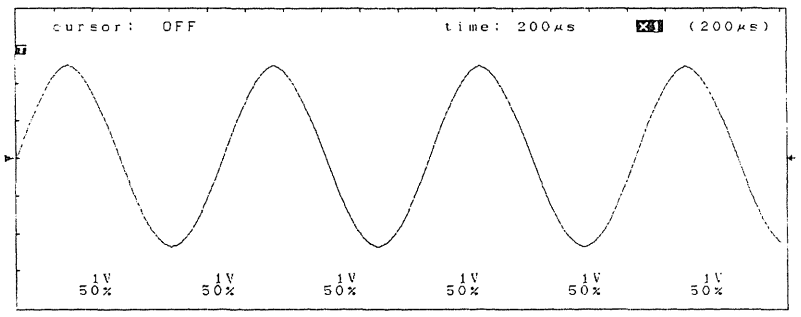


4 − 3 − 7 Time Axis Enlargement and Reduction

The waveform can be enlarged or reduced in the horizontal (time axis) direction. Available scaling settings are ×8, ×4, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50 and×1/100.

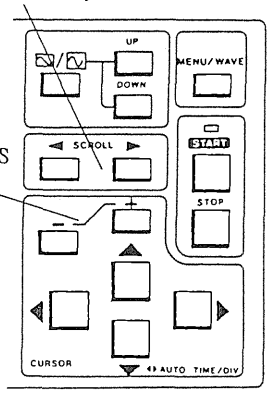
They can be selected both at the MENU display status section (mag) and at the WAVE display.

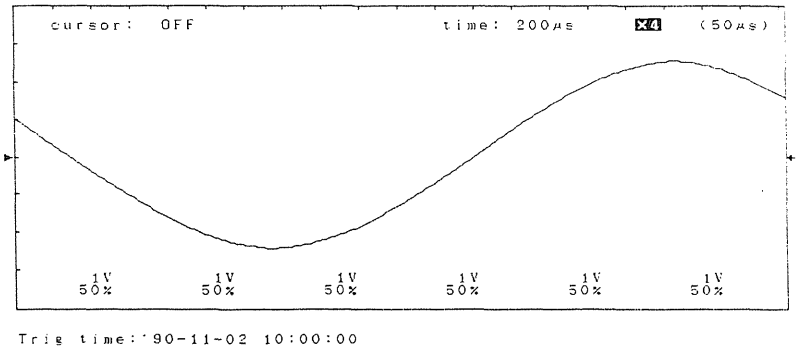




SCROLL keys

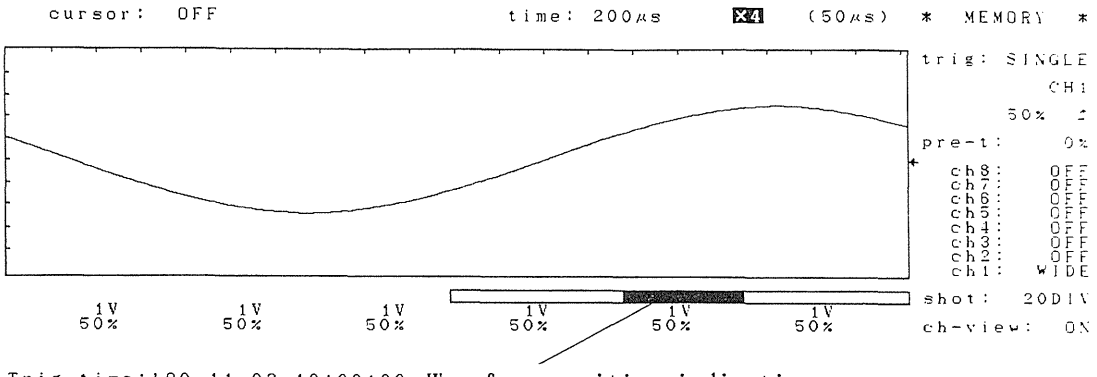
⊞ and ⊟ keys





The waveform can be scrolled horizontally with the SCROLL keys to observe all its parts. When full amplitude is used in the vertical (voltage axis) direction, the waveform position indication appears on the bottom of the LCD. The displayed section of the waveform is darkened.

The waveform automatically scrolls to the left if the [-] key is pressed while the ◀ SCROLL key is held down. Automatic scrolling to right is possible if the [+] key is pressed while the ▶ SCROLL key is held down. Automatic scrolling stops when the STOP key is pressed. The scroll function can be used with both the full amplitude and complete resolution displays.



Waveform position indication

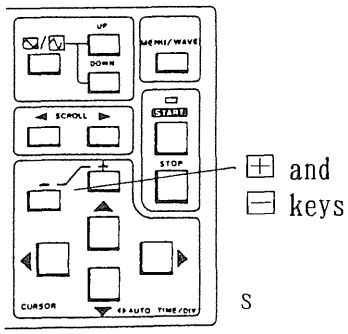
Note: When the entire waveform recording is contained within the display screen, the waveform does not scroll.

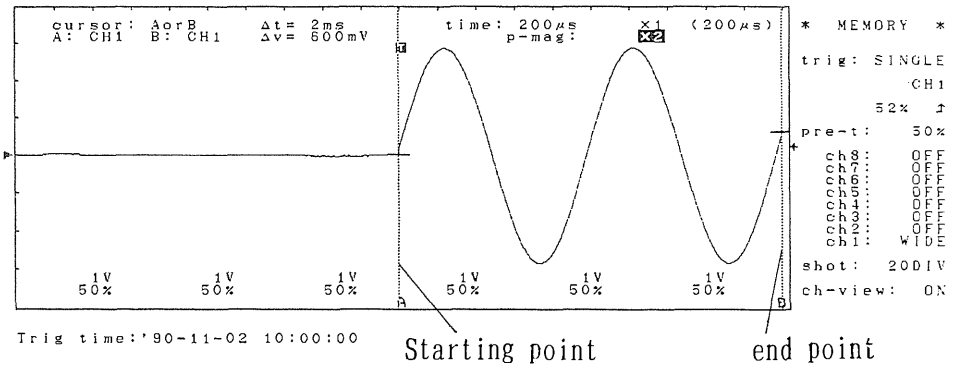
MEM

4－3－8 Partial Printing Function

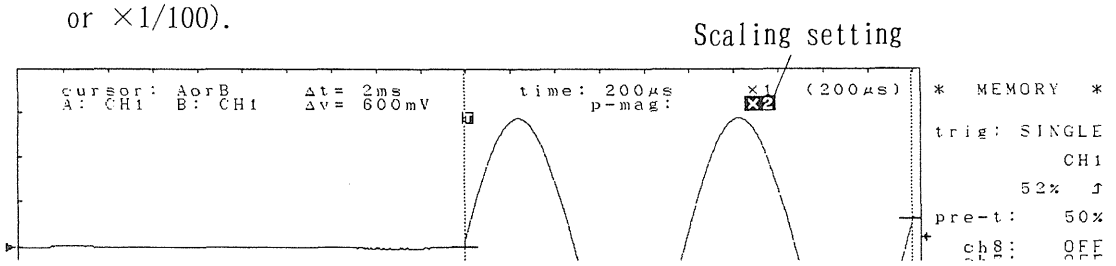
You can print just a certain portion of a waveform stored in memory. The range to print is specified using the line cursors.
In the WAVE display mode, the cursor indication should be set to a position other than "OFF".

① Specify the starting point with the "A" line cursor. Select the position with the ⊞ and ⊟ keys.
② Switch to the "B" line cursor.
③ Specify the end point with the "B" line cursor. Select the position with the ⊞ and ⊟ keys (If only the "A" cursor is used, the whole waveform after the "A" cursor will be printed out).

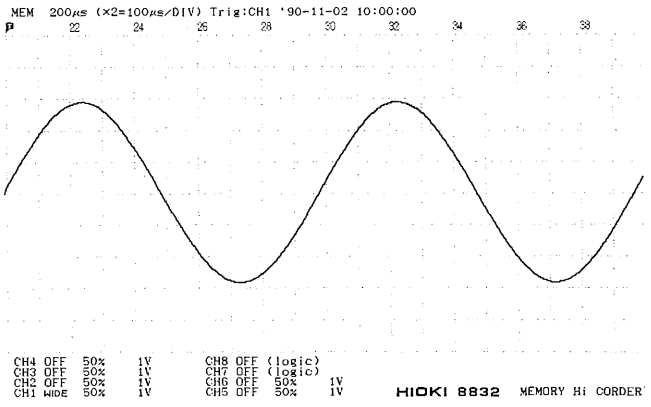




④ Set the scaling (p-mag) as desired.
The section between the line cursors will be printed out at the selected scaling (×8, ×4, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50 or ×1/100).



⑤ Press the PRINT key.



Note: When normal printing is desired, set the "cursor" indication to OFF.

4 — 3 — 9 Automatic Time Axis Setting

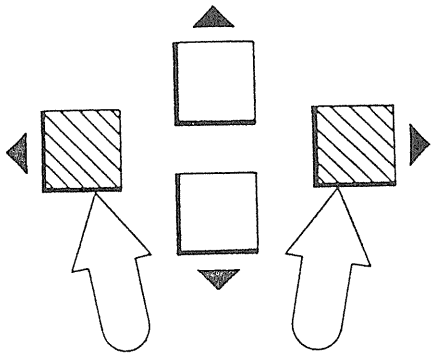
When the trigger function is set, the time axis is adjusted automatically in the WAVE display mode so that 1 to 2.5 cycles of the waveform are recorded on 10 divisions.

Setting Procedure

① Set a trigger for the signal to be measured. Internal triggering may be used.

② Press the ◀ and ▶ CURSOR keys simultaneously in the WAVE display mode.

③ Maximum trigger signal searching time is 20 seconds. To stop operation halfway, press the STOP key.



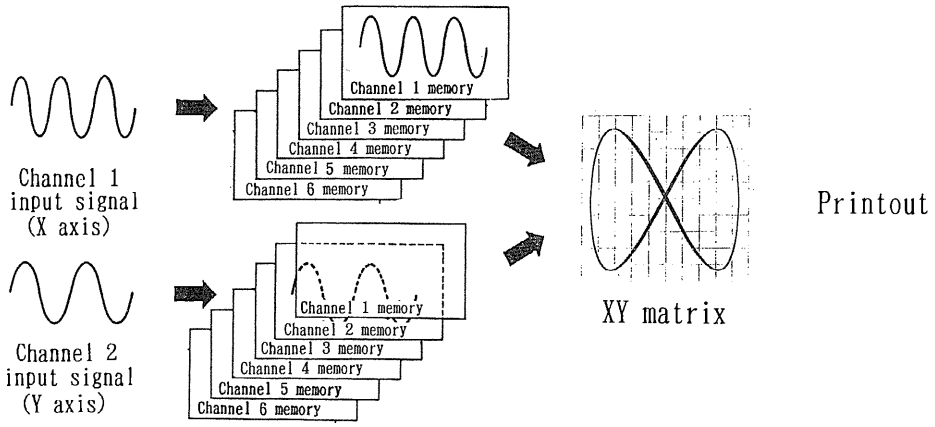
MEM

Notes:
- This function cannot be used with the trigger function off. The trigger is used to calculate the waveform cycle. Set an adequate trigger.
- This feature cannot be used with the Recorder and Continuous X-Y Recorder function.
- When automatic time axis setting is used, the trigger output signal is delivered through the TRIG OUT terminal. Pay attention to this when synchronizing the unit with other devices.

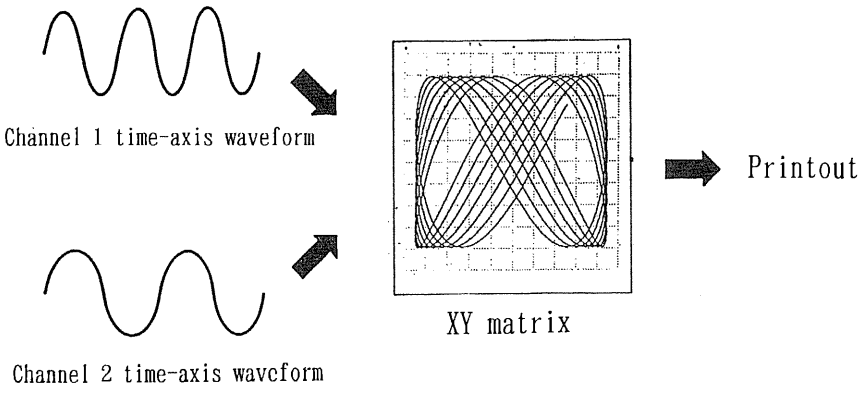
4 − 4. Using the High-speed X-Y Recorder Function

4 − 4 − 1 Features of the High-speed X-Y Recorder Fanction

(1) Like with the memory recorder, input signals for each channel are stored in memory.
(2) The stored time-axis signals undergo XY combination.
(3) Channel 1 corresponds to the X axis, and channel 2～6 to the Y axis.
(4) Output format can be converted. If signals stored in the high-speed XY recorder mode are printed in the memory recorder mode, a time-axis waveform is obtained. The opposite procedure is also possible.



Operation Principle of the XY MEM Function



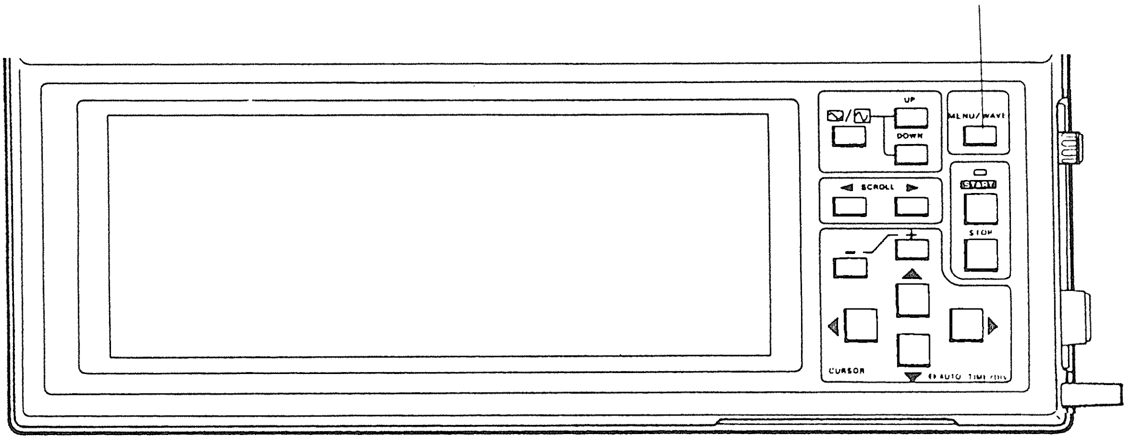
Memory recorder function High-speed XY recorder function

Output Format Conversion

4 − 4 − 2 The MENU Display

The MENU and WAVE display modes are switched alternately by pressing the MENU/WAVE key.

MENU/WAVE key



MENU Display

```
MENU        **  XYmem  **                             '90-11-02 10:00:00
****STATUS***************TRIGGER*************PRINT***************SPECIAL*******
* time/div:   200μs * mode:       SINGLE * ch6:           OFF * RAM card:    OFF *
*                   * source:        CH1 * ch5:           OFF *  auto-save       *
* shot:       40DIV *   level:       50% * ch4:           OFF *                  *
*                   *   slope:        ↑  * ch3:           OFF *                  *
* auto-print:   OFF *   filter:      OFF * ch2:          SLIM *                  *
*                   *                    * ch1:      (X-axis) *                  *
*                   * pre-trig:      50% *                    *                  *
*                   * wait-less:     OFF * dot-line:     LINE *                  *
*********************************************************************************
RECORDER MEMORY XYmem XYcont SYSTEM
```

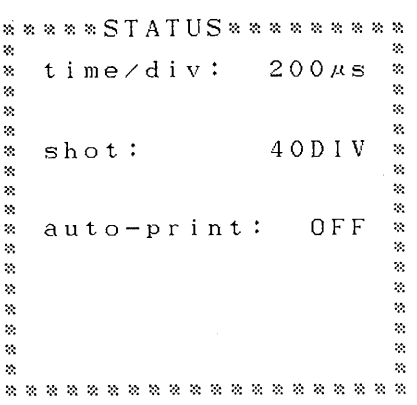
Trigger section
For trigger-related settings

Special Section
For RAM card automatic save function setting.

Status section
For setting time axis range, recording length, and printer output ON/OFF.

Printing section
For setting the printer output, the waveform interpolation function and whether the waveform is displayed or not on the LCD (WAVE mode).

①Status Section



time/div

Indicates the amount of time equivalent to 1 division (1 square on the recording paper) in the time axis direction. It can be changed in 15 steps from 100 μs to 5 s/DIV (1-2-5 steps). For automatic time axis setting, refer to section 4-4-7.

shot

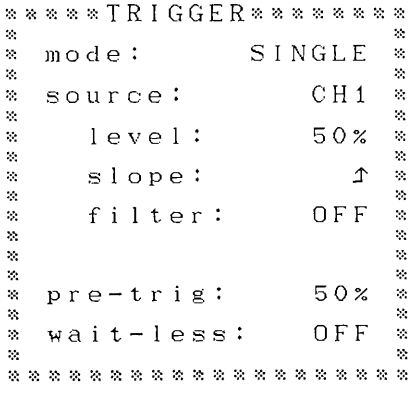
Indicates the recording paper length used per recording operation. It can be set to 20, 40, 80, 160, 300, 600, 1200 and 2500 divisions (see note below).

Note: ▪ When 1200 DIV is selected, only the waveform from three channel can be recorded.
▪ When 2500 DIV is selected only the waveform from one channel can be recorded.

auto-print

Indicates whether the waveform is to be output not only to the LCD but also to the printer when the START key is pressed.

②Trigger Section (see 6. USING THE TRIGGER FUNCTION for details on trigger operation)



mode

Indicates the trigger mode.

[SINGLE]…The trigger signal is valid only once after pressing the START key.

[REPEAT]…Triggering is applied continuously.

[AUTO]…Same as [REPEAT], but triggering is applied automatically if no triggering is applied for approx. 1 second.

source

Indicates the signal type that triggers the recording operation.

[OFF]…The trigger function does not work. Recording will start immediately when the START key is pressed.

[CH1] to [CH8]…Operation is triggered by the signals input through channels 1 to 8, respectively.

[EXT]…Recording starts when the EXT IN terminal is short-circuited or an approx. 2.5-V falling signal is input to it.

[MANU]…Operation is triggered manually by pressing the MANU TRIG key.

[TIMER]…Triggering at desired interval is possible after a starting time is set.

level

Indicates trigger level in 1% steps from 0% to 100% of the full chart.

slope

Indicates in which direction should the input signal cross the trigger level to start recording.

[↑]…Recording triggered when the signal crosses the level upwards.

[↓]…Recording triggered when the signal crosses the level downwards.

filter

Indicates the trigger filter type. 7 settings are available: OFF, 0.1, 0.2, 0.3, 0.6, 1.3 and 2.6 DIV.

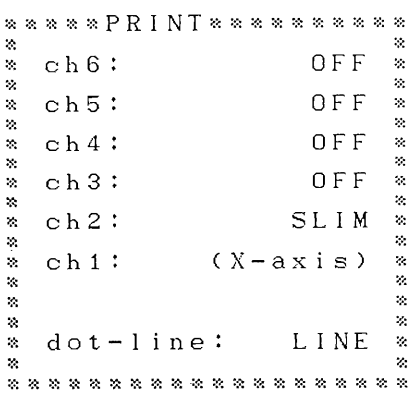
pre-trig

Indicates the amount of data to be recorded before the trigger point as a percentage of total recording length. It can be set to 0, 5, 25, 50, 75, 95, 100 and -95%.

wait-less

Indicates the (ON/OFF) status of the wait-less mode. For details, refer to 6-5. Wait-less Mode.

③Printing Section



ch1 to ch6

Indicates whether the waveform is displayed on the WAVE display, and selects the line thickness the printed waveform.

	OFF	SLIM	WIDE
WAVE Display	Not displayed	Displayed	Displayed
Printer	No output	Thin line output	Thick line output

Note: Line thickness setting (SLIM or WIDE) has no effect on the WAVE display. (Channel 1 is used as the X axis waveform.)

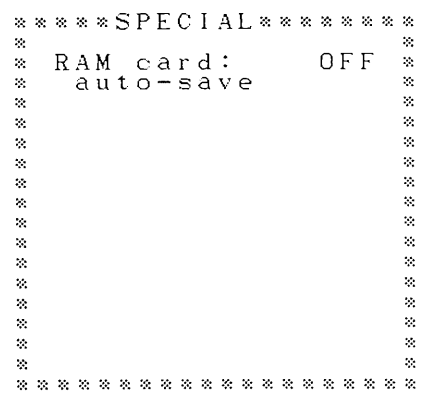
dot-line

Indicates interpolation of waveforms displayed on the LCD and output to the printer.

[DOT]…Line interpolation is not applied. Sampled points are displayed and output as they are.

[LINE]…Line interpolation is applied. Sampled points are connected with straight lines for display and output.

④Special Section

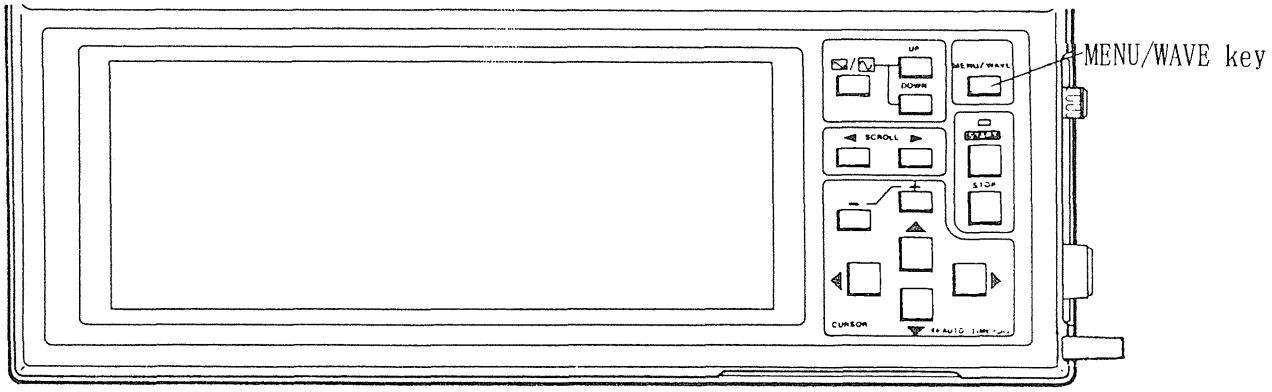


RAM card auto save

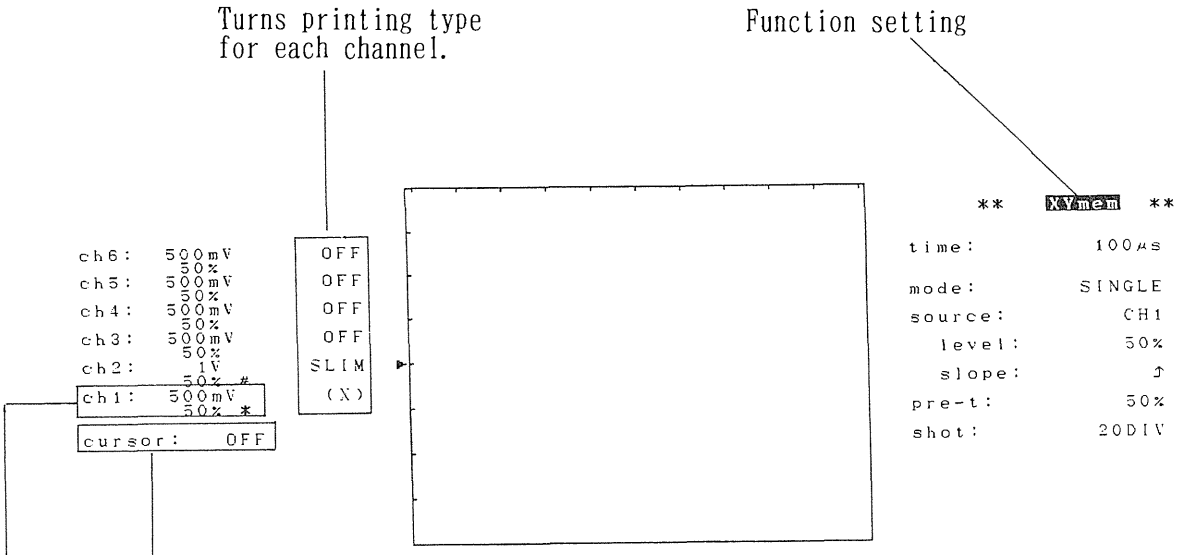
Indicates the (ON/OFF) status of the RAM automatic save function. For details, refer to 8-7. Automatic Save Function.

4 — 4 — 3 The WAVE Display

Press the MENU/WAVE key to change the display mode from MENU to WAVE.



WAVE display



cursor: Line cursor setting.
For details, refer to 4.4.5.
Using the Line Cursors.

time: Time axis setting (time/div.)

mode:
source:
level:
slope:
} Trigger settings. For details, refer to Chapter 6. USING THE TRIGGER FUNCTION.

pre-t: * 5Hz
500Hz

shot: Indicates recording length.

Indicates the channel 1 analog unit condition.

ch 1 : 500mV — Indicates the range.

50% * — Indicates the unit filter

Indicates the zero position.

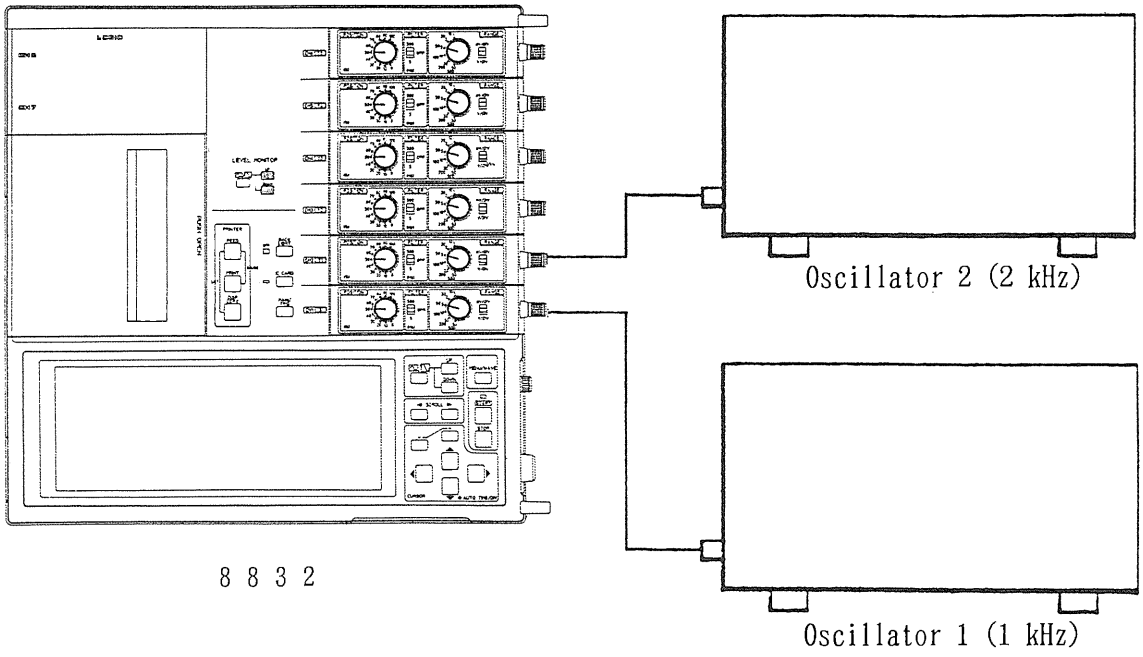
XY MEM

4 — 4 — 4 High-speed XY Recorder Operation Example

Applying XY composition to a 1-kHz signal and a 2-kHz signal from two oscillators.

Connection

Connect the oscillators to channels 1 and 2 of the 8832.



Oscillator Setting

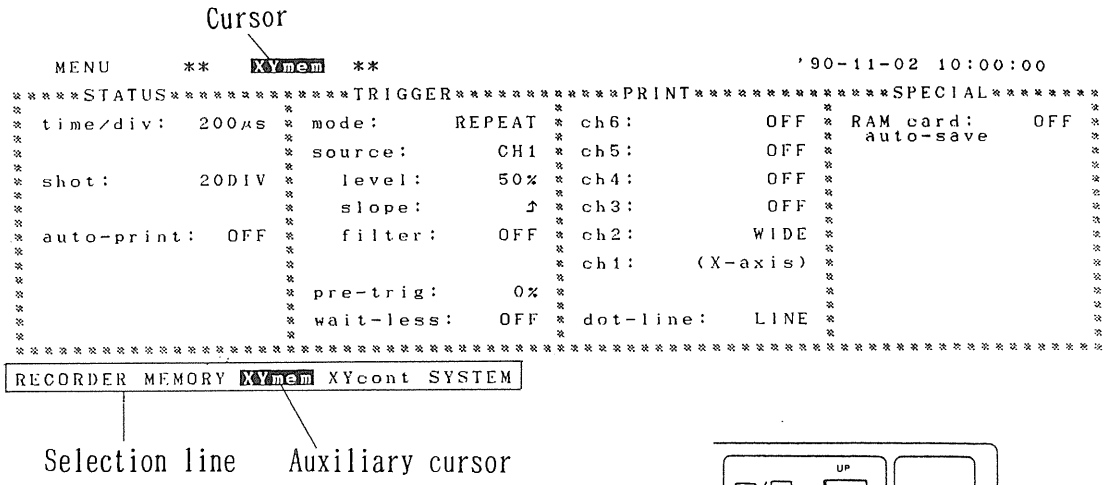
Oscillator 1: Frequency····· 1 kHz
Output voltage··· Approx. 6 V_{p-p}
Waveform····· Sine wave

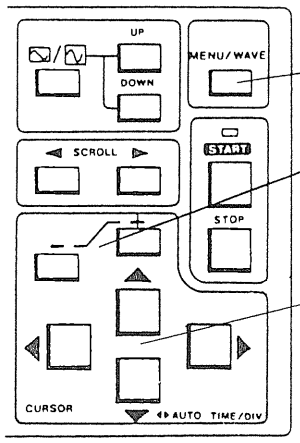
Oscillator 2: Frequency····· 2 kHz
Output voltage··· Approx. 6 V_{p-p}
Waveform····· Sine wave

Adjust both oscillators so as to generate the above waveforms.

(1) MENU Display Setting

Set the MENU display mode with the MENU/WAVE key.





①Function Selection

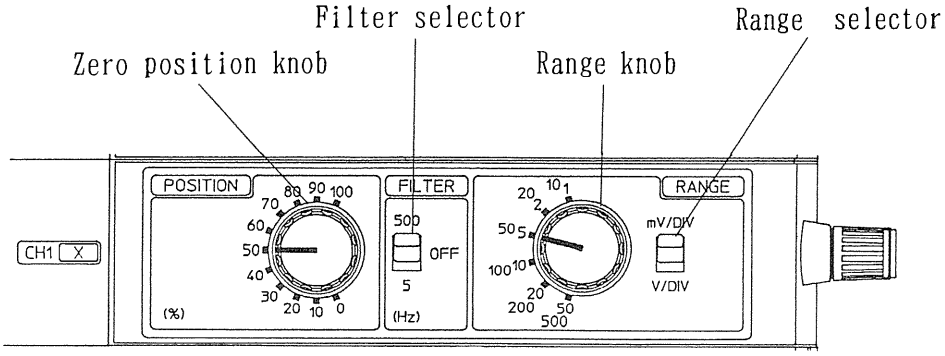
Using the CURSOR key, move the cursor to the function indication. The selection line will show the available functions. Use the ⊞ and ⊟ keys to move the auxiliary cursor to the XY MEM position.

②Various Settings

Change settings to match the above figure.

First, use the CURSOR keys to place the curs or on the desired parameter. The selection line will shows the available settings. Use the ⊞ and ⊟ keys to move the auxiliary cursor to the desired setting.

(2) Input Unit Setting



①RANGE Setting

Set the range selector to the V/DIV (black) position, and the range knob to the 1 position. This sets a measurement range of 1 V/DIV

②FILTER Setting

Set the FILTER selector to OFF.

③POSITION Setting

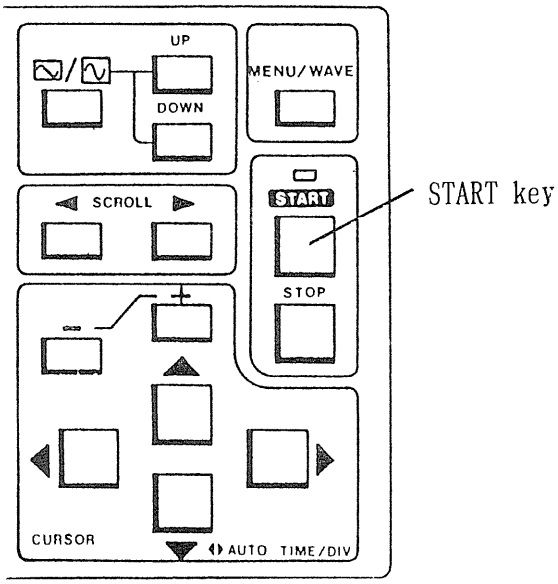
Set the Zero POSITION knob to 50%.

* Perform the above settings for both channels 1 and 2.

This completes the setting procedure. For details on the input units, refer to Chapter 5. USING THE INPUT UNIT.

(3) Measurement

Press the START key.



START key

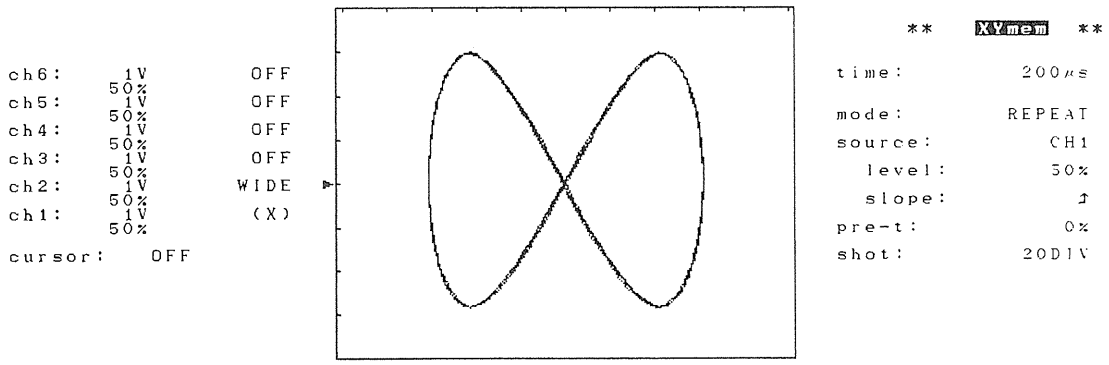
If an Error Occurs

- Check the error message.
- Press the STOP key.
- Remove the cause of the error.

(refer to Appendix 1. Error Messages)

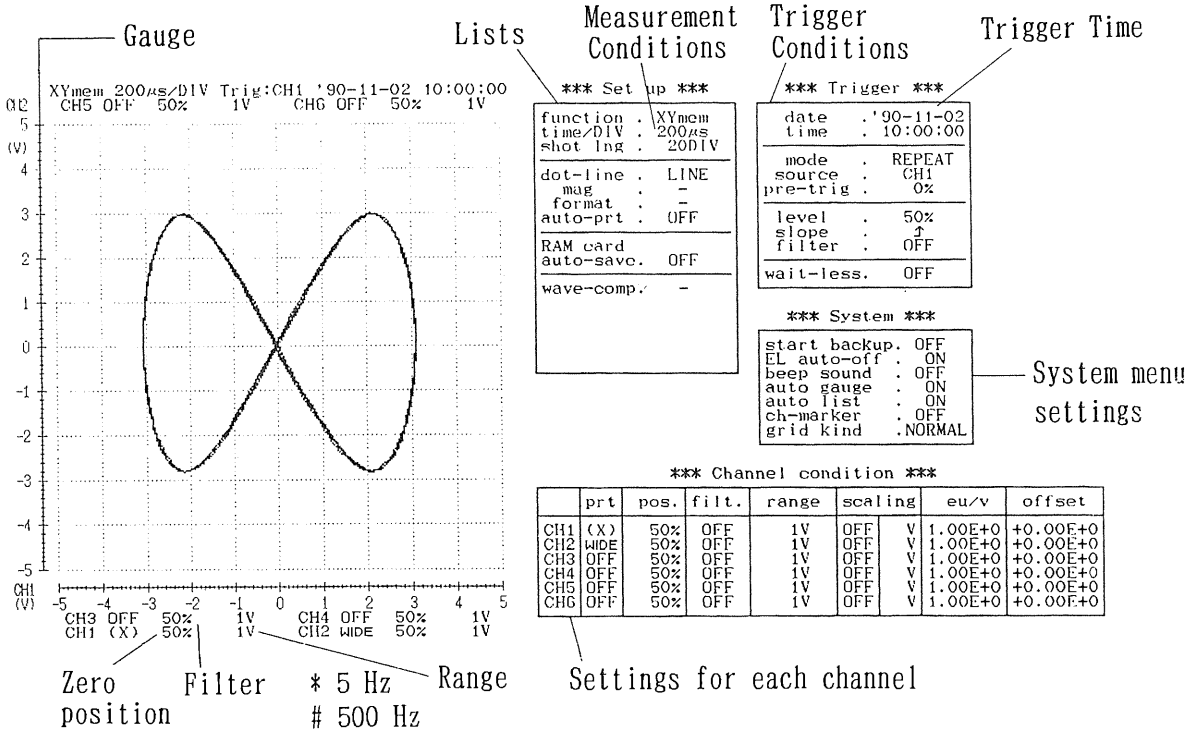
WAVE display

- Press the DISP COPY key to get a hard copy of the display.



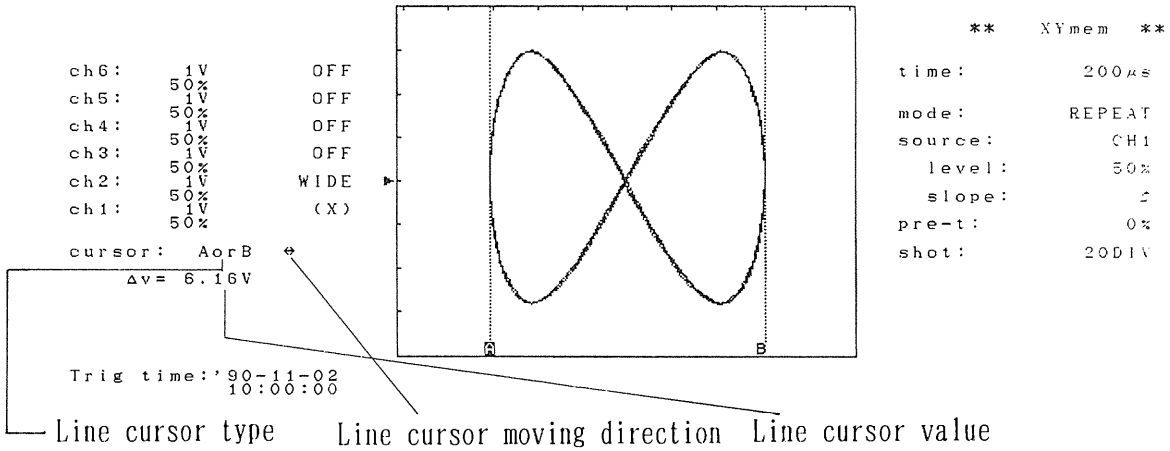
Trigger time is displayed when the waveform is on the LCD.

Chart



- To print only the lists, press the FEED and DISP COPY keys simultaneously.
- To print only the gauge, press the FEED and PRINT keys simultaneously.

4 — 4 — 5 Using the Line Cursors



In the high-speed XY recorder mode, line cursors move both horizontally and vertically.

In the WAVE display mode, select the line cursor type.

cursor: [OFF] No line cursor is displayed.

[A] Only the [A] cursor is displayed.

[A or B] Both the [A] and [B] cursors are displayed, but only one of them can be moved at a time.

[A & B] Both the [A] and [B] cursors are displayed, and they can be moved together.

Select the line cursor moving direction.

[↔] Horizontal (X axis) direction.

[↕] Vertical (Y axis) direction.

The value between the line cursors is displayed.

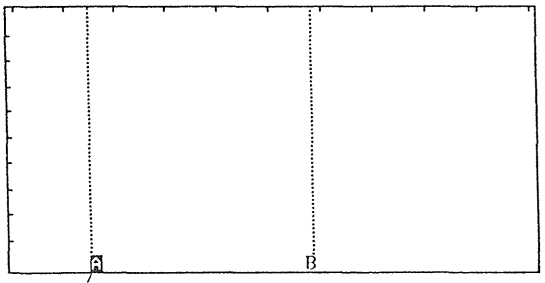
[△V=] When only the A cursor is used, the potential at the A cursor is displayed. When both cursors are used, the voltage between them is displayed. The range and zero position assigned to channel 1 are applied for [↔] cursors, and those assigned to the SLIM or WIDE channel of smallest number among channels 2 to 6 (for example, channel 2 when channels 2 and 3 are SLIM or WIDE) for [↕] cursors.

● Moving the Line Cursors

① Using the CURSOR keys, place the main cursor in the position shown in the figure.

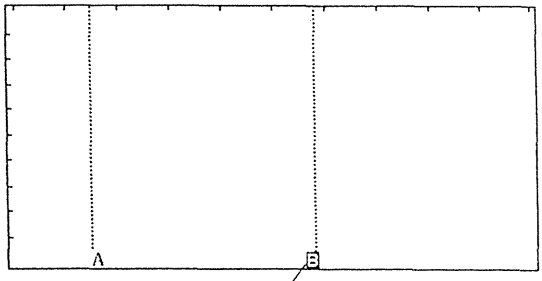
[↔] Cursors

"A" Cursor



A Cursor

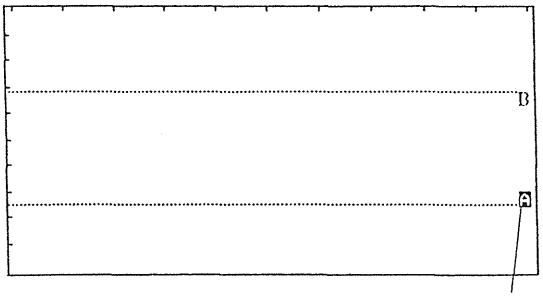
"B" Cursor



B Cursor

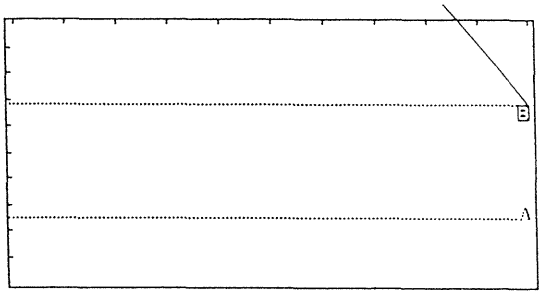
[↕] Cursors

"A" Cursor



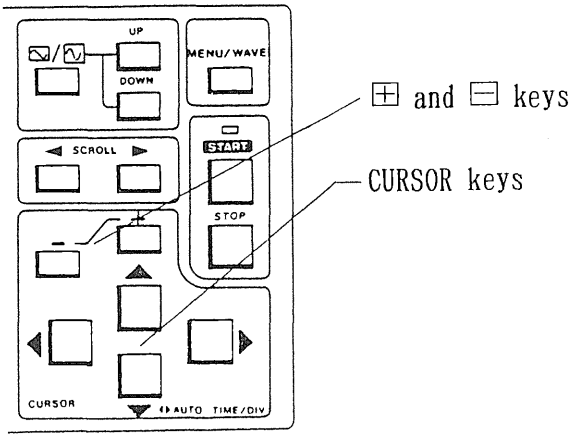
A Cursor

"B" Cursor

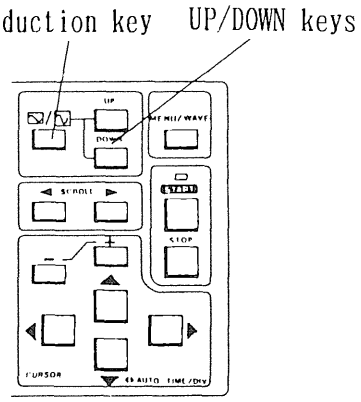


B Cursor

② Move the line cursors with the ⊞ and ⊟ keys.

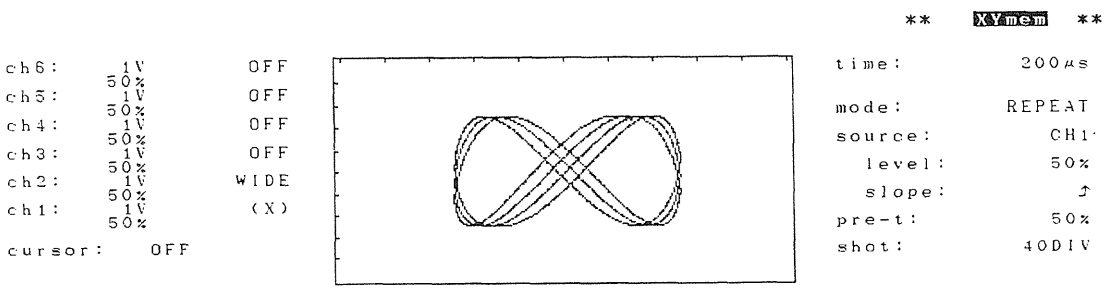


4 — 4 — 6 On the Vertical Axis of the WAVE Display

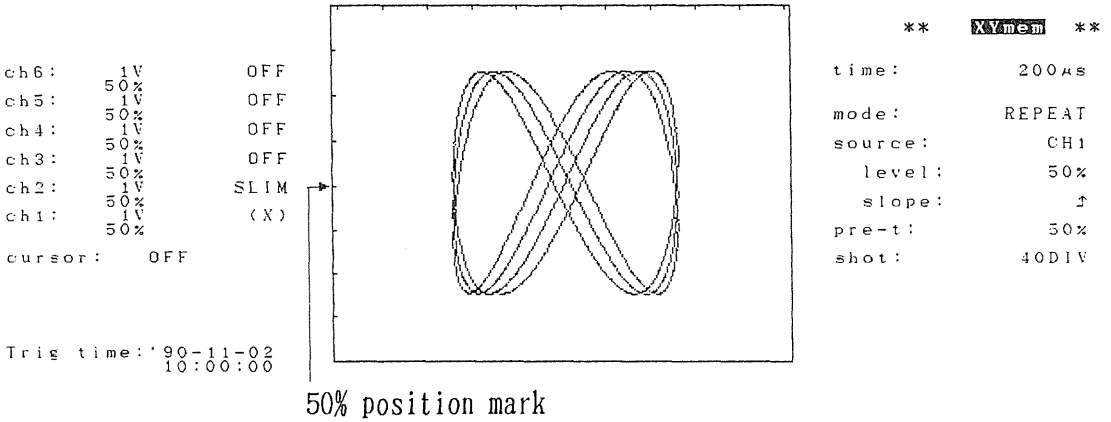


Vertical scaling of the waveform display in the WAVE mode can be selected between two settings. Switching between these is performed by pressing the display reduction key.

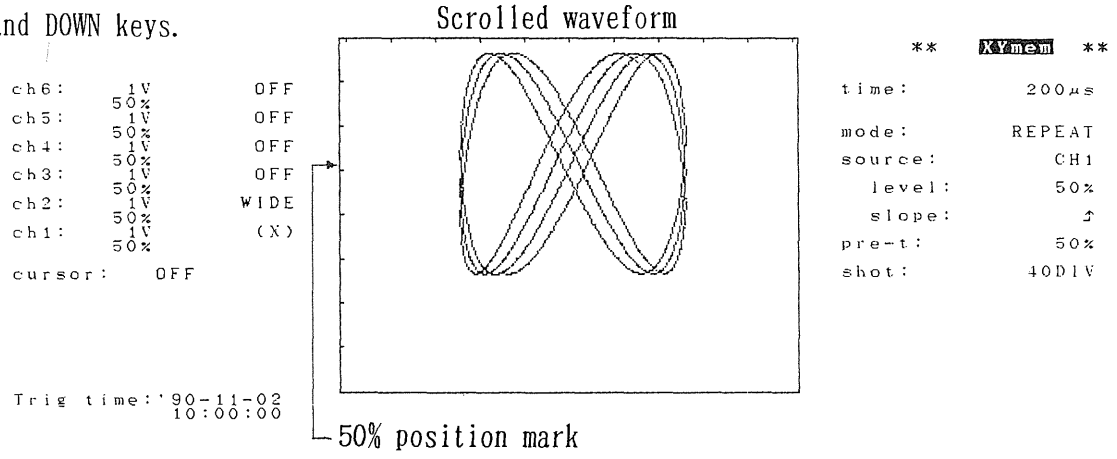
● Full-amplitude Display: The whole amplitude of the waveform is displayed at once on the LCD. Resolution is reduced by half.



● Full-resolution Display: Approx. 78% (200/256) of the waveform amplitude is displayed on the LCD, at the full A/D resolution.



● In the full-resolution mode, the waveform can be scrolled vertically on the LCD with the UP and DOWN keys.



4 − 4 − 7 Automatic Time Axis Setting

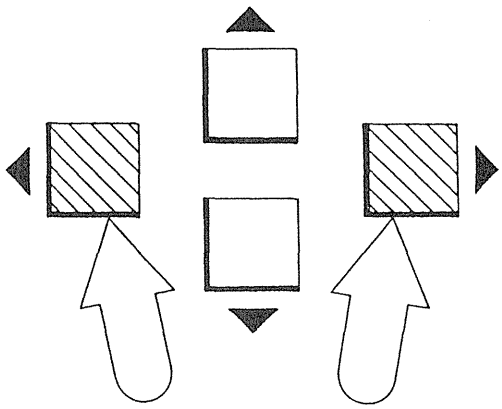
When the trigger function is set, the time axis is adjusted automatically in the WAVE display mode so that 1 to 2.5 cycles of the waveform are recorded on 10 divisions.

Setting Procedure

① Set a trigger for the signal to be measured. Internal triggering may be used.

② Press the ◀ and ▶ CURSOR keys simultaneously in the WAVE display mode.

③ Maximum trigger signal searching time is 20 seconds. To stop operation halfway, press the STOP key.

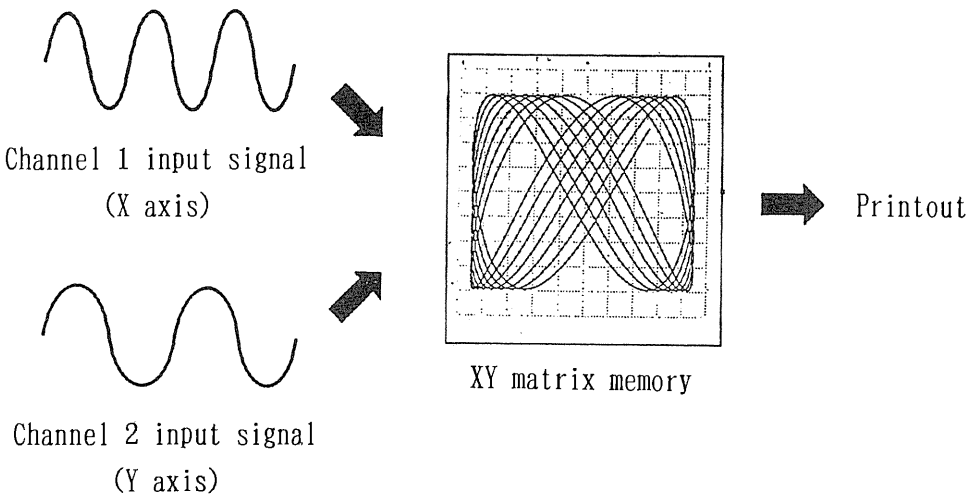


Notes:
- This function cannot be used with the trigger function off. The trigger is used to calculate the waveform cycle. Set an adequate trigger.
- This feature cannot be used with the Recorder and Continuous X-Y Recorder Function.
- When automatic time axis setting is used, the trigger output signal is delivered through the TRIG OUT terminal. Pay attention to this when synchronizing the unit with other devices.

4 — 5 Using the Continuous X-Y Recorder Function

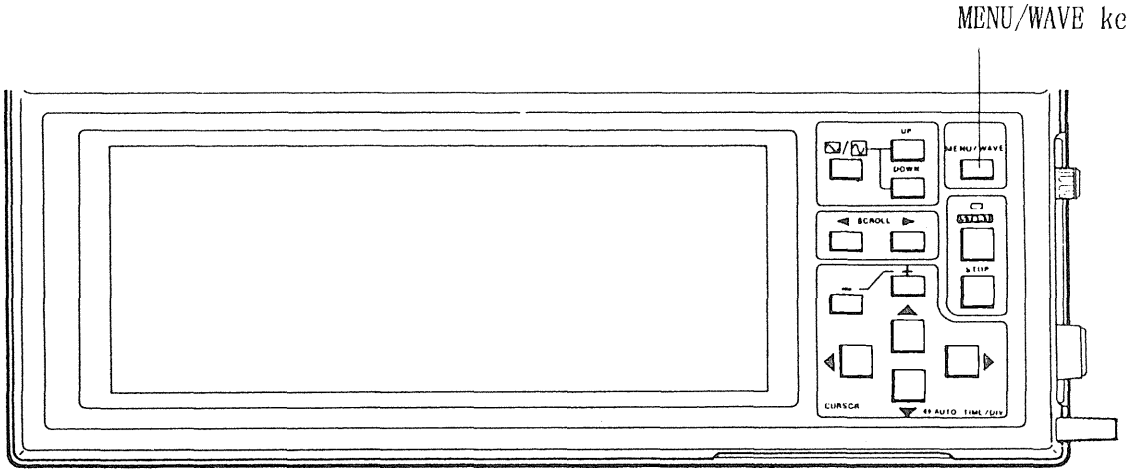
4 — 5 — 1 Features of the Continuous X-Y Recorder Function

(1) Like in the normal XY recorder mode, it allows for XY combination of input channels.
(2) Unlike the high-speed recorder function, time-axis signals for each channel are not recorded.
(3) The XY composite signal is recorded.
(4) Channel 1 corresponds to the X axis, and channels 2-6 to the Y axis.
(5) High-speed sampling
Recording is performed at a minimum sampling interval of 60μs.
(6) Unlimited recording time
Since operation is basically the same as in the normal XY recorder, recording can be continued as long as desired.
(7) Overlapped recording
Waveforms can be overlapped by setting the "LCD clear" indication to OFF.

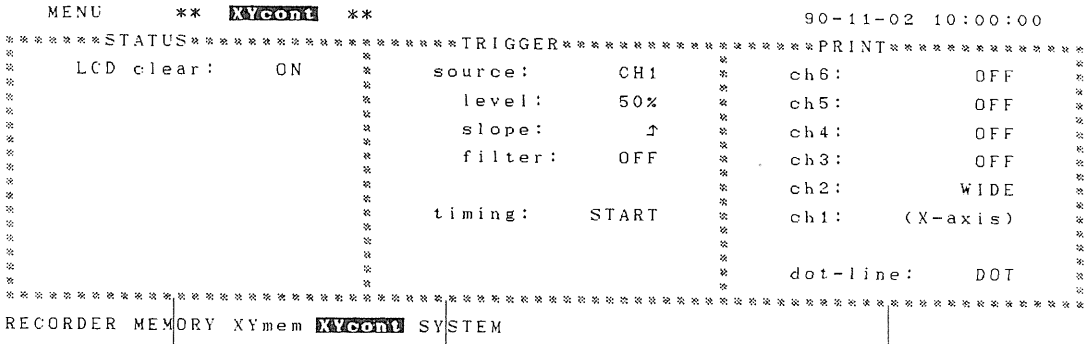


4 — 5 — 2 The MENU Display

The MENU and WAVE display modes are switched alternately by pressing the MENU/WAVE key.



MENU Display

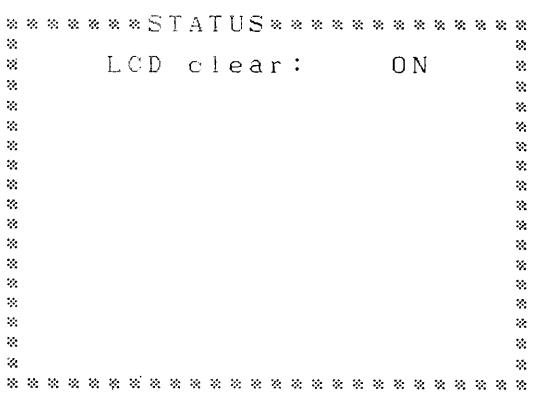


Trigger section
For trigger-related settings

Status section
To select whether the previous waveform is to be erased or new waveforms overlapped.

Printing section
For LCD (WAVE mode) and printer output setting, and waveform interpolation function setting.

① Status Section

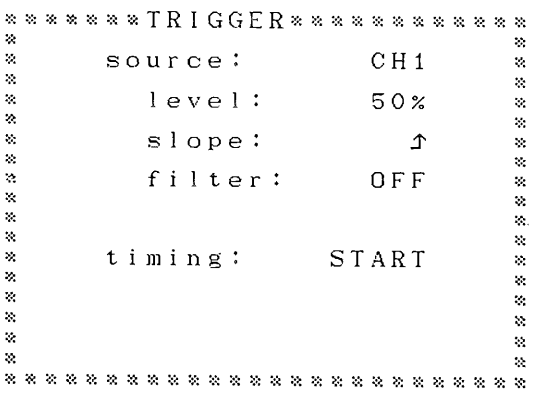


LCD clear

〔 OFF 〕…The previous waveform is not erased when pressing the START key (the new waveform is displayed overlapped).

〔 ON 〕…The previous waveform is erased when pressing the START key.

② Trigger Section (see 6. USING THE TRIGGER FUNCTION for details on trigger operation)



source

Indicates the signal type that triggers the recording operation.

〔 OFF 〕…The trigger function does not work. Recording will start immediately when the START key is pressed.

〔 CH1 to CH8 〕…Operation is triggered by the signals input through channels 1 to 8, respectively.

〔 EXT 〕…Recording starts when the EXT IN terminal is short-circuited or an approx. 2.5-V falling signal is input to it.

〔 MANU 〕…Operation is triggered manually by pressing the MANU TRIG key.

〔 TIMER〕…Triggering at desired interval is possible after a starting time is set.

level

Indicates trigger level in 1% steps from 0% to 100% of the full chart.

slope

Indicates in which direction should the input signal cross the trigger level to start recording.

〔↑〕…Recording triggered when the signal crosses the level upwards.

〔↓〕…Recording triggered when the signal crosses the level downwards.

filter

Indicates the current setting of the filter used to prevent trigger misoperation due to chattering.

〔 ON 〕…Trigger filtering is applied.

〔 OFF 〕…Trigger filtering is not applied.

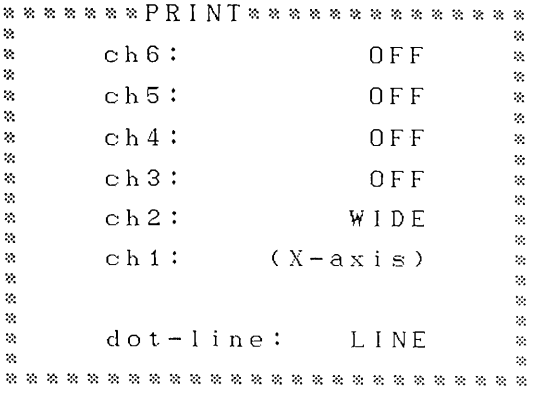
timing

Indicates trigger timing

〔 START〕…Recording starts at the trigger point.

〔 STOP 〕…Recording stops at the trigger point.

③ Printing Section



ch1 to ch6

Indicates whether the waveform is displayed on the WAVE display, and selects the line thickness the printed waveform.

	OFF	SLIM	WIDE
WAVE Display	Not displayed	Displayed	Displayed
Printer	No output	Thin line output	Thick line output

Note: Line thickness setting (SLIM or WIDE) has no effect on the WAVE display. (Channel 1 is used as the X axis waveform.)

dot-line

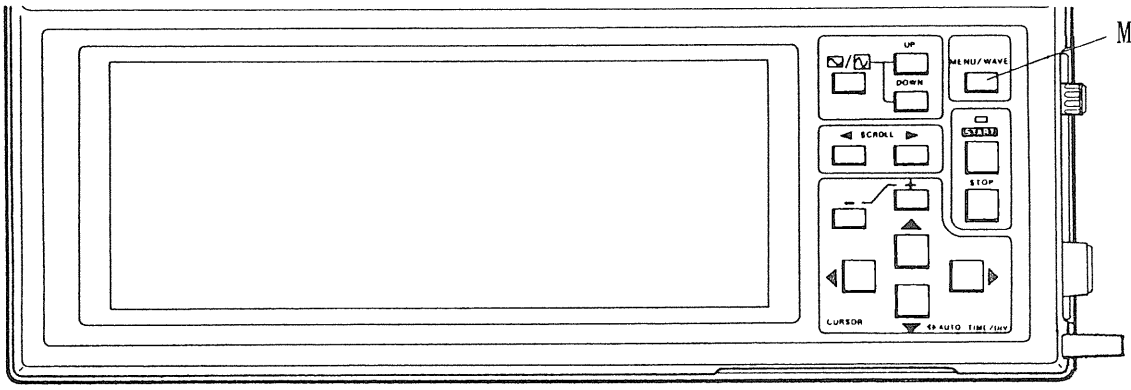
Indicates interpolation of waveforms displayed on the LCD and output to the printer.

〔 DOT 〕…Line interpolation is not applied. Sampled points are displayed and output as they are.

〔 LINE 〕…Line interpolation is applied. Sampled points are connected with straight lines for display and output.

4 — 5 — 3 The WAVE Display

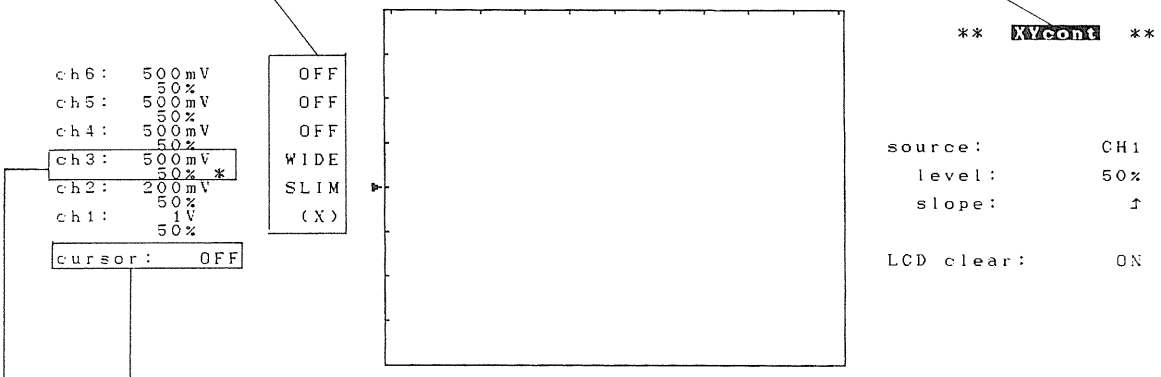
Press the MENU/WAVE key to change the display mode from MENU to WAVE.



WAVE display

Turns waveform display type for each channel.

Function setting



cursor: Line cursor setting. For details, refer to 4.5.5. Using the Line Cursors.

source: / level: / slope: Trigger settings. For details, refer to Chapter 6. USING THE TRIGGER FUNCTION.

LCD clear: If ON, the previous waveform is erased when recording starts. Set it to OFF for overlapped waveform display.

Indicates the channel 3 analog unit condition.

ch3: (500mV) — Indicates the range.

(500mV)(*) — Indicates the unit filter

* 5Hz

500Hz

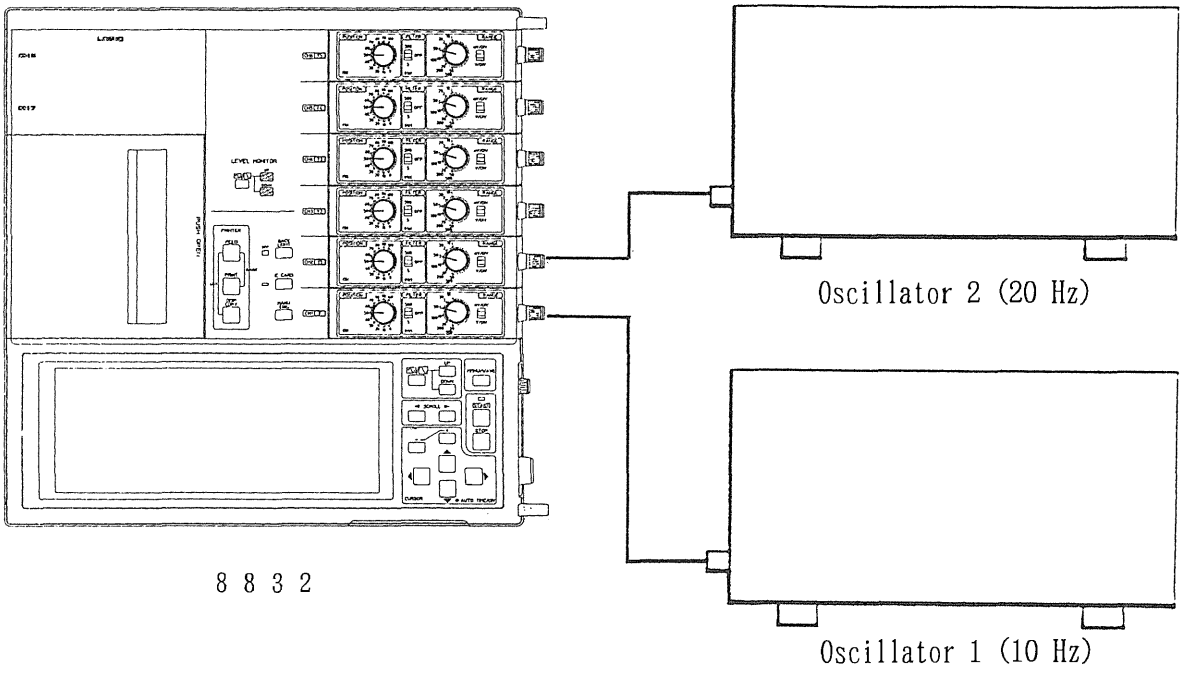
Indicates the zero position.

4 – 5 – 4 Continuous X-Y Recorder Operation Examples

Applying XY composition to a 10-Hz signal and a 20-Hz signal from two oscillators.

Connection

Connect the oscillators to channels 1 and 2 of the 8832.



Oscillator Setting

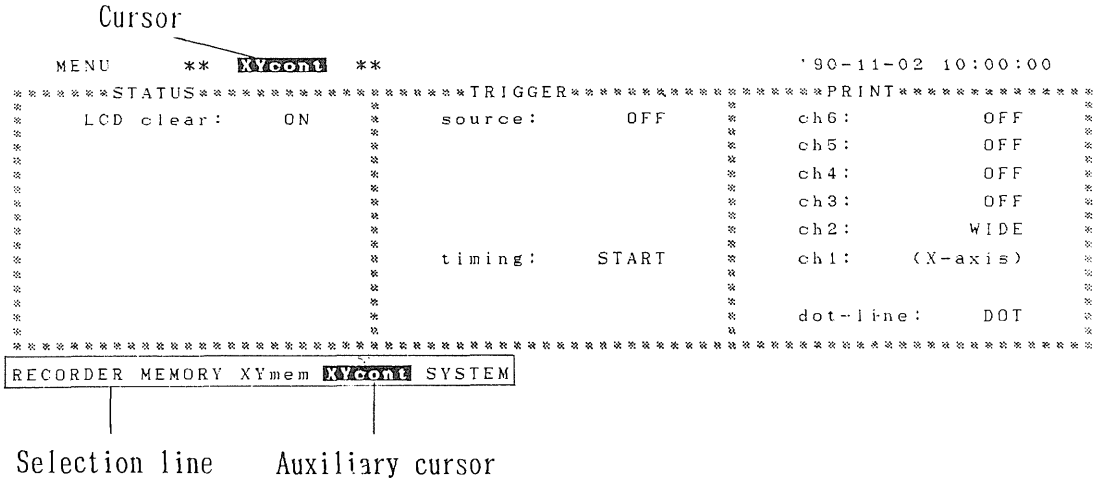
Oscillator 1: Frequency ····· 10 Hz
Output voltage ··· 3 V_{P-P}
Waveform ····· Sine wave

Oscillator 2: Frequency ····· 20 Hz
Output voltage ··· 3 V_{P-P}
Waveform ····· Sine wave

Adjust both oscillators so as to generate the above waveforms.

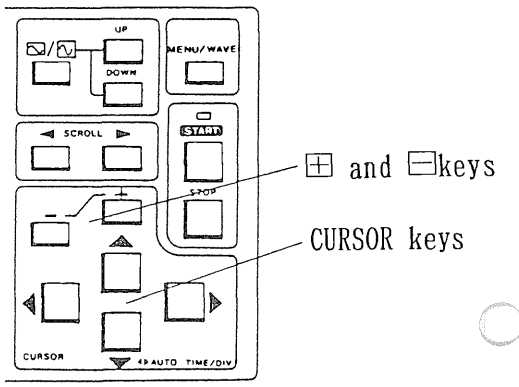
(1) MENU Display Setting

Set the MENU display mode with the MENU/WAVE key.



① Function Selection

Using the CURSOR key, move the cursor to the function indication. The selection line will showthe available functions. Use the ⊞ and ⊟ keys to move the auxiliary cursor to the [XY CONT] position.

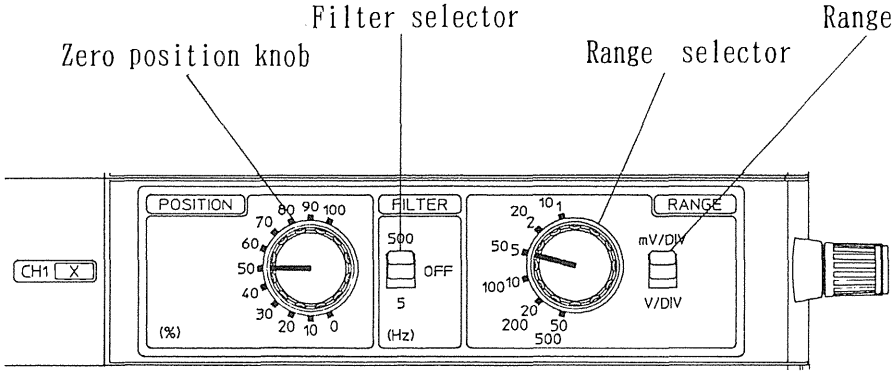


② Various Settings

Change settings to match the above figure.

First, use the CURCOR keys to place the cursor on the desired parameter. The selection line will shows the available settings. Use the⊞ and ⊟ keys to move the auxiliary cursor to the desired setting.

(2) Input Unit Setting



① RANGE Setting

Set the range selector to the mV/DIV (green) position, and the range knob to the 500 position. This sets a measurement range of 500 mV/DIV

② FILTER Setting

Set the FILTER selector to OFF.

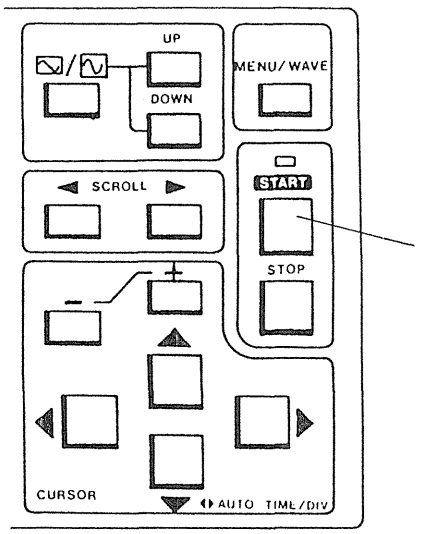
③ POSITION Setting

Set the Zero POSITION knob to 50%.

* Perform the above settings for both channels 1 and 2.
This completes the setting procedure. For details on the input units, refer to Chapter 5. USING THE INPUT UNIT.

(3) Measurement

Press the START key.



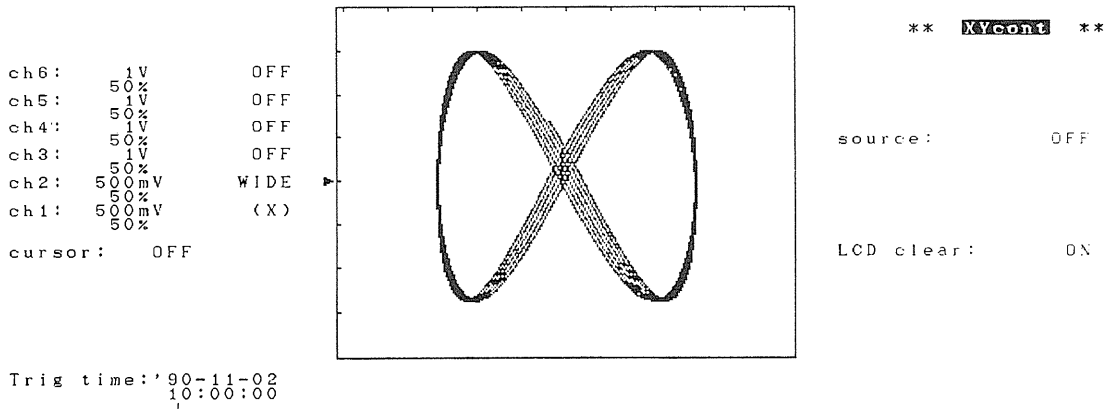
START key

If an Error Occurs
- Check the error message.
- Press the STOP key.
- Remove the cause of the error.
(refer to Appendix 1. Error Messages)

A waveform like the one shown below will be output.

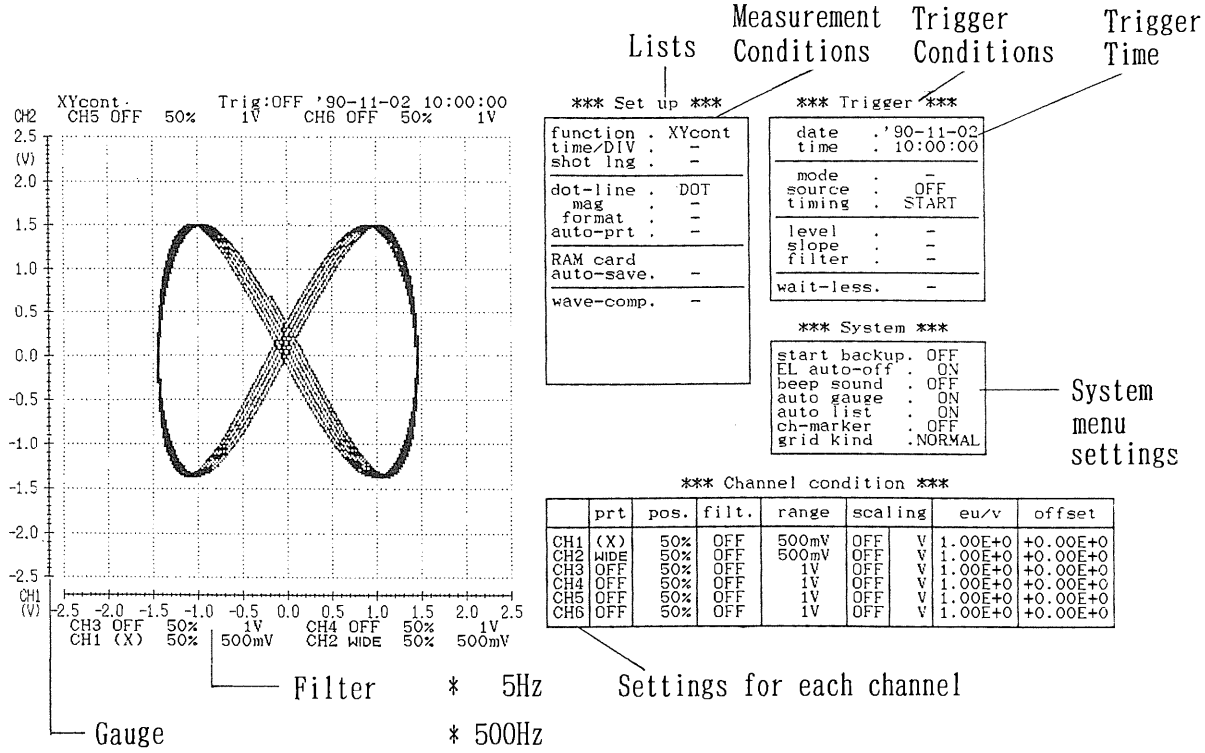
WAVE display

- Press the DISP COPY key to get a hard copy of the display.



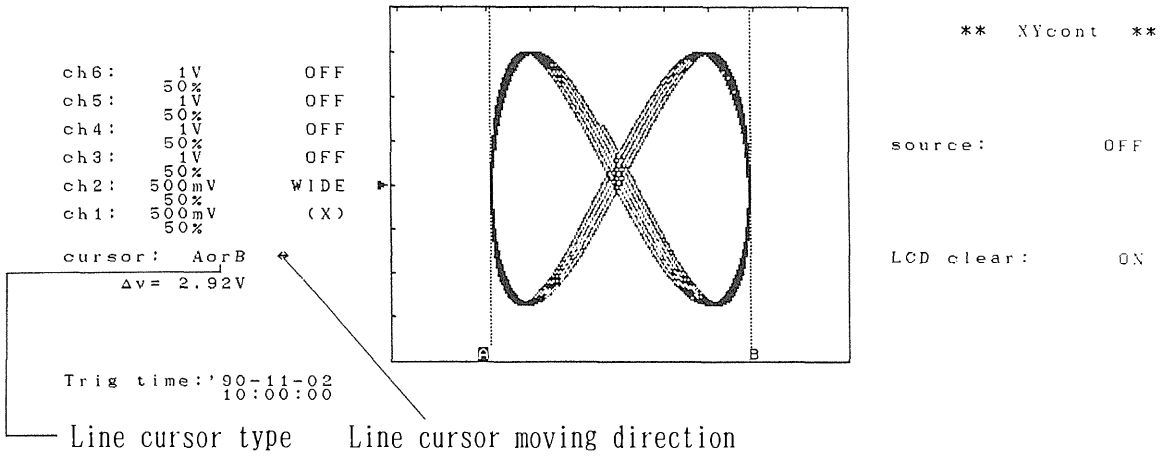
Trigger time is displayed when the waveform is on the LCD.

Chart



- To print only the lists, press the FEED and DISP COPY keys simultaneously.
- To print only the gauge, press the FEED and PRINT keys simultaneously.

4－5－5 Using the Line Cursors



In the continuous XY recorder mode, line cursors move both horizontally and vertically.

In the WAVE display mode, select the line cursor type.

cursor: 〔 OFF 〕 No line cursor is displayed.

〔 A 〕 Only the [A] cursor is displayed.

〔A or B〕 Both the [A] and [B] cursors are displayed, but only one of them can be moved at a time.

〔A & B〕 Both the [A] and [B] cursors are displayed, and they can be moved together.

Select the line cursor moving direction.

〔 ↔ 〕 Horizontal (X axis) direction.

〔 ↕ 〕 Vertical (Y axis) direction.

The value between the line cursors is displayed.

〔△V＝〕 When only the A cursor is used, the potential at the A cursor is displayed. When both cursors are used, the voltage between them is displayed. The range and zero position assigned to channel 1 are applied for 〔↔〕 cursors, and those assigned to the SLIM or WIDE channel of smallest number among channels 2 to 6 (for example, channel 2 when channels 2 and 3 are SLIM or WIDE) for 〔↕〕 cursors.

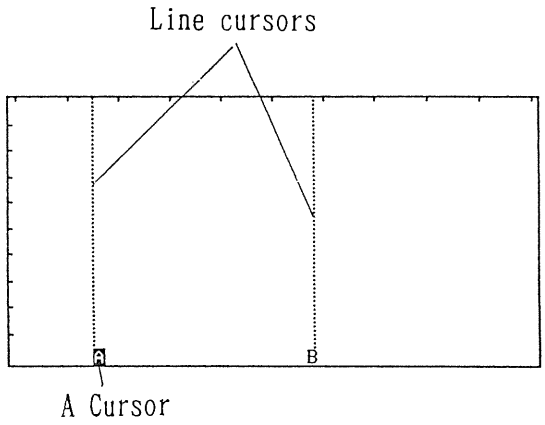
XY CONT

● Moving the Line Cursors

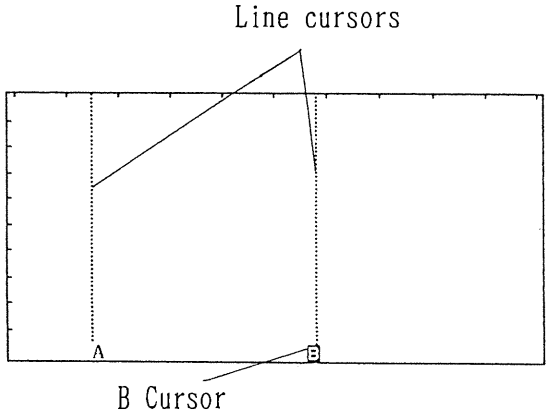
① Using the CURSOR keys, place the main cursor in the position shown in the figure.

〔↔〕 Cursors

"A" Cursor

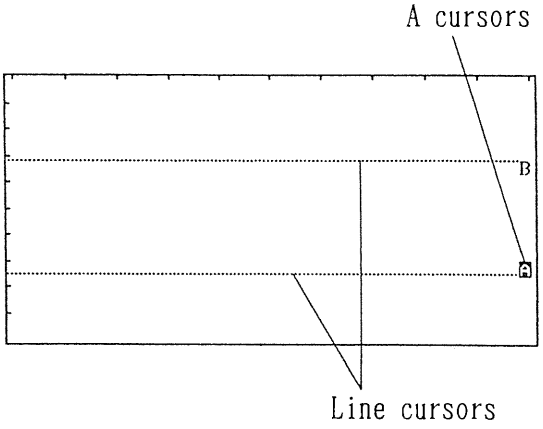


"B" Cursor

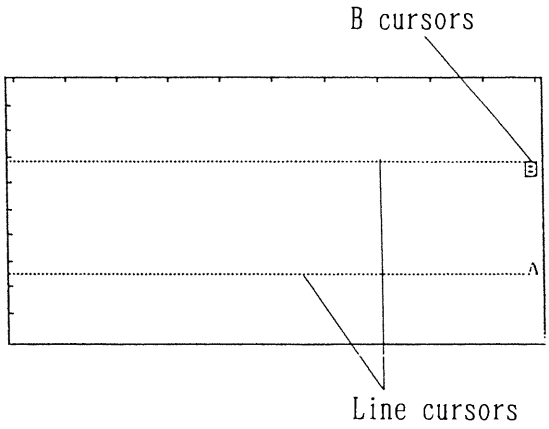


〔↕〕 Cursors

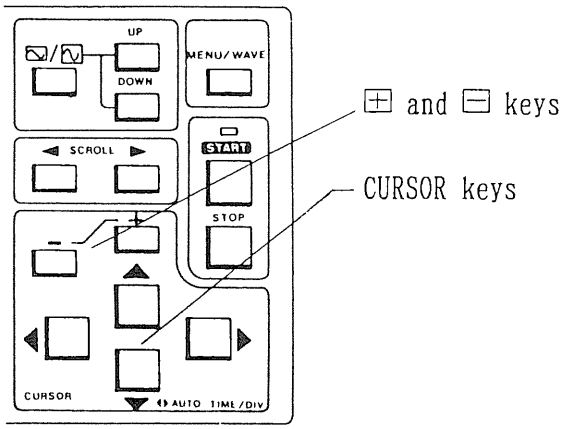
"A" Cursor



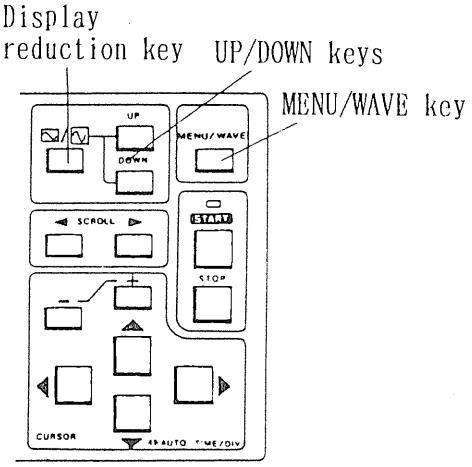
"B" Cursor



② Move the line cursors with the ⊞ and ⊟ keys.

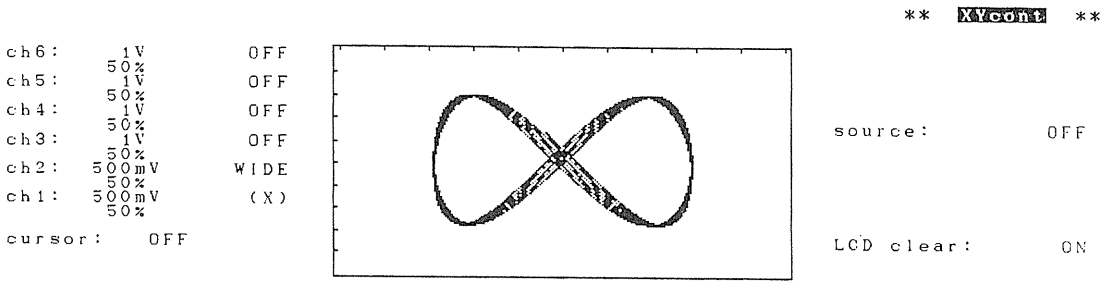


4－5－6 On the Vertical Axis of the WAVE Display

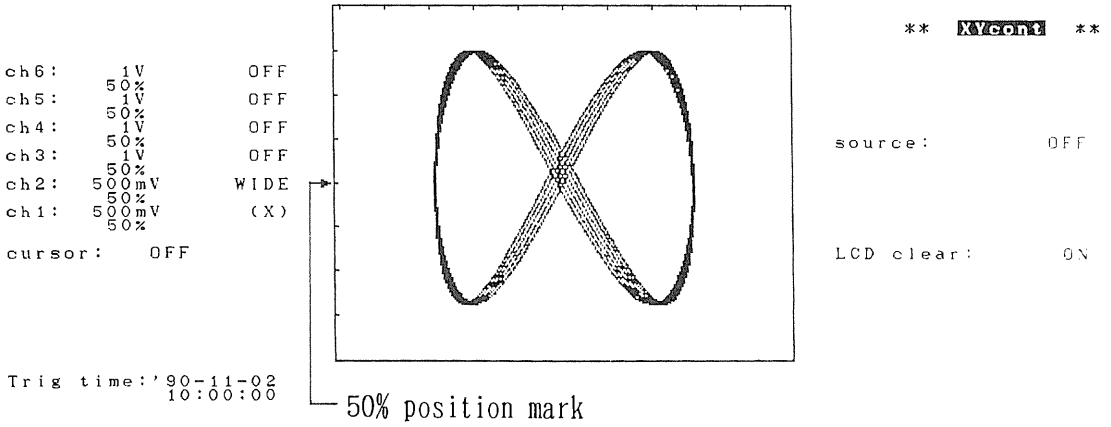


Vertical scaling of the waveform display in the WAVE mode can be selected between two settings. Switching between these is performed by pressing the display reduction key.

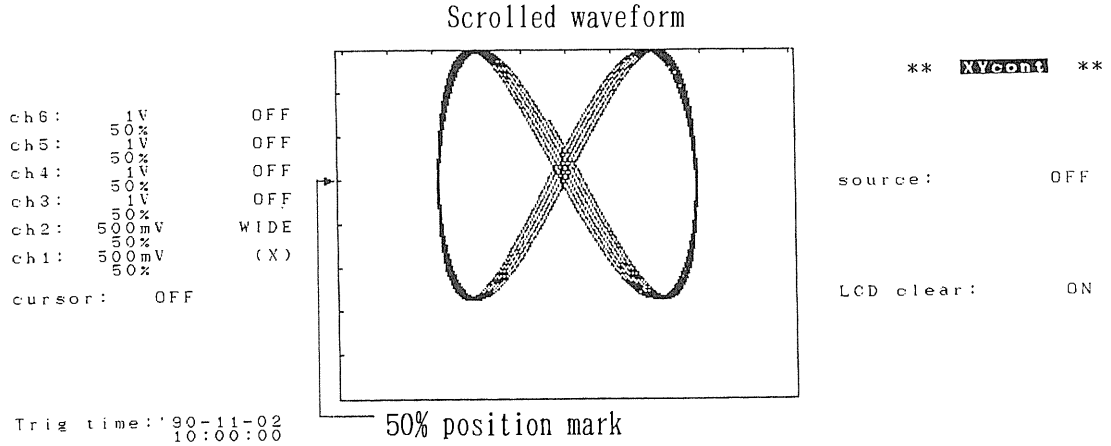
- Full-amplitude Display:
  The whole amplitude of the waveform is displayed at once on the LCD. Resolution is reduced by half.



- Full-resolution Display: Approx. 78% (200/256) of the waveform amplitude is displayed on the LCD, at the full A/D resolution.



- In the full-resolution mode, the waveform can be scrolled vertically on the LCD with the UP and DOWN keys.

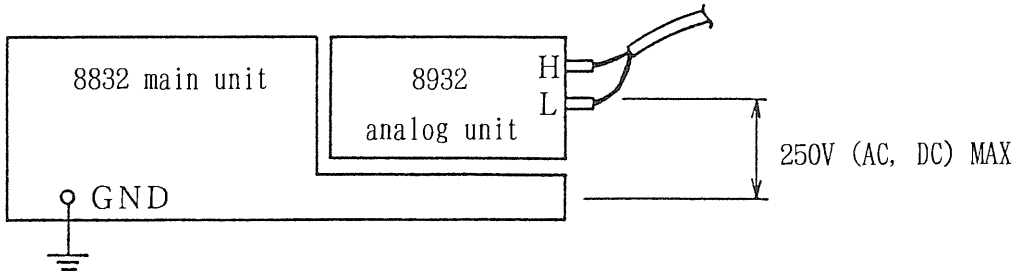


CHAPTER 5

USING THE INPUT UNIT

⚠ WARNING

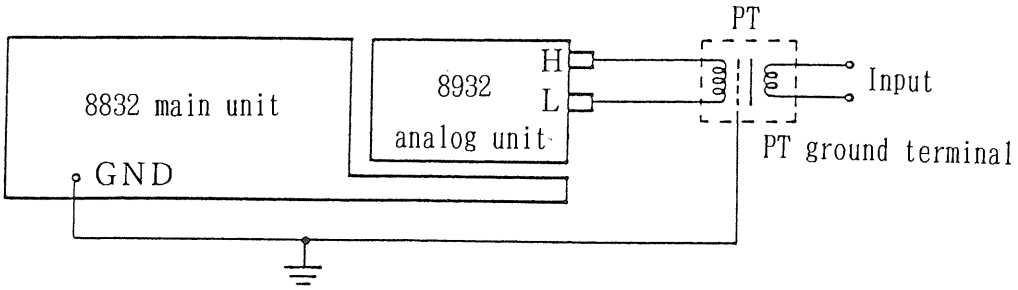
- Be sure to insert the input plug completely to avoid the danger of an electric shock.
- The 8932 input and output are mutually insulated.
- The maximum floating voltage between the input unit and the 8830 case, or between two analog units, is 250 V AC/DC. Take care to avoid voltages over this limit.
- The maximum floating voltage does not change even when an attenuator, etc. is used at the input.



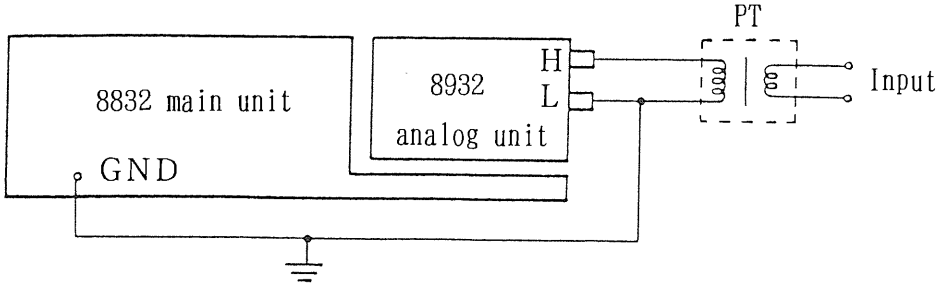
⚠ WARNING

- The maximum permissible input voltage for the 8932 is 500 V (AC+DC peak). Take care to avoid voltage levels above this limit.

- When using a PT for measurement of AC power lines, etc., be sure to ground it.

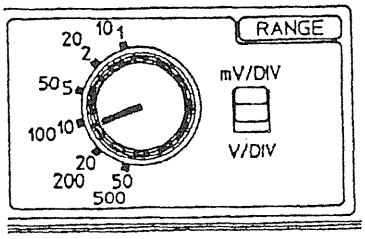


(a) PT with ground terminal



(b) PT without ground terminal

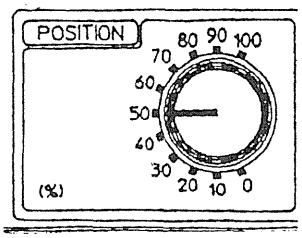
5 − 1 − 1 Measurement RANGE



Sets the voltage corresponding to one square (1 division) on the recording paper voltage axis. Since the voltage axis is ten-squares long, the maximum voltage that can be recorded is equal to ten times this setting (100 mV to 500 V).

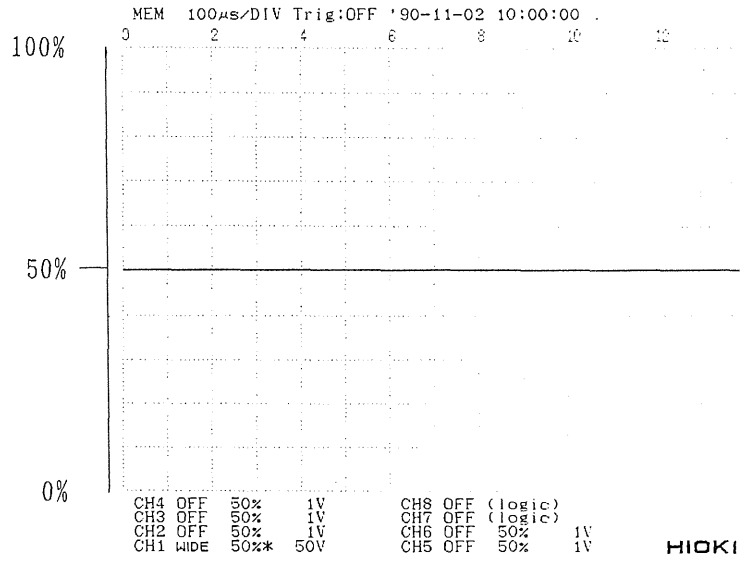
[Setting Range]
10 mV to 50 V (12 settings)

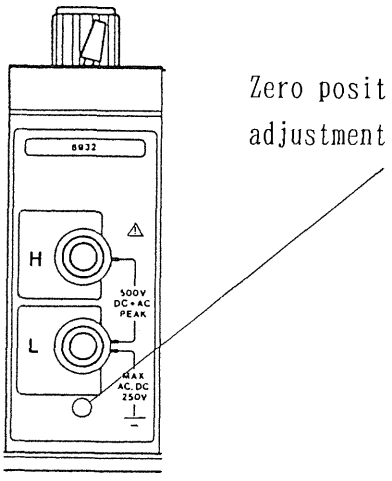
5 − 1 − 2 Zero POSITION



Selects the 0 V position on the recording paper among 11 settings on the paper dotted lines.

[Setting Range]
0% to 100% (11 settings)



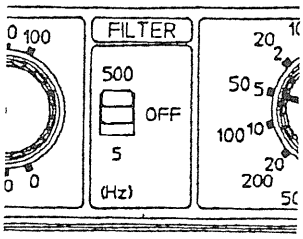


Zero position fine adjustment knob

When the zero position does not coincide with a square on the recording paper, turn the fine adjustment potentiometer with a flathead screw-driver until they align. If this adjustment does not work, contact your dealer.

Note: During waveform recording do not change the setting of the POSITION switch rapidly or set the switch to a position between the clicks. Doing so may result in display of erroneous values; however, such errors are not a sign of trouble with the instrument.

5－1－3 FILTER



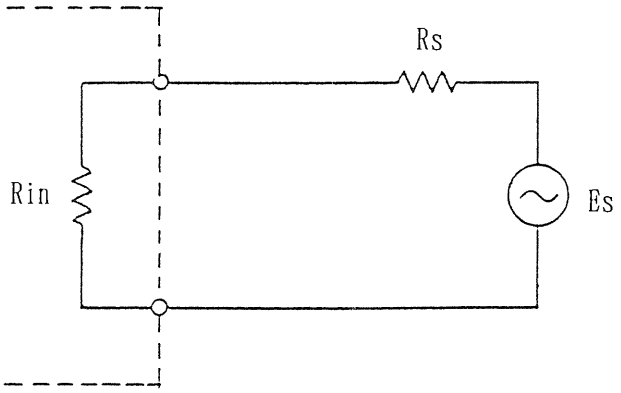
The frequency band is limited by the built-in low-pass filter .
Attenuation gradient: -6 dB/oct.
Cutoff frequency: Approx. 5 Hz/500 Hz

This filter is effective for preventing the following phenomena:

- Thickening of the recording line caused by signal ripple components and noise during level recording in the recorder mode, because of the use of high-speed sampling and a high-frequency amplifier.
- Thickening of the recording line due to ripple contained in the output from a transducer, etc.

5－1－4 Measurement Error Due to Source Impedance

- Source impedance is not a problem when sufficiently low compared to the unit's input impedance. It affects measurement, however, if it is above a certain level.



Es : Signal voltage
Rs : Source impedance
Rin : Input impedance

$$\text{Measurement error} = Es\left(1 - \frac{Rin}{Rs + Rin}\right)$$

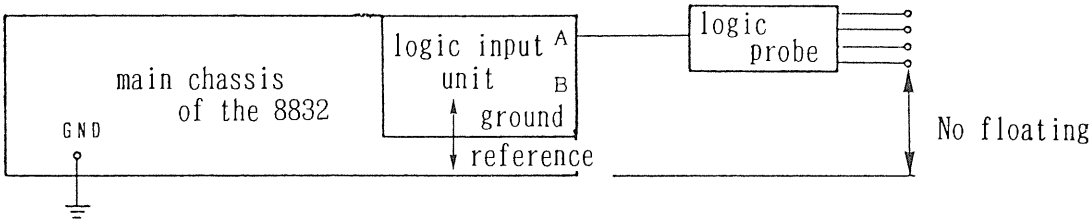
〔Example〕 Since the unit's input impedance is 1 MΩ, a source impedance of 1 kΩ will cause an error of approx. 0.1%.

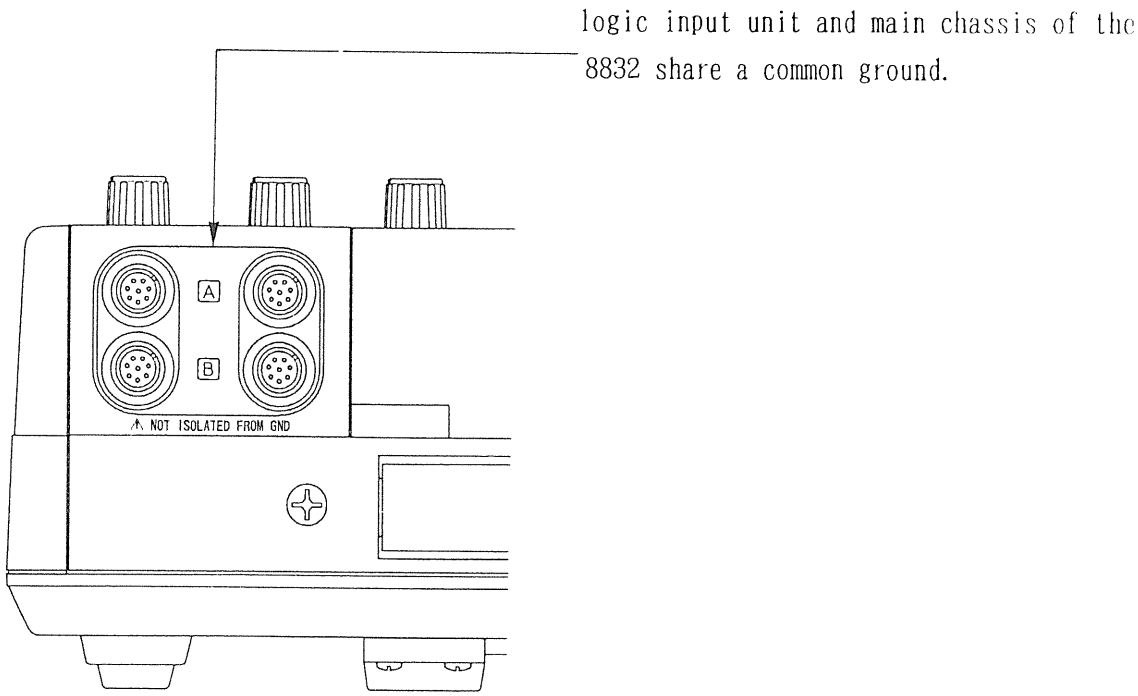
5 − 2 Logic input

The 8832 can record logic waveforms on up to 16 channels using the built-in logic input unit. See section 6-2-5, "Setting the logic trigger", for the operating procedure of the logic input unit.

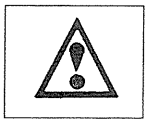
CAUTION

- Four probes can be connected to the logic input unit.
  However, the main chassis and the probes share a common ground.
- Never connect logic probes other than those designated in this manual to the logic input unit.





5 — 3 Logic Probes



5 — 3 — 1 Using the 9306 Logic Probe

This probe can be switched between voltage input and contact input, allowing for a wide range of applications from electronic circuits to relay operation timing measurement.

CAUTION

- Two 9306 probes can be connected to four logic unit, but they will have a common ground.
- Please read the 9306 instruction manual thoroughly before use.

5 — 3 — 2 Using the 9307 Line Logic Probe

Allows for detection of AC line voltage on/off switching. High voltages up to 250 V can be input, making it suitable for relay sequencer timing measurement, etc.

CAUTION

- Input channels are insulated, both mutually and from the outputs. Do not apply voltages over the maximum floating voltage.
- Please read the 9307 instruction manual thoroughly before use.
- Indicators do not light if this device is connected to early versions of the 9307 (those with serial numbers prior to 1987 191974). However, otherwise operation is normal. To check H and L levels, use the input level monitor function.

5 — 3 — 3 Using the 9308 Line Dip Detector

Detects transient drops in commercial (AC 100/120 V) line voltage. Dip level can be set to either approx. 80% or 90%.

CAUTION

- The low clip (black) is common with the input clip (black).
- An 8932 input unit is required.
- Please read the 9308 instruction manual thoroughly before use.

The input unit removal method will be explained next. For unit installation, reverse this procedure.

① Remove input cords from all input units.

② Turn the main unit power off and unplug its power cord.

CAUTION

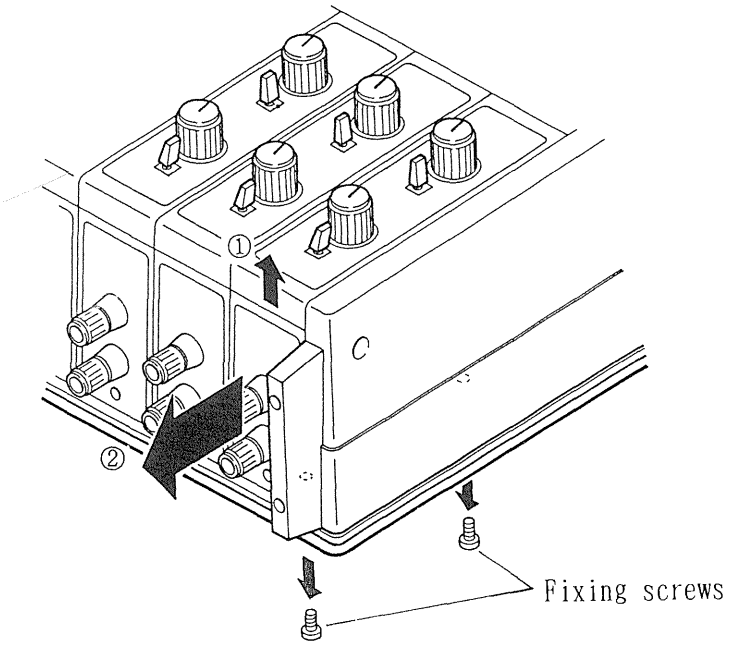
Always confirm that input cords are disconnected and turn power off before detaching the input unit.

③ Remove the two fixing screws securing the input unit with a Phillips-head screwdriver as shown in the figure.

④ Push the input unit up a little in the direction of arrow ①, then put your fingers in the gap between the input and main units and pull in the direction of arrow ② to remove.

CAUTION

When pulling the input unit off, do not force the knobs and switches on its top panel.



CAUTION

- Never use the recorder with an input unit removed.
- If the recorder has to be used with an input unit removed, install a 9508 blank panel (optional accessory) in its place.

CHAPTER 6

USING THE TRIGGER FUNCTION

6. Using the Trigger function

6－1 On the Trigger

(1) The trigger function makes waveform recording or memory storage start or stop under control of a certain signal.

(2) Four triggering modes are provided:

[CH1 to CH8] : Internal trigger (see 6-2.)
- Operation is triggered by the signal from one of the channels 1 to 8.
- Used to monitor the signal and start recording when it reaches a specified condition.

  Note: 8 logic channels correspond to 1 analog channel.

[EXT] : External trigger (see 6-3.)
- Operation is triggered when the (TRIG IN) terminal is short-circuited or an approx. 2.5-V falling signal is applied to it.

[MANU] : Manual trigger (see 6-4.)
- Operation is triggered by pressing the MANU TRIG key.
- Start operation speed is higher than when the START key is used.

[TIMER] : Timer trigger (see 6-5)
: Triggering occurs at specified intervals between the previously set start and stop times.
: Used for fixed time recording.

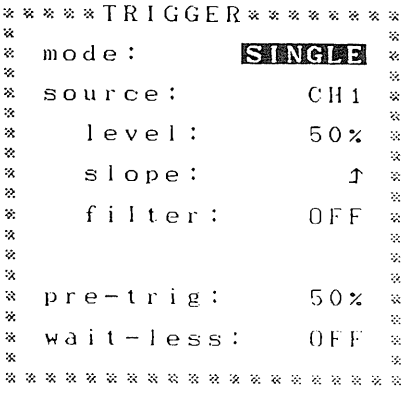
(3) Trigger mode setting (excluding XY CONT)

Except in the continuous XY recorder function, trigger mode can be selected. This determines whether repeated triggering will be acknowledged after the recording operation has been completed. If the "source" indication is set to OFF, triggering can be applied immediately after recording.

[SINGLE]: The trigger signal is valid only once after the START key is pressed.
No repeated triggering is performed.

[REPEAT]: Triggering is applied continuously for repeated measurement.

[AUTO]: Same as [REPEAT], however, recording automatically starts even if triggering does not after approximately 1 second has elapsed.



(4) Pre-trigger and trigger timing setting

The waveform can be recorded not only after triggering, but also before it.

MEM, XY_{MEM}

```
*****TRIGGER*********
*                    *
*  mode:      SINGLE  *
*                    *
*  source:      CH1   *
*                    *
*    level:     50%   *
*                    *
*    slope:       ↑   *
*                    *
*    filter:    OFF   *
*                    *
*                    *
*  pre-trig:    50%   *
*                    *
*  wait-less:   OFF   *
*                    *
**********************
```

REC, XY_{CONT}

```
*****TRIGGER*********
*                    *
*  mode:      SINGLE  *
*                    *
*  source:      CH1   *
*                    *
*    level:     50%   *
*                    *
*    slope:       ↑   *
*                    *
*    filter:    OFF   *
*                    *
*                    *
*  timing:    START   *
*                    *
*                    *
**********************
```

In the [MEM] and [XY_{MEM}] modes

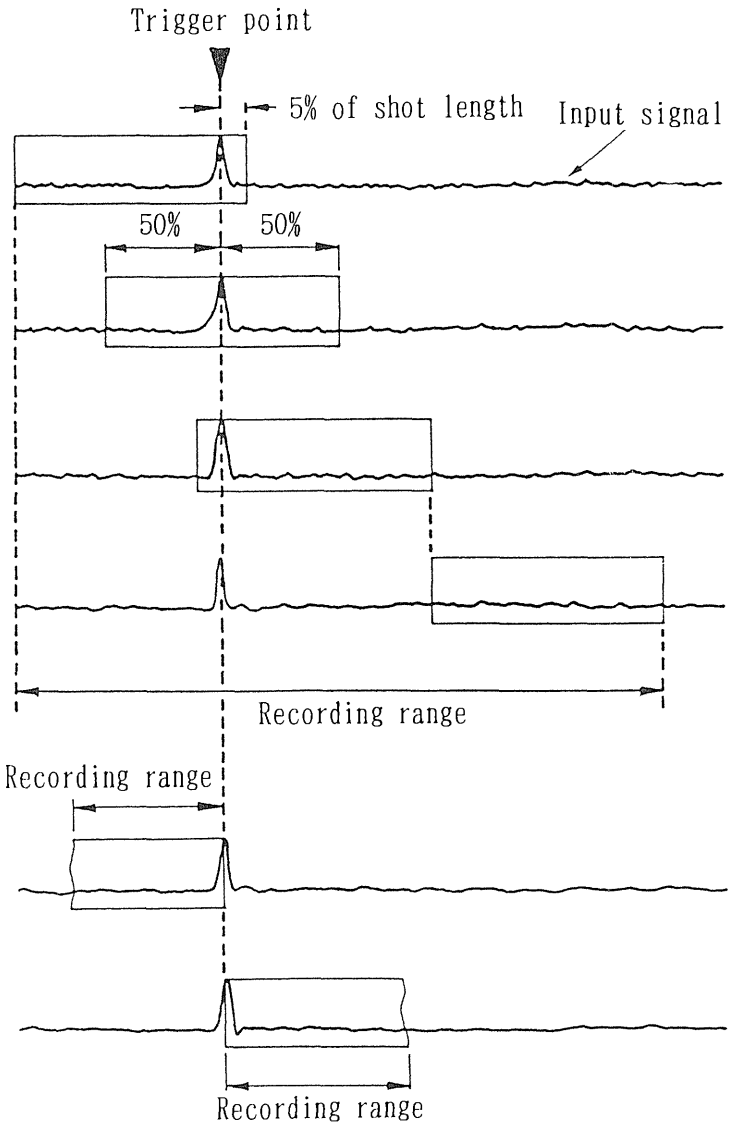
: All pre-trigger settings (0, 5, 25, 50, 75, 95, 100 and -95%) except OFF can be usd.

[95%] : 95% of the shot length covers the waveform before the trigger point.

[50%] : Equal portions before and after the trigger point are recorded.

[5%] : 95% of the shot length covers the waveform after the trigger point.

[-95%] : The waveform is recorded from a point located 1 shot after the trigger point.



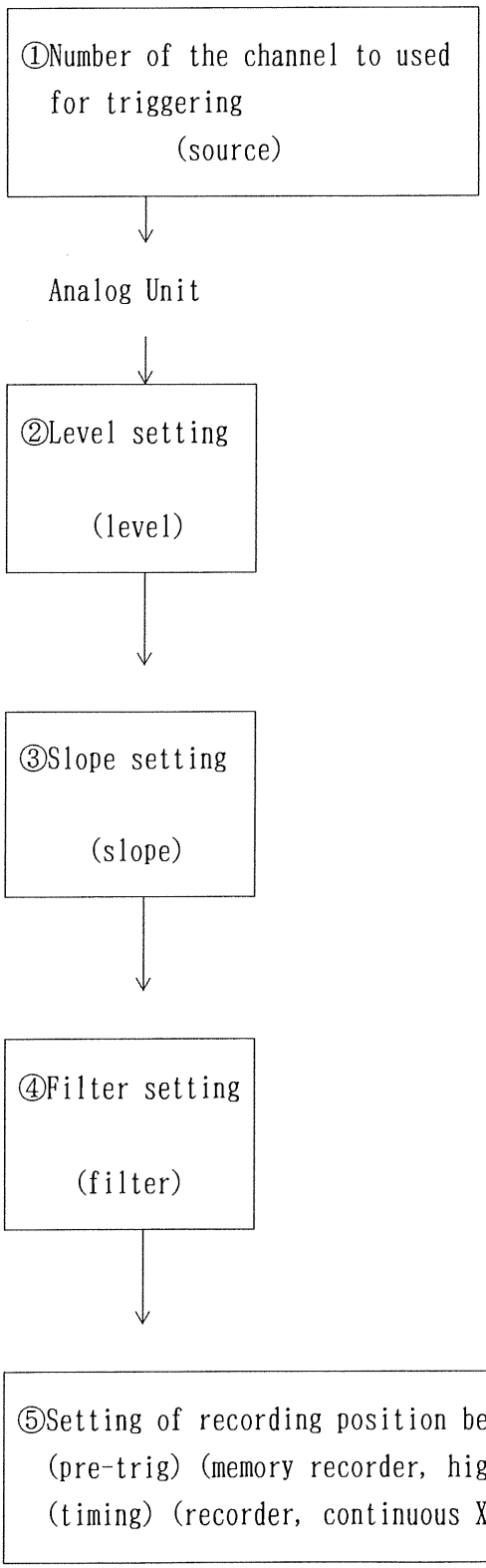
In the [REC] and [XY_{CONT}] modes

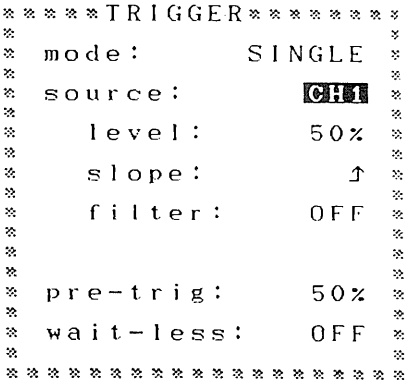
[STOP] : Triggered stop

[START] : Triggered start

6－2 Internal Triggers for the Analog Unit (CH1 to CH6)

Operation is triggered by the signal from one of the channels 1 to 6. Set the following items for each channel's trigger.





6－2－1　Trigger Channel Numbers

Select the channel you want to use for triggering, among those with an input unit installed .

```
※※※※TRIGGER※※※※※※※※
※                      ※
※  mode:       SINGLE  ※
※                      ※
※  source:        CH1  ※
※                      ※
※    level:       50%  ※
※                      ※
※    slope:         ↑  ※
※                      ※
※    filter:      OFF  ※
※                      ※
※                      ※
※                      ※
※  pre-trig:     50%  ※
※                      ※
※  wait-less:    OFF  ※
※                      ※
※※※※※※※※※※※※※※※※※※※※
```

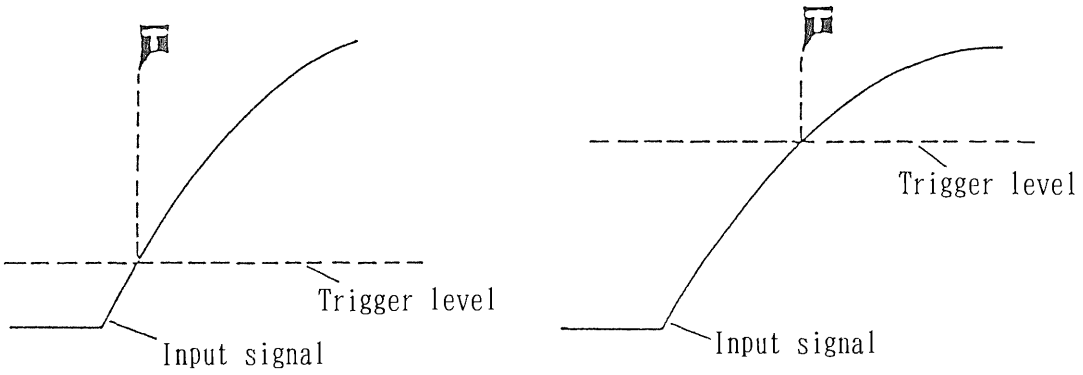
6－2－2　Setting Trigger Level

```
※※※※※TRIGGER※※※※※※※※
※                      ※
※  mode:       SINGLE  ※
※                      ※
※  source:        CH1  ※
※                      ※
※    level:       50%  ※
※                      ※
※    slope:         ↓  ※
※                      ※
※    filter:      OFF  ※
※                      ※
```

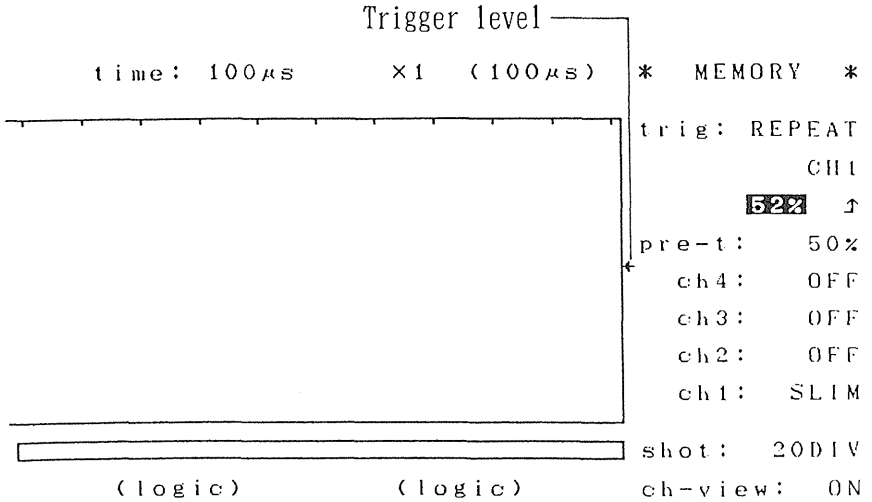
The input signal trigger level can be set between 0% and 100% in 1% steps.

Note: Triggering will not work if "level" is set to 100% and "slope" to "falling".

● Trigger level [0% to 100%]

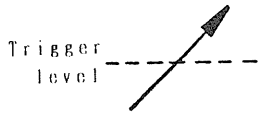


● Trigger level is indicated by an arrow on the right side of the recorder and memory recorder function WAVE display.

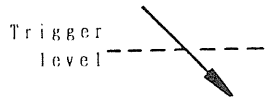


6－2－3 Setting Trigger Slope (only for internal trigger)

```
※※※※TRIGGER※※※※※※※※
※                      ※
※  mode:       SINGLE  ※
※                      ※
※  source:        CH1  ※ 〔↑〕
※                      ※
※    level:       50%  ※
※                      ※
※    slope:           ※
※                      ※
※    filter:      OFF  ※
※                      ※
※                      ※
※                      ※
※  pre-trig:      50%  ※ 〔↓〕
※                      ※
※  wait-less:     OFF  ※
※                      ※
※※※※※※※※※※※※※※※※※※※※
```



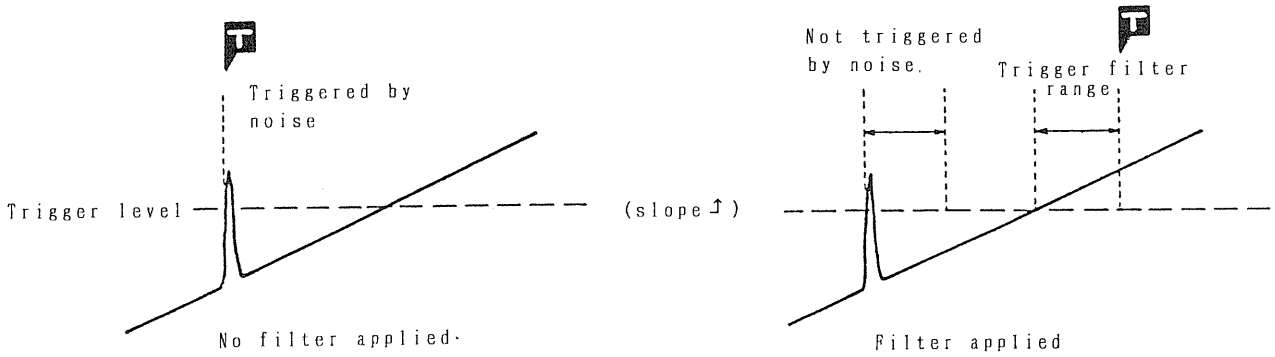
Recording is triggered when the signal crosses the trigger level upwards.



Recording is triggered when the signal crosses the trigger level downwards.

6－2－4 Setting Trigger Filter

The filter prevents accidental triggering caused by noise in the input signal.



Triggering is performed when trigger conditions are met within a specified filter range.

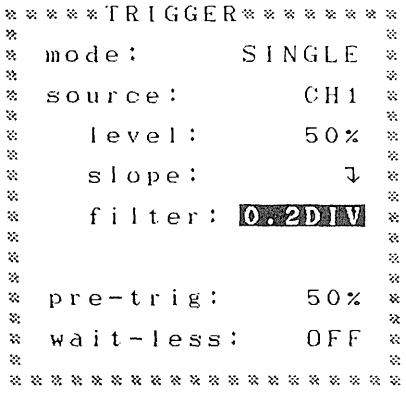
(1) In the recorder and continuous XY recorder modes

The filter can only be set to ON or OFF. When set to ON, filter range is set to 128 samples. In these modes, sampling frequency depends on printing style (OFF, SLIM/WIDE). Unlike in the memory recorder and high-speed XY recorder modes, setting in division (square) units is not possible.

```
※※※※TRIGGER※※※※※※※※※※※※※※※※
※                                  ※
※   mode:                SINGLE    ※
※                                  ※
※   source:                 CH1    ※
※                                  ※
※      level:               50%    ※
※                                  ※
※      slope:                ↑     ※
※                                  ※
※      filter:              ON     ※
※                                  ※
※                                  ※
※                                  ※
※   timing:              START     ※
※                                  ※
※                                  ※
※                                  ※
※※※※※※※※※※※※※※※※※※※※※※※※※※※※
```

(2) In the memory recorder and high-speed XY recorder modes

Trigger filter range is expressed in divisions (squares). It can be set to OFF, 0.1, 0.2, 0.3, 0.6, 1.3 or 2.6 DIV.



6－3 Internal triggers for the logic input unit (CH7, CH8)

Triggering is performed by the signal from either CH7 or CH8. Set the following items for triggering each channel.

Note: 8 logic channels correspond to 1 analog channel.

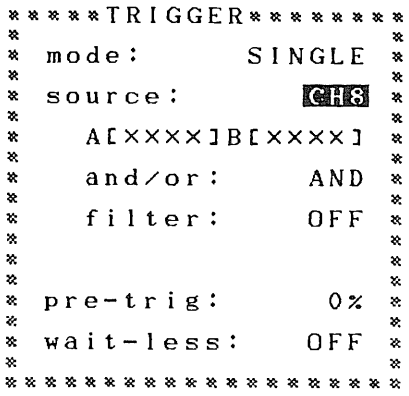
① Select channel number for triggering (source)

② Set trigger pattern (A [××××] B [××××])

③ Set trigger logic (and/or)

④ Set filter (filter)

⑤ Set recording position for pre- and post triggering
(pre-trig) (memory recorder, high-speed X-Y recorder)
(timing) (recorder, continuous X-Y recorder)



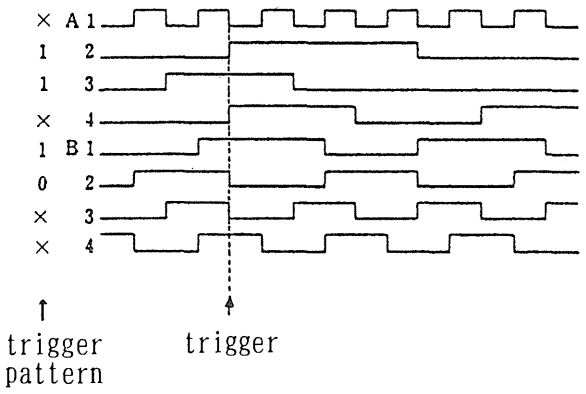
6 — 3 — 1 Trigger Channel Numbers

Select the number of the logic input unit you wish to trigger. (CH7, CH8)

```
※※※※※TRIGGER※※※※※※※※
※                       ※
※  mode:        SINGLE  ※
※                       ※
※  source:          CH8 ※
※                       ※
※    A[××××]B[××××]     ※
※                       ※
※    and/or:       AND  ※
※                       ※
※    filter:       OFF  ※
※                       ※
※                       ※
※                       ※
※  pre-trig:         0% ※
※                       ※
※  wait-less:     OFF   ※
※                       ※
※※※※※※※※※※※※※※※※※※※※
```

6 — 3 — 2 Setting Trigger Pattern

Set the logic pattern at the time of triggering.
"1" indicates HI, "0" indicates LO, and "X" means "don't care".




```
※※※※※TRIGGER※※※※※※※※
※                       ※
※  mode:        SINGLE  ※
※                       ※
※  source:          CH8 ※
※                       ※
※    A[×11×]B[10××]     ※
※                       ※
※    and/or:       AND  ※
※                       ※
※    filter:       OFF  ※
※                       ※
※                       ※
※                       ※
※  pre-trig:         0% ※
※                       ※
※  wait-less:     OFF   ※
※                       ※
※※※※※※※※※※※※※※※※※※※※
```

A [×11×] B [×10××]

Detection of a "1" or "0" signal is performed by the logic probe.
The threshold value for the HI and LO levels is given in the specifications of the logic probes.

Note: ● Set all channels of unused probes to "X", since even disconnected probes are detected.
● If a valid triggering condition exists for the input signal from the start, release the trigger condition once to start triggering.

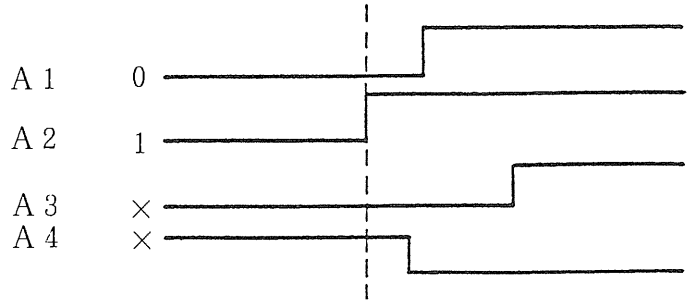
6 − 3 − 3 Setting Trigger Logic

Logical product (AND) and logical sum (OR) with the trigger pattern can be selected.

Example) When channel 1 of probe A is "0",
channel 2 of probe A is "1",
and other channels are "X".

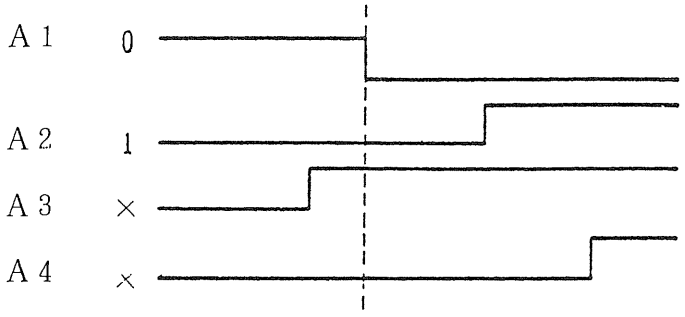
```
*****TRIGGER********
*                  *
*  mode:     SINGLE *
*                  *
*  source:     CH8  *
*                  *
*    A[01××]B[××××] *
*                  *
*    and/or:   AND  *
*                  *
*    filter:   OFF  *
*                  *
*                  *
*                  *
*  pre-trig:    0%  *
*                  *
*  wait-less:  OFF  *
*                  *
********************
```

When AND is selected, trigger pattern T (trigger point)



triggers when in conformity all trigger pattern conditions are satisfied

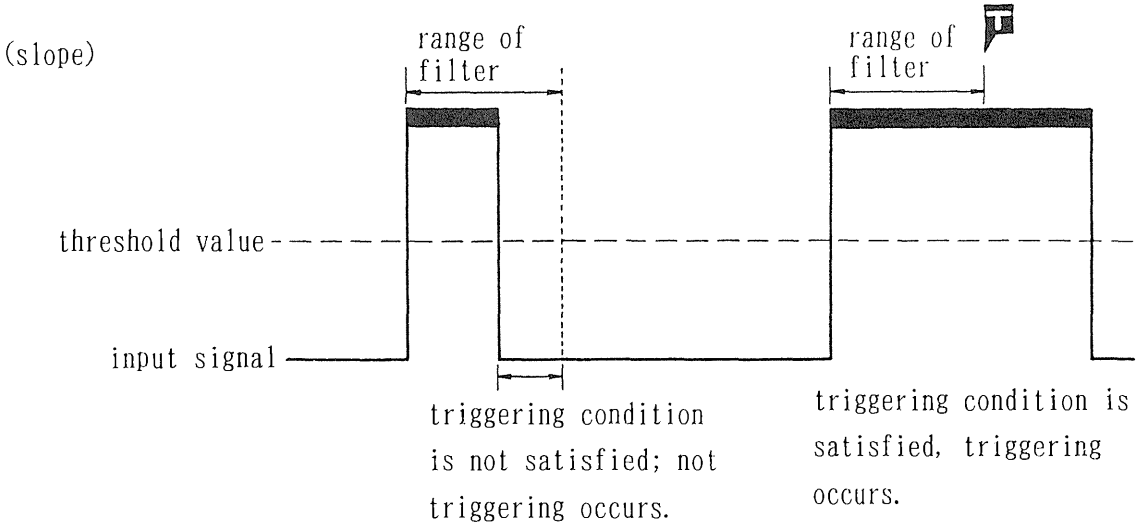
When OR is selected, trigger pattern T



triggers when at least one trigger pattern condition is satisfied.

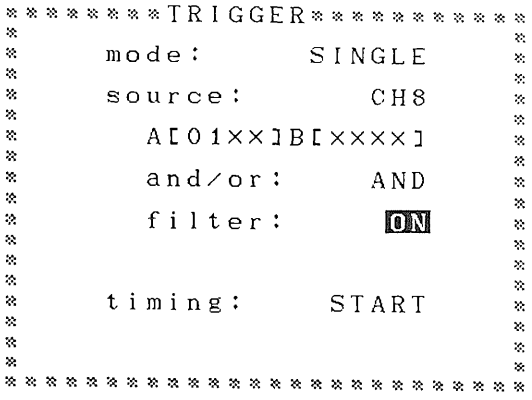
6－3－4 Setting Trigger Filter

Triggering occurs when the filter width and triggering conditions are satisfied.



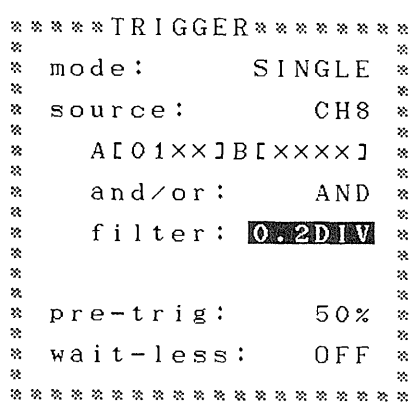
(1) In the recorder and continuous X-Y recorder modes:

Trigger filter can be set to [ON] and [OFF]. When set to ON, the filter ranges are all set to 128 samples. In these modes, the sampling frequency varies according to the number of channels used. Unlike the memory recorder and the high-speed X-Y recorder modes, setting in DIV units is not possible.



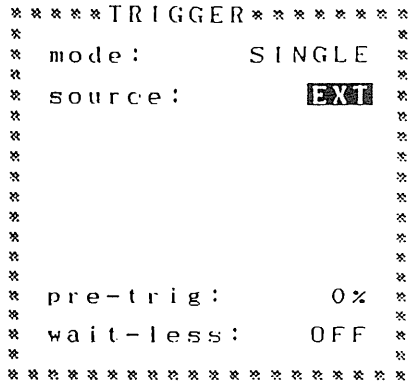
(2) In the memory recorder and high-speed X-Y recorder modes:

The range of the trigger filter is indicated by DIV. It can be set to OFF, 0.1, 0.2, 0.3, 0.6, 1.3, or 2.6 DIV.

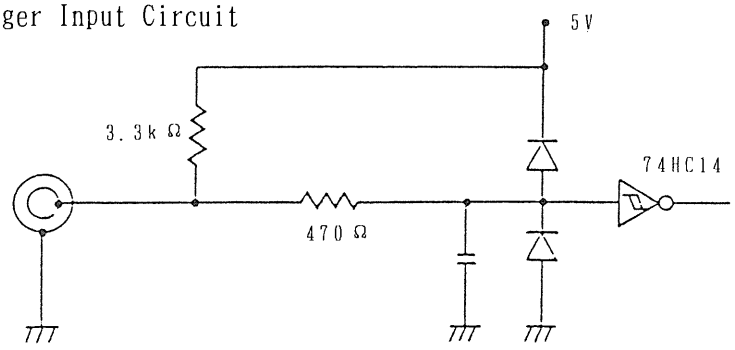


6 — 4 EXTernal Trigger

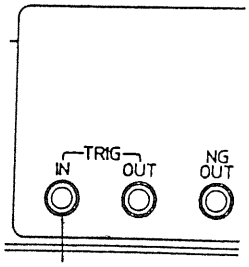
Operation is triggered when the TRIG IN terminal is short-circuited or an approx. 2.5-V falling signal is applied to it.



Trigger Input Circuit

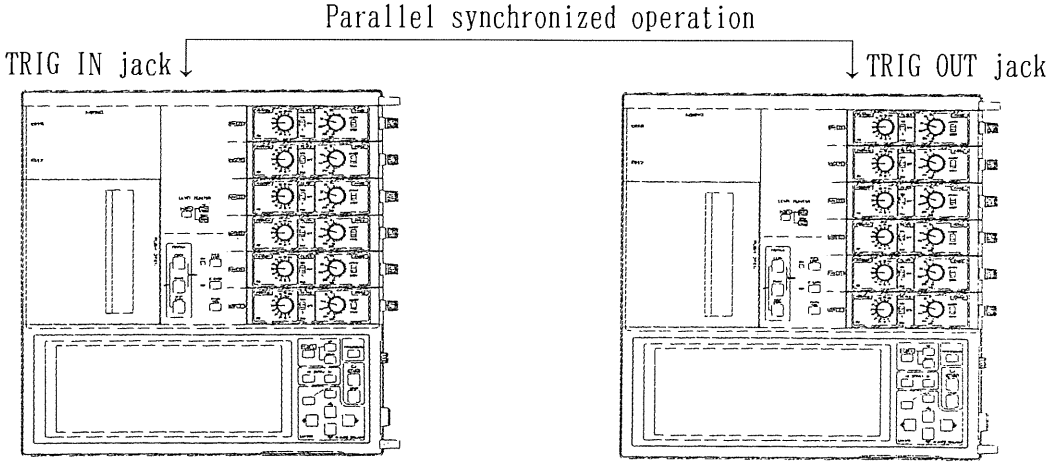


Input voltage: -5V to +10 V



TRIG IN jack

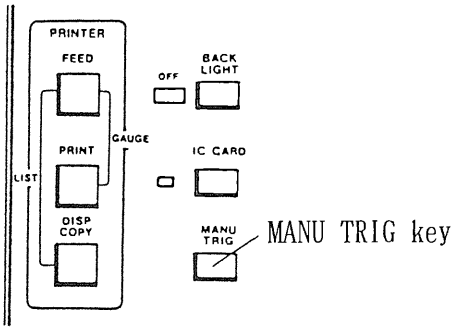
Parallel synchronized operation is possible using two or more 8830 units.



External trigger used

6 — 5 MANUal Trigger

Operation is triggered by pressing the MANU TRIG key.



Start operation speed is higher than when the START key is used.

Example: Start timing comparison using the recorder function

Using the START key ····· Approx. 90 ms

Using the MANU TRIG key ····· 0 s (min.) to sampling interval (max.)

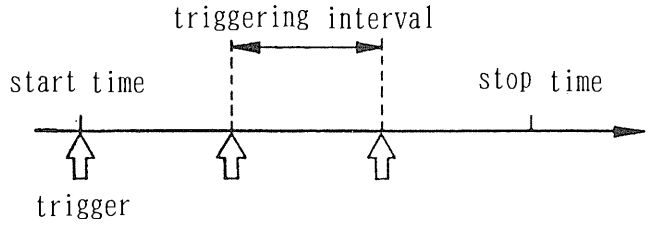
6 — 6 Timer Trigger

Triggering occurs at specified intervals between the previously set start and stop times.

Note: ● The start and stop times can be set to the time at which the START key is pressed.

● When the trigger mode is set to "SINGLE", recording is performed only once after the start time, regardless of the interval setting.

```
*****TRIGGER********
*                  *
* mode:      SINGLE *
* source:     TIMER *
*  start:          *
*   01-01 00:00    *
*  stop: (next)    *
*   01-01 00:00    *
*  interval:       *
*        00:00:00  *
*                  *
* pre-trig:     0%  *
* wait-less:   OFF  *
********************
```



(1) Setting the start time

```
*****TRIGGER********
*                  *
* mode:      SINGLE *
* source:     TIMER *
*  start:          *
*   11-02 10:00    *
*  stop: (next)    *
*   01-01 00:00    *
*  interval:       *
*        00:00:00  *
*                  *
* pre-trig:     0%  *
* wait-less:   OFF  *
********************
```

The month, day, hour, and minute of the desired starting time can be set. The present time can be set by pressing both SCROLL keys simultaneously.

(2) Setting the stope time

```
*****TRIGGER********
*                  *
* mode:      SINGLE *
* source:     TIMER *
*  start:          *
*   11-02 10:00    *
*  stop:           *
*   11-02 10:10    *
*  interval:       *
*        00:00:00  *
*                  *
* pre-trig:     0%  *
* wait-less:   OFF  *
********************
```

The month, day, hour, and minute of the desired stop time can be set. The present time can be set by pressing both SCROLL. keys simultaneously.

(3) Setting time intervals(intervals)

```
*****TRIGGER********
*                  *
* mode:      SINGLE *
* source:     TIMER *
*  start:          *
*   11-02 10:00    *
*  stop:           *
*   11-02 10:10    *
*  interval:       *
*        00:02:30  *
*                  *
* pre-trig:     0%  *
* wait-less:   OFF  *
********************
```

The hour, minutes, and seconds of an interval can be set.

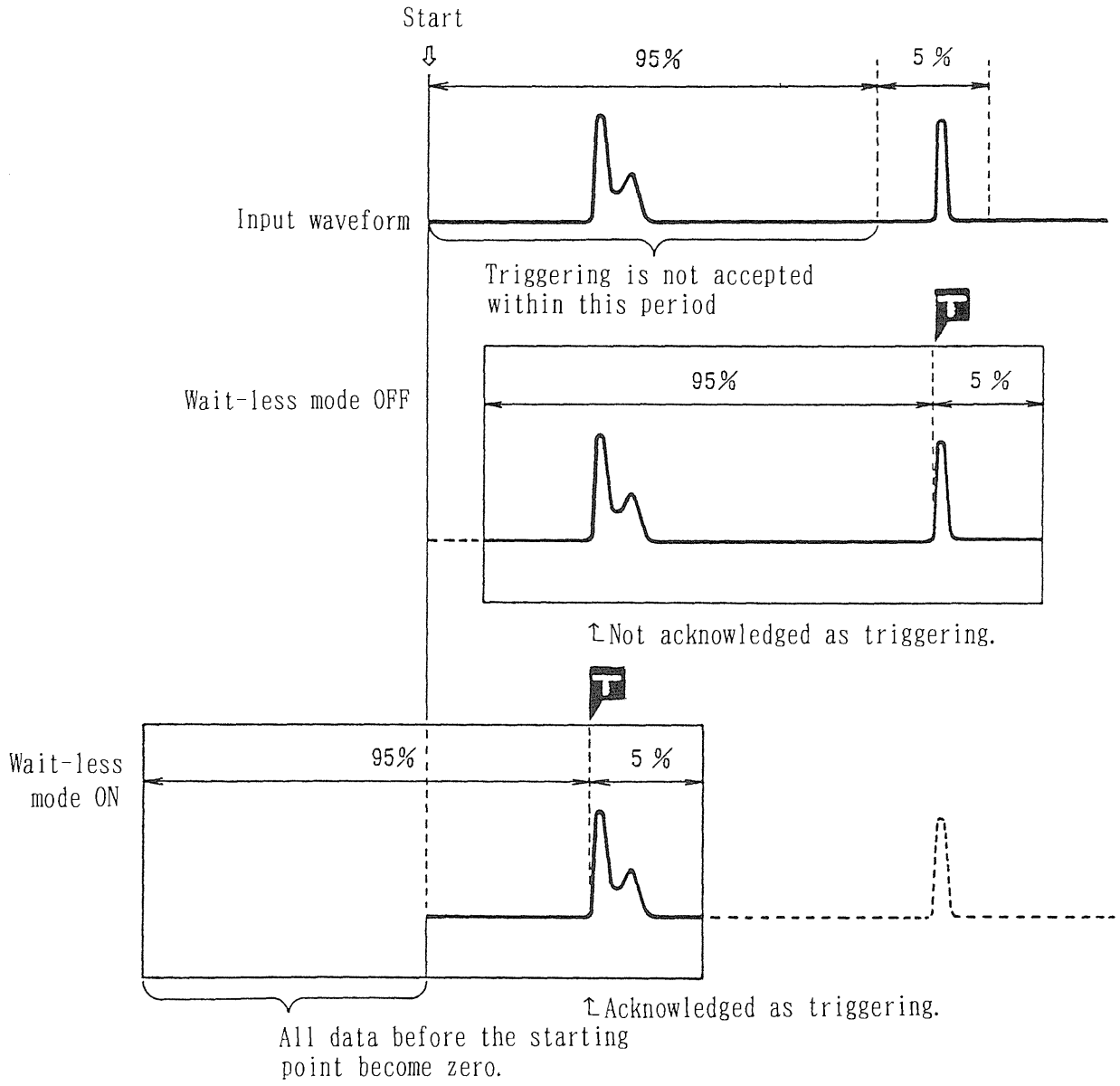
When the setting shows "00:00:00", triggering is performed only once, at the start time.

6 — 7 Wait-less Mode (only MEM and XY_{MEM} functions)

The wait-less mode can be used in two ways:

(1) When the pre-trigger (refer to 6.1. (4) Pre-trigger and trigger timing setting) is set to a value from 5% to 100%, triggering is not acknowledged for a certain time after the START key is pressed. If the wait-less mode is set, triggering is accepted even within that period.

〔At 95% pre-trigger〕

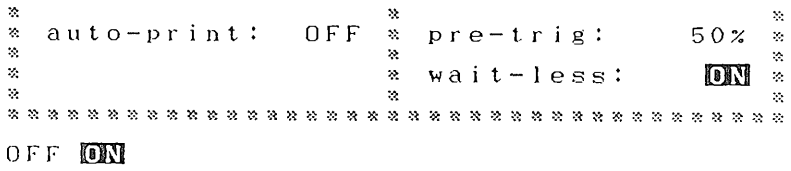


(2) When the trigger "mode" indication has been set to REPEAT or AUTO (refer to 6.1. (3) Trigger mode setting), new waveforms are accepted even during printing. Periods on which a new waveform cannot be accepted during printing can be eliminated by dividing the memory in two sections and using them alternately.
This function works along with that described in (1) above when all the following conditions are met:

- Trigger mode is set to REPEAT or AUTO.
- The MEM or XY_{MEM} function is used.
- TIME/DIV is within 1 ms to 5 s/DIV.
- Shot length is below 300 divisions.

● Wait-less mode setting

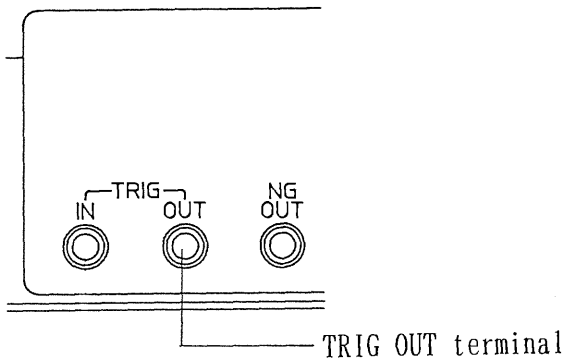
The wait-less mode is set at the MENU display in the memory recorder or high-speed XY recorder mode. It works when the "wait-less" indication is ON.



Note: The waveform judgement function cannot be used when the wait-less mode is on.

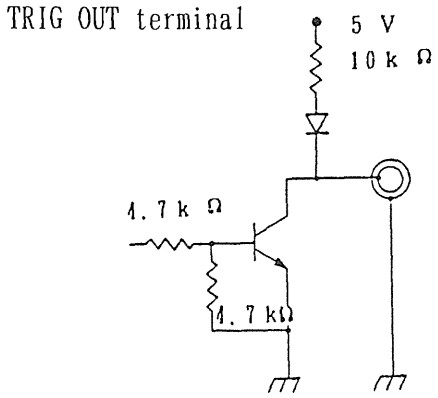
6 − 8 The Trigger Output Terminal

This terminal delivers the trigger output signal.



Open collector (with voltage output)
3.5-mm-dia. minijack

Pulse width approx. 1.5 ms



Load voltage	−20 to +30 V
Max. load current	300 mA_{MAX}
Max. load power	200 mW_{MAX}

Note: The trigger output signal is delivered when automatic time axis setting is performed. Take this into consideration when performing automatic time axis setting while using the trigger output terminal.

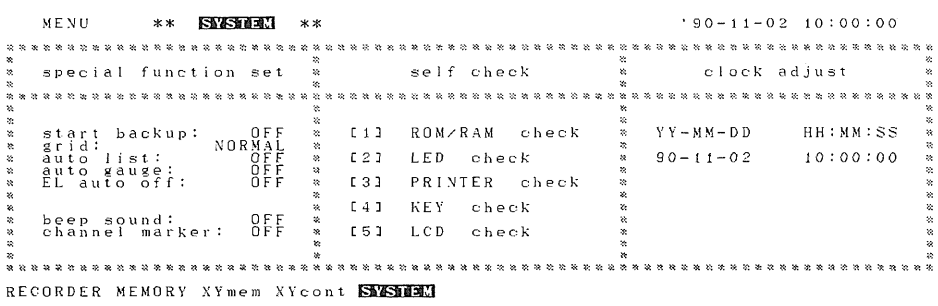
CHAPTER 7

THE SYSTEM MENU

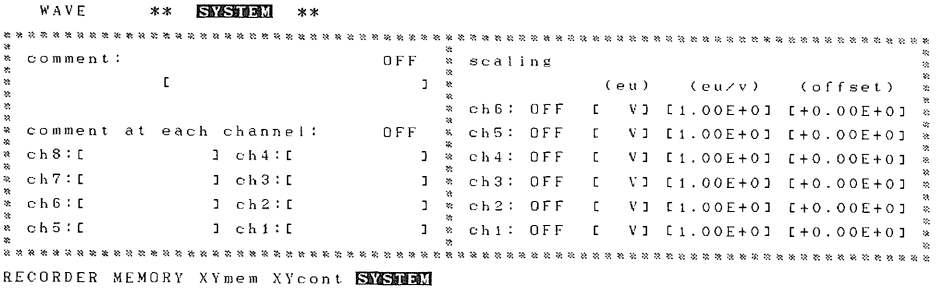
7. The system menu

Two systems, the MENU display and the WAVE display, are available with this unit, and can be selected by pressing MENU/WAVE.

System Menu



System WAVE



This menu is used for setting items not directly related to measurement and for checking the unit. It can be broadly divided in five sections:

System Menu

〔1〕 Special function set

① start backup
② grid (grid printing)
③ auto list (list printing)
④ auto gauge (gauge printing)
⑤ EL auto off (EL backlight auto-off function)
⑥ beep sound
⑦ channel marker

〔2〕 self check

① ROM/RAM check
② LED check
③ PRINTER check
④ KEY check
⑤ LCD check

〔3〕 clock adjust

System WAVE

〔4〕 comment(user's)

① comment
② comment at each channal

〔5〕 scaling

7 — 1 Special Functions Setting

〔1〕 START Backup (start backup)

If power supply is interrupted during recording (with the LED above the START key lit), recording is restarted immediately after power is restored.

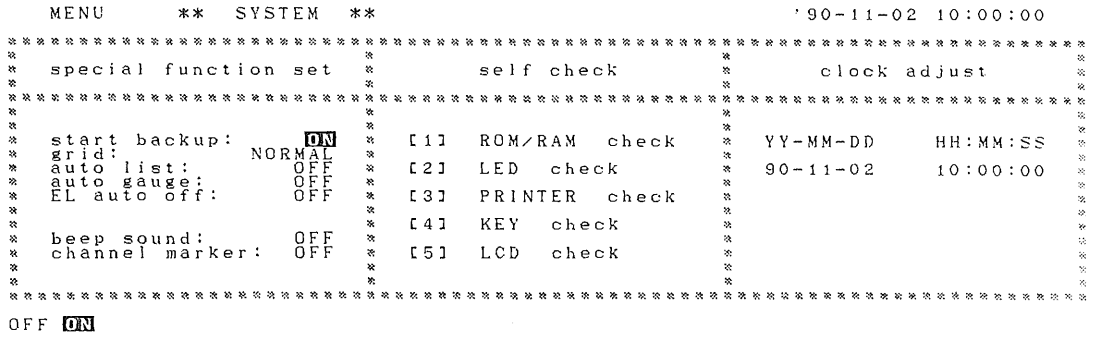
When the trigger function is used, the trigger is primed in this state.

Setting Procedure

① Call the SYSTEM menu.

② Using the CURSOR keys, move the cursor to the "start backup" indication.

③ Using the ⊞ and ⊟ keys, set the "start backup" indication to ON.



This completes the procedure.

Recording is interrupted when power is turned off. When power is turned on again, recording is restarted.

〔2〕 Grid Selection (grid)

Selects the type of grid to be printed on the recording paper (the grid is not displayed on the LCD). The three available settings are: OFF, NORMAL and FINE.

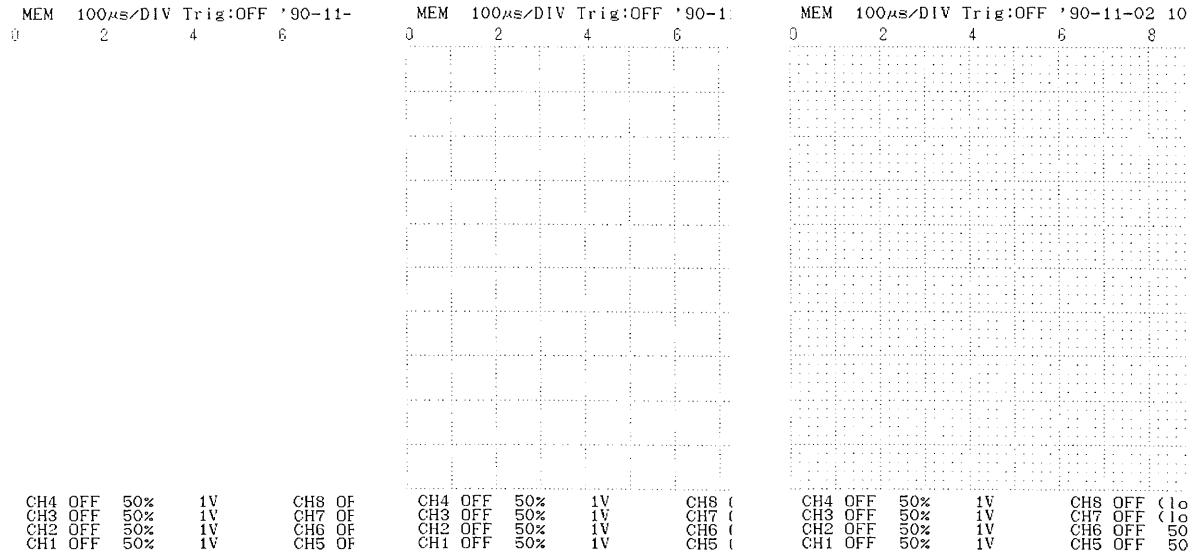
Setting Procedure

① Call the SYSTEM menu.

② Using the CURSOR keys, move the cursor to the "grid" indication.

③ Using the ⊞ and ⊟ keys, set the "grid" indication to the desired setting.

Grid Types



〔3〕 List Printing (auto list)

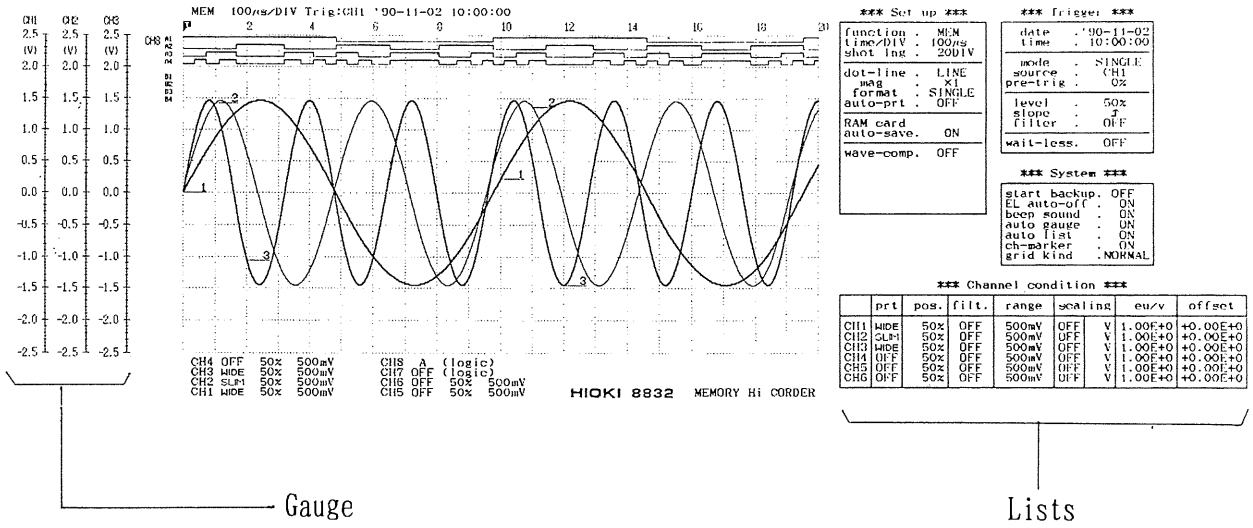
Lists containing various data are printed after the waveform.

〔4〕 Gauge Printing (auto gauge)

The gauge is printed before the waveform.

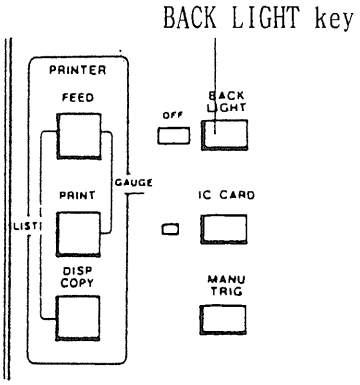
Note: The gauge is only printed for channels with the "print" indication set to ON.

A printout like the one shown below is obtained when both the "auto list" and "auto gauge" indications are set to ON.



〔5〕 EL backlight Auto-off Function (EL auto off)

The LCD backlight can be turned out with the BACK LIGHT key. Also, if the "EL auto off" indication is set to ON, the backlight goes out when no keys are pressed for about 10 minutes. After this, pressing any key will turn the backlight on again.



⚠ CAUTION

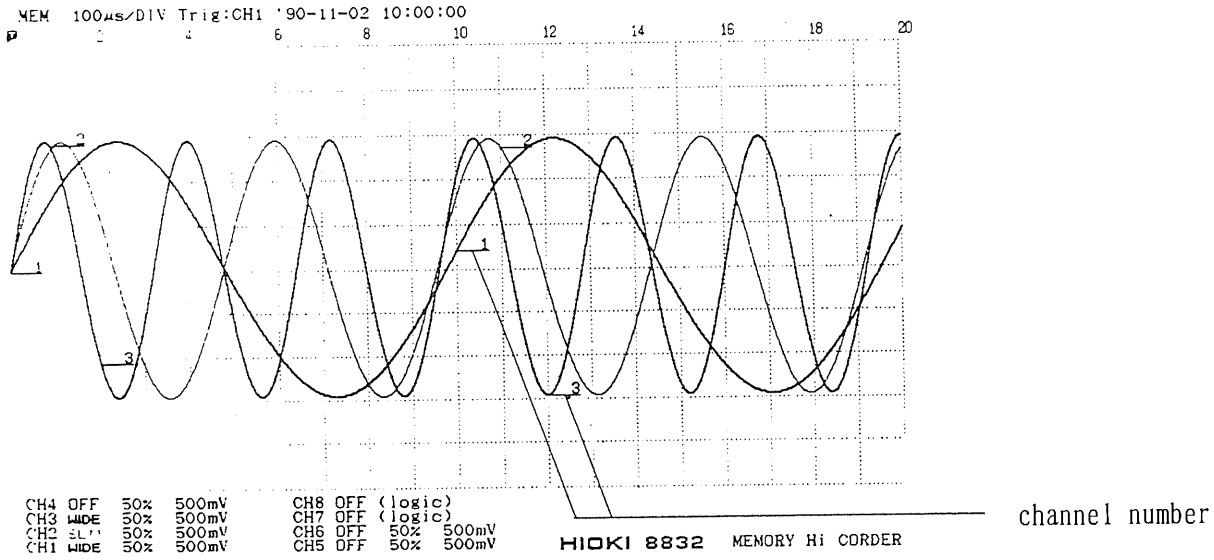
To extend the life of the EL backlight, turn it off when not using the LCD.

〔6〕 ON/OFF for beep sound (beep sound)

This turns the beep sound ON/OFF. If set to "ON", a beep sounds when an error occurs during an alarm condition and during improper detection of a waveform.

〔7〕 Setting the channel number marker (channel marker)

When turned "ON", channel numbers are printed on the waveform charts together with waveforms, as shown below:



Notes: • Logic channel numbers are not printed.

• In high-speed X-Y recorder and continuous X-Y recorder function the channel numbers' are not printed.

7 — 2 Self-check

(1) ROM/RAM Check

Checks the internal ROM and RAMs. Place the cursor as shown below, then press the START key.

```
MENU      **  SYSTEM  **                                   '90-11-02 10:00:00
*****************************************************************************
*                         *                        *                        *
*  special function set   *       self check       *      clock adjust      *
*                         *                        *                        *
*****************************************************************************
*                         *                        *                        *
*  start backup:      ON  *  [1]  ROM/RAM check    *  YY-MM-DD   HH:MM:SS   *
*  grid:          NORMAL  *                        *                        *
*  auto list:        OFF  *  [2]  LED check        *  90-11-02   10:00:00   *
*  auto gauge:       OFF  *                        *                        *
*  EL auto off:      OFF  *  [3]  PRINTER check    *                        *
*                         *                        *                        *
*                         *  [4]  KEY check        *                        *
*  beep sound:       OFF  *                        *                        *
*  channel marker:   OFF  *  [5]  LCD check        *                        *
*                         *                        *                        *
*****************************************************************************
                                              Push 'START' key to check execute
```

"OK" indicates that the element is in proper operating conditions.

```
*** ROM/RAM check ***  V1.00

                               FEDCBA9876543210
  * Storage bus                  0000000000000    OK.
  * Bank                                  0000    OK.        OK.
  * Work bus                   000000000000000    OK.

  * ROM                  OK.
  * V-RAM1               OK.
  * V-RAM2               OK.
  * Storage RAM          OK.
  * Work RAM             OK.
                                                      Push 'STOP' key to exit
```

Press the STOP key to exit this mode.

(2) LED check

Checks whether all LEDs light up properly. Place the cursor as shown below, then press the START key.

```
MENU      **  SYSTEM  **                                   '90-11-02 10:00:00
*****************************************************************************
*                         *                        *                        *
*  special function set   *       self check       *      clock adjust      *
*                         *                        *                        *
*****************************************************************************
*                         *                        *                        *
*  start backup:      ON  *  [1]  ROM/RAM check    *  YY-MM-DD   HH:MM:SS   *
*  grid:          NORMAL  *                        *                        *
*  auto list:        OFF  *  [2]  LED check        *  90-11-02   10:00:00   *
*  auto gauge:       OFF  *                        *                        *
*  EL auto off:      OFF  *  [3]  PRINTER check    *                        *
*                         *                        *                        *
*                         *  [4]  KEY check        *                        *
*  beep sound:       OFF  *                        *                        *
*  channel marker:   OFF  *  [5]  LCD check        *                        *
*                         *                        *                        *
*****************************************************************************
                                              Push 'START' key to check execute
```

Confirm that all LEDs start blinking.

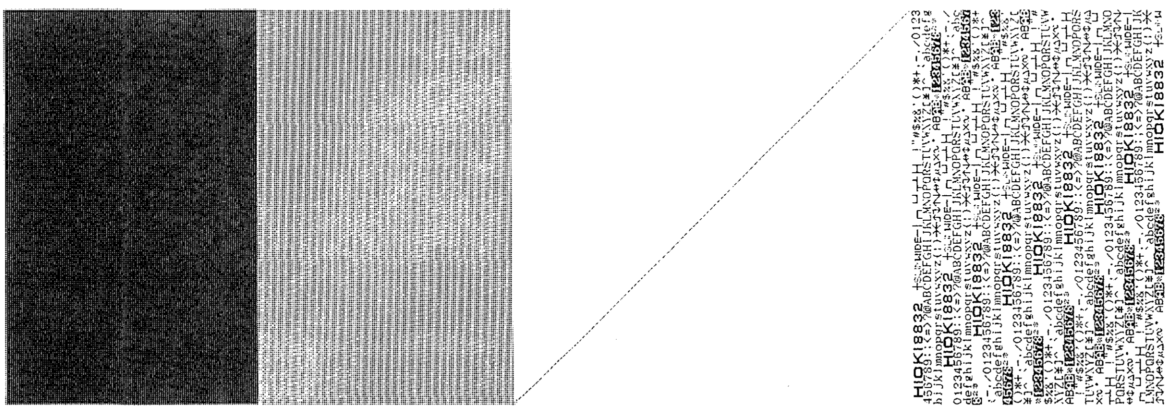
Press the STOP key to exit this mode.

(3) PRINTER check

Checks printer operation. Place the cursor as shown below, then press the START key.

```
MENU      **  SYSTEM  **                                          '90-11-02 10:00:00
**********************************************************************************
*                              *                         *                        *
*  special function set        *       self check        *      clock adjust      *
*                              *                         *                        *
**********************************************************************************
*                              *                         *                        *
*  start backup:        ON     *  [1]  ROM/RAM check     *  YY-MM-DD    HH:MM:SS  *
*  grid:             NORMAL    *                         *                        *
*  auto list:          OFF     *  [2]  LED check         *  90-11-02    10:00:00  *
*  auto gauge:         OFF     *                         *                        *
*  EL auto off:        OFF     *  [3]  PRINTER check     *                        *
*                              *                         *                        *
*  beep sound:         OFF     *  [4]  KEY check         *                        *
*  channel marker:     OFF     *  [5]  LCD check         *                        *
*                              *                         *                        *
**********************************************************************************
                                            Push 'START' key to check execute
```

The following printout will be obtained.



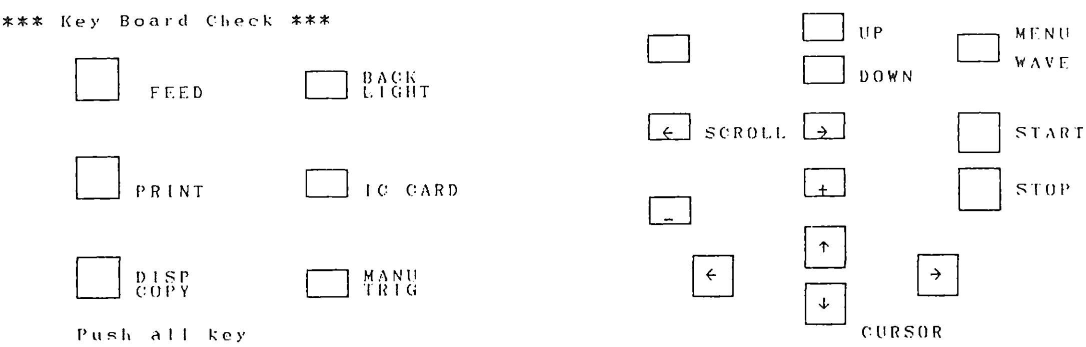
(4) key check

Checks operation keys.

Place the cursor as shown below, then press the START key

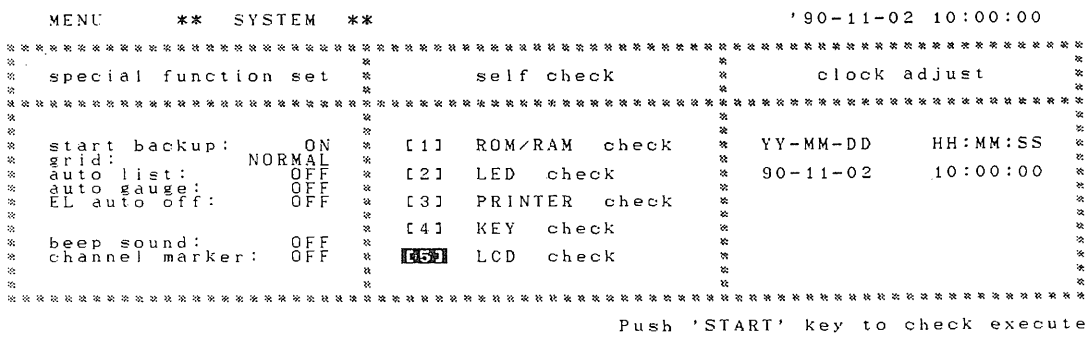
```
MENU      **  SYSTEM  **                                          '90-11-02 10:00:00
**********************************************************************************
*                              *                         *                        *
*  special function set        *       self check        *      clock adjust      *
*                              *                         *                        *
**********************************************************************************
*                              *                         *                        *
*  start backup:        ON     *  [1]  ROM/RAM check     *  YY-MM-DD    HH:MM:SS  *
*  grid:             NORMAL    *                         *                        *
*  auto list:          OFF     *  [2]  LED check         *  90-11-02    10:00:00  *
*  auto gauge:         OFF     *                         *                        *
*  EL auto off:        OFF     *  [3]  PRINTER check     *                        *
*                              *                         *                        *
*  beep sound:         OFF     *  [4]  KEY check         *                        *
*  channel marker:     OFF     *  [5]  LCD check         *                        *
*                              *                         *                        *
**********************************************************************************
                                            Push 'START' key to check execute
```

The display will look as shown below. Press each key and confirm that the corresponding indication turns black. After checking all keys, press the STOP key to exit this mode.

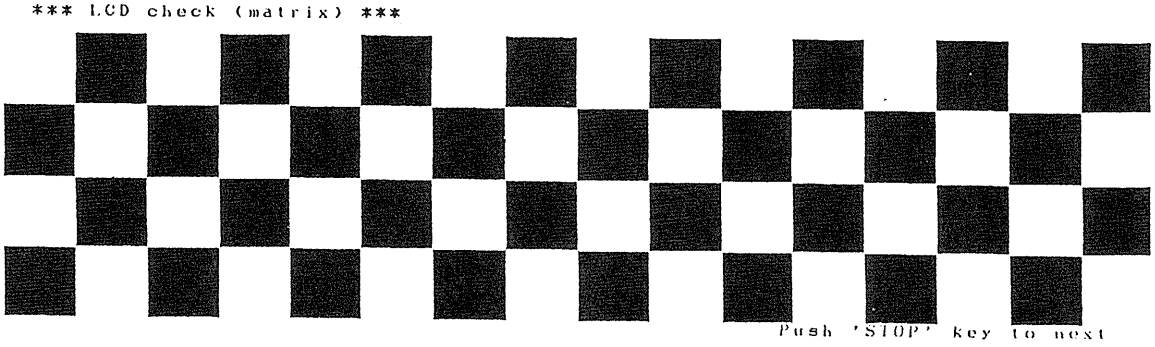


(5) LCD check

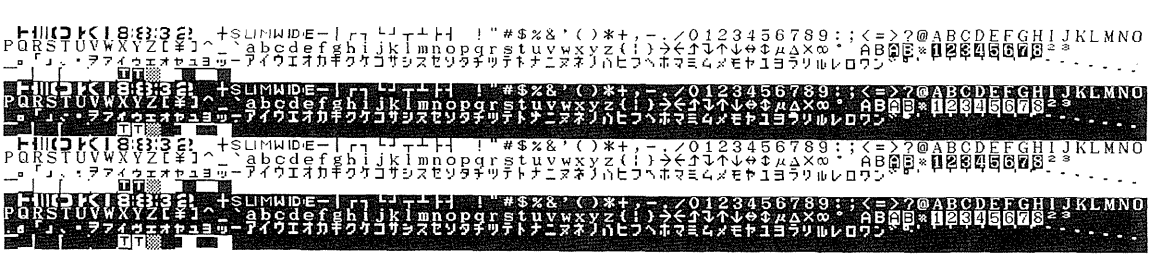
Checks the LCD. Place the cursor as shown below, then press the START key.



The display will look as shown below.

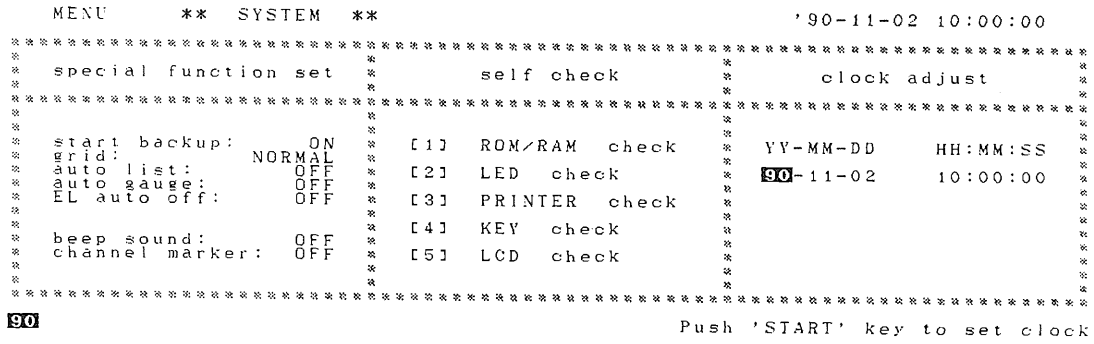


Press the STOP key, and you will obtain the following display:



Press the STOP key to exit this mode.

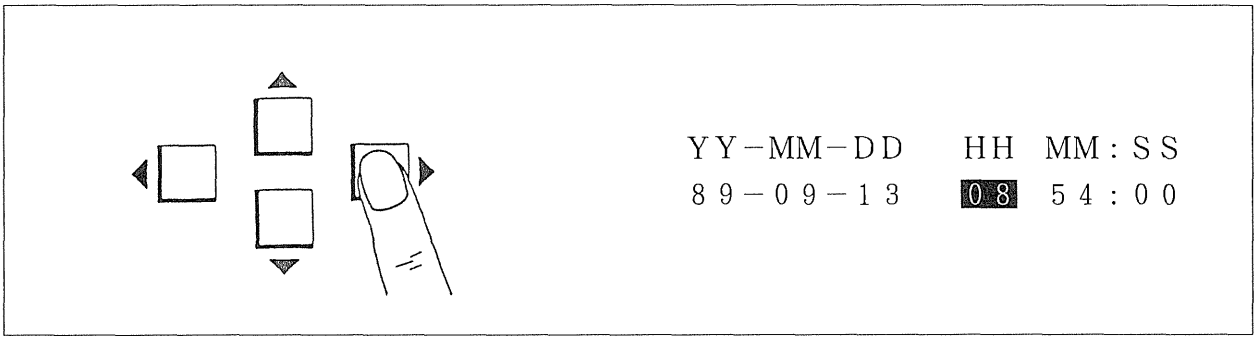
7 – 3 Time Setting (clock adjust)



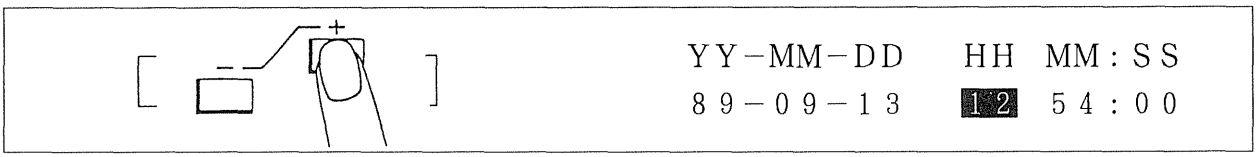
Sets the time and the date.

[YY] Year
[MM] Month
[DD] Day
[HH] Hours
[MM] Minutes
[SS] Seconds

Using the CURSOR keys, move the cursor to the item you want to adjust.



Change the indication with the ⊞ and ⊟ keys.



Press the START key. The clock will start running from the set time.

7 — 4 Entering Comments

comments are entered using the WAVE display, selected by pressing MENU/WAVE key.

〔1〕 Comment input

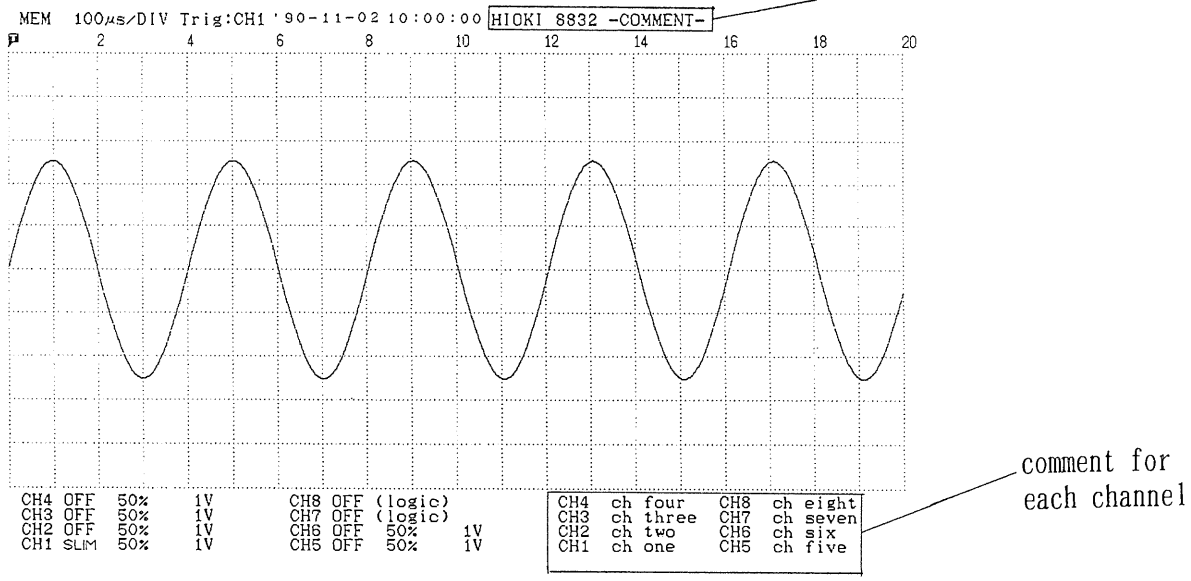
A comment up to 20 characters log can be included in the chart. Once set, the comment will be printed in the position shown below for each function.

〔2〕 Inputting a comment for each channel

Comments of up to 10 characters can be entered on the chart for each channel. When a comment is input, it appears on all charts.

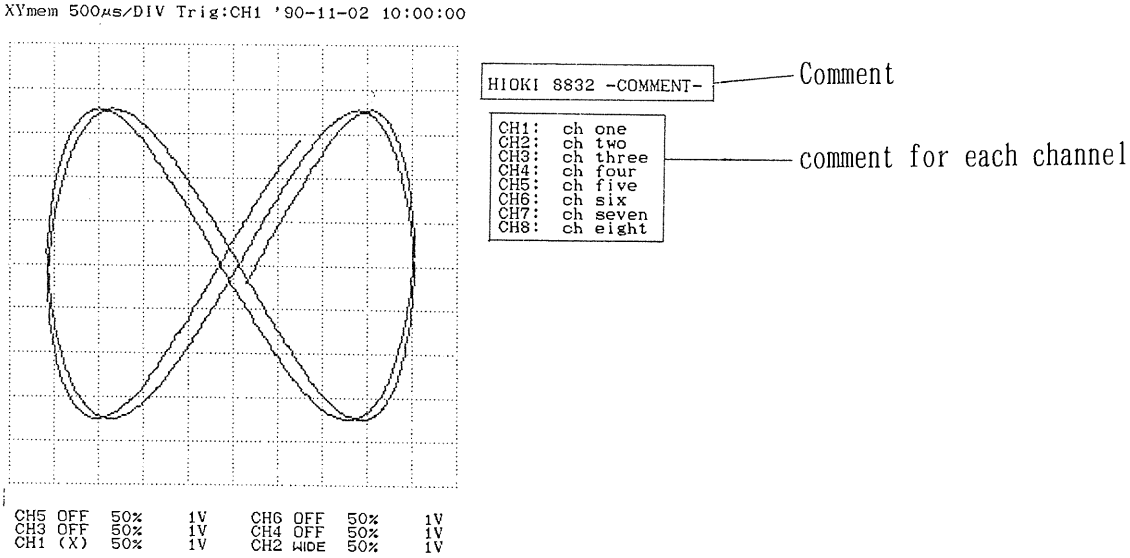
Recorder Function

Memory Recorder Function



High-speed XY Recorder Function

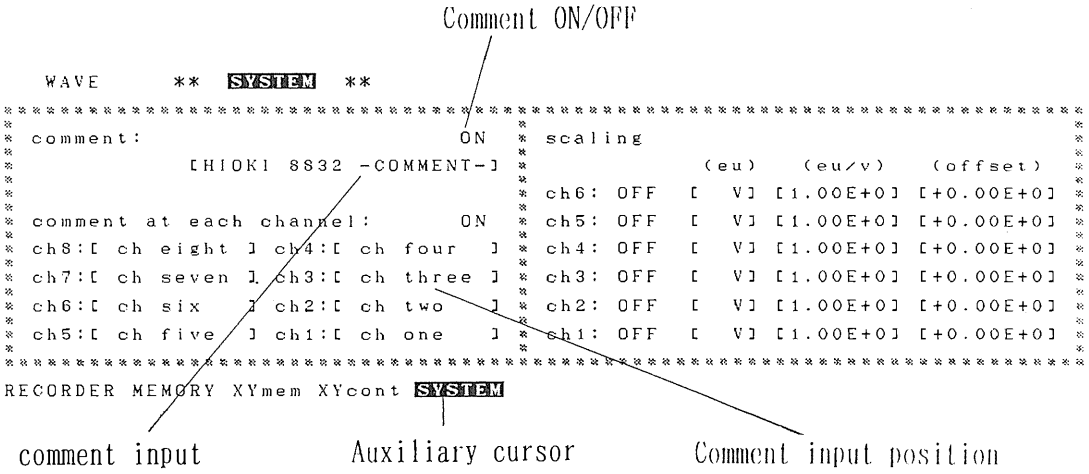
Continuous XY Recorder Function



Note: In the high-speed X-Y recorder or continuous X-Y recorder mode, if a single comment and comments input for each channel are turned ON, both comments are output.

Comment Setting

comments are entered using the WAVE display, selected by pressing MENU/WAVE key.



comment: [OFF] : No comment is printed.

[ON] : The comment input by the user is printed on all charts.

[HIOKI 8832 COMMENT-] : The comment is input here.

Comment at each channel: [OFF] : Comment for each channel is not printed.

[ON] : The comment input by the user is printed of the for each channel, on all charts.

ch1 :[ ]~ch8 :[ ] : Comment input for each channel. A comment up to 10 characters long can be included in the chart.

Comment Input Procedure

① Move the cursor to the comment input position with the CURSOR keys. Press both SCROLL keys simultaneously to clear the old comment.

```
comment:                                ON
              [                           ]

comment at each channel:               OFF
ch8:[              ] ch4:[                ]
ch7:[              ] ch3:[                ]
ch6:[              ] ch2:[                ]
ch5:[              ] ch1:[                ]
```

② Use the ⊞ and ⊟ keys to move the window cursor to the first letter of the comment on the selection line. To enter a space, press both ⊞ and ⊟ keys simultaneously.

```
WAVE      **  SYSTEM  **

comment:                                ON
              [H                          ]

comment at each channel:               OFF
ch8:[              ] ch4:[                ]
ch7:[              ] ch3:[                ]
ch6:[              ] ch2:[                ]
ch5:[              ] ch1:[                ]
```

```
 0123456789μ°
^(),.$%&=+-*/
ABCDEFGHIJKLM
NOPQRSTUVWXYZ
abcdefghijklm
nopqrstuvwxyz
```

window

③ Move the cursor one space to the right with the CURSOR ▶ key.

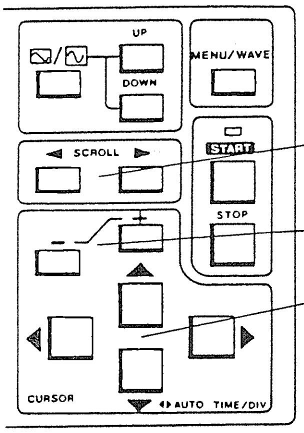
```
WAVE      **  SYSTEM  **

comment:                                ON
              [H                          ]

comment at each channel:               OFF
ch8:[              ] ch4:[                ]
ch7:[              ] ch3:[                ]
ch6:[              ] ch2:[                ]
ch5:[              ] ch1:[                ]
```

④ Repeat steps ② and ③ to enter the remaining letters.

```
WAVE      **  SYSTEM  **

comment:                                ON
              [HIOKI  8832  -COMMENT      ]

comment at each channel:               OFF
ch8:[              ] ch4:[                ]
ch7:[              ] ch3:[                ]
ch6:[              ] ch2:[                ]
ch5:[              ] ch1:[                ]
```

⑤ Comment input for each channel can be performed in the same way.

```
WAVE      **  SYSTEM  **

comment:                                ON
              [HIOKI  8832  -COMMENT-     ]

comment at each channel:                ON
ch8:[ ch eight     ] ch4:[ ch four        ]
ch7:[ ch seven     ] ch3:[ ch three       ]
ch6:[ ch six       ] ch2:[ ch two         ]
ch5:[ ch five      ] ch1:[ ch one         ]
```



SCROLL keys

⊞ and ⊟ keys

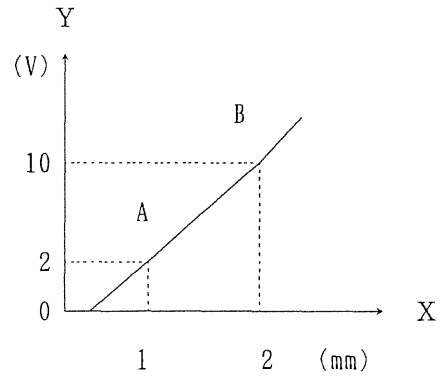
CURSOR keys

7－5 Setting the Scaling Function

Scaling:

- ○ By setting the physical quantity (eu/v) per unit volt of input signal 1V, offset (offset) and unit name (eu), the measured input voltage value can be converted to the desired units.
- ○ The scaled values are shown as divisions, the range value, and the△V of the line cursor.

Below is an example of scaling performed on the input voltage using a displacement sensor having characteristics shown below:



$Y = 8X - 6$ ——— (1)

(V) (mm)

⇩

$X = 0.125Y + 0.75$ —— (2)

(mm) (V)

Solving for X in equation (1) gives equation (2) with the following scaling, the measured voltage is scaled to units of displacement (mm).

	(eu)	(EU/v)	(offset)
ch1:ON	[mm]	[1.25E-1]	[+7.50E-1]

At point A, where Y = 2V,

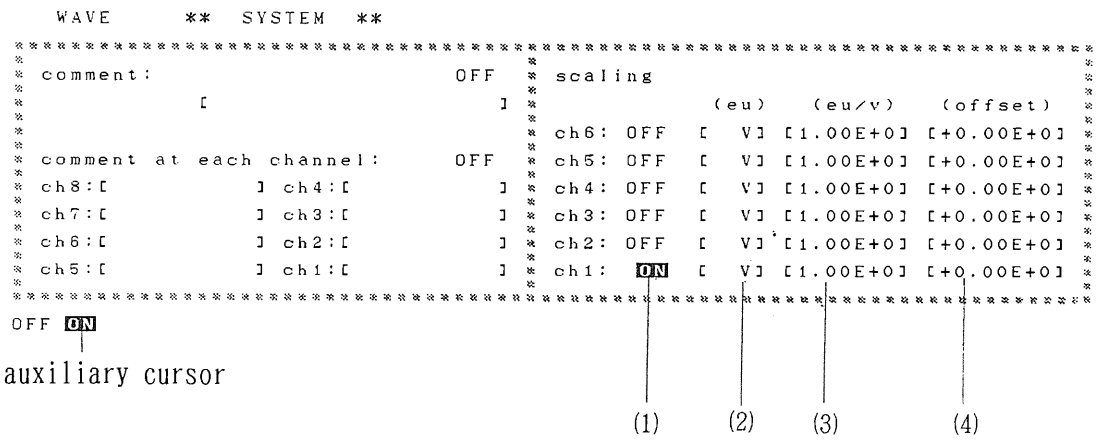
The displacement is : (1.25E-1)×2+(7.50E-1) = 1mm

At point B, where Y = 10V,

The displacement is : (1.25E-1)×10+(7.50E-1) = 2mm

Setting the scaling

The scaling is set using the WAVE display, selected by pressing the MENU/WAVE key.



(1) ch1 ～ ch6 [OFF] Scaling for each channel is not performed.
[ON] Scaling for each channel is performed.

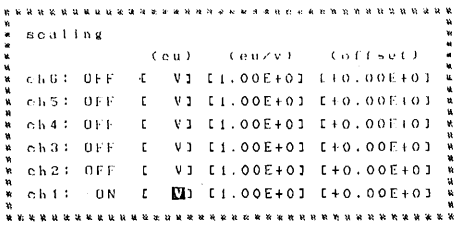
(2) (eu) [V] Physical unit of each channel is input.
Maximum or 3 characters is allowed for the unit.

(3) (eu/v) [1.00E+0] Values from 0.00 to 9.99 can be assigned to the mantissa.
Values from -9 to +9 can be assigned to the exponent.

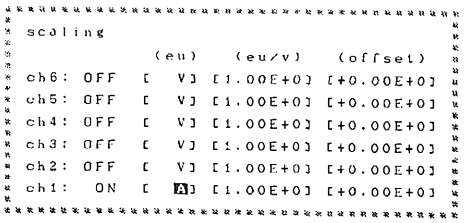
(4) (offset)[0.00E+0] Values from -9.99 to +9.99 can be assigned to the mantissa.
Values from -9 to +9 can be assigned to the exponent.

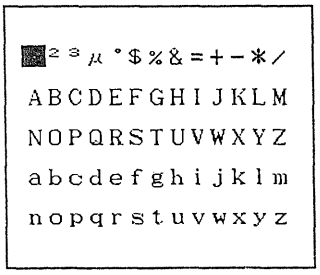
Setting the scaling

(1)The cursor is moved to the setting position with the CURSOR keys.
An initial value is obtained by pressing both SCROLL keys simultaneously.



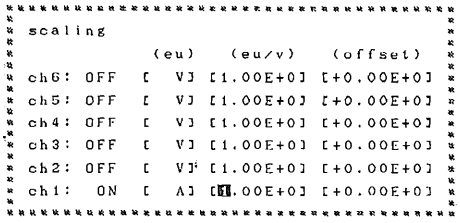
(2)The scaling unit (eu) is entered using the ⊞, ⊟ keys, making selections from the row of characters in the window. The physical quantity (eu/v) per unit volt and offset (offset) are selected from a row of characters with the auxiliary cursor. An initial value is set by pressing the ⊞, ⊟ keys, simultaneously.



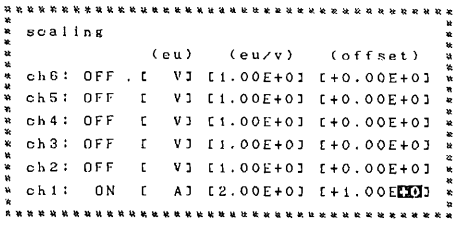


window

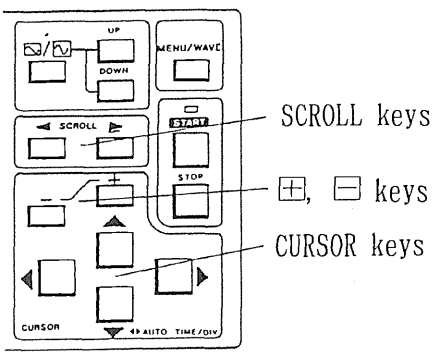
(3)Cursor is moved to the right with the CURSOR ▶ key.

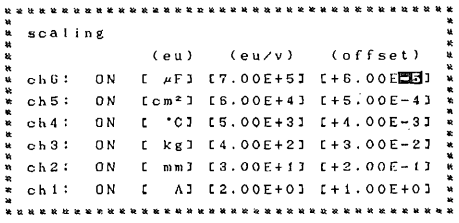


(4)The scaling is set by repeating steps (2) and (3) above.



(5)Setting the scaling for ch1 ～ ch6 is performed in the same way.





Scaled values are displayed as divisions, the range value, and the △V value of the line cursor as follow:

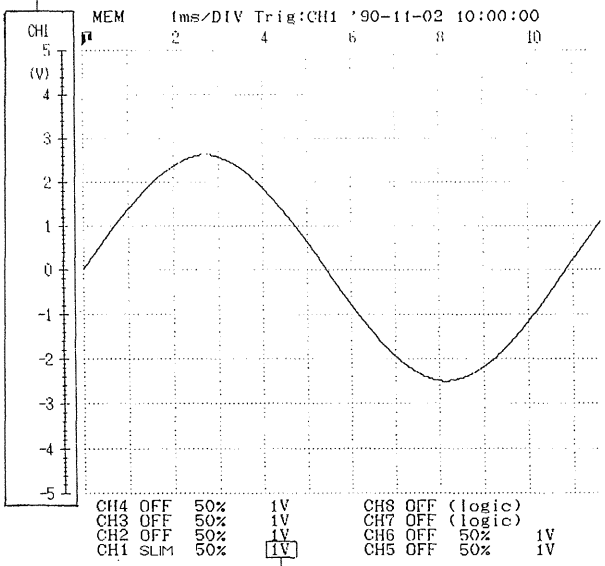
scaling OFF

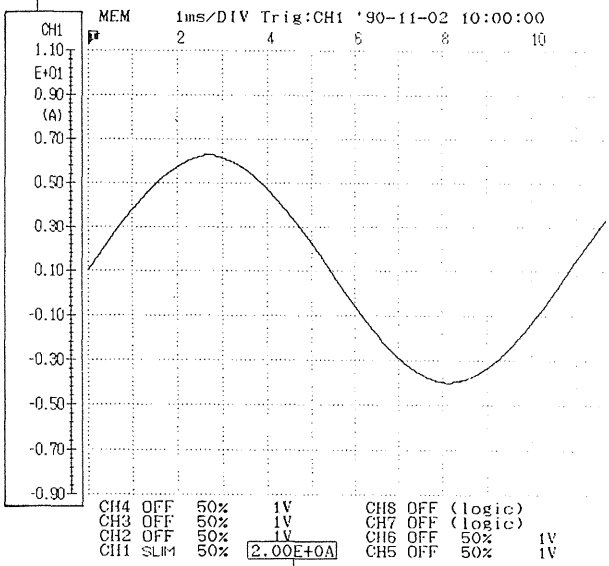
```
scaling
                (eu)    (eu/v)    (offset)
ch6: OFF   [   V] [1.00E+0] [+0.00E+0]
ch5: OFF   [   V] [1.00E+0] [+0.00E+0]
ch4: OFF   [   V] [1.00E+0] [+0.00E+0]
ch3: OFF   [   V] [1.00E+0] [+0.00E+0]
ch2: OFF   [   V] [1.00E+0] [+0.00E+0]
ch1: OFF   [   A] [2.00E+0] [+1.00E+0]
```

scaling ON

```
scaling
                (eu)    (eu/v)    (offset)
ch6: OFF   [   V] [1.00E+0] [+0.00E+0]
ch5: OFF   [   V] [1.00E+0] [+0.00E+0]
ch4: OFF   [   V] [1.00E+0] [+0.00E+0]
ch3: OFF   [   V] [1.00E+0] [+0.00E+0]
ch2: OFF   [   V] [1.00E+0] [+0.00E+0]
ch1: ON    [   A] [2.00E+0] [+1.00E+0]
```

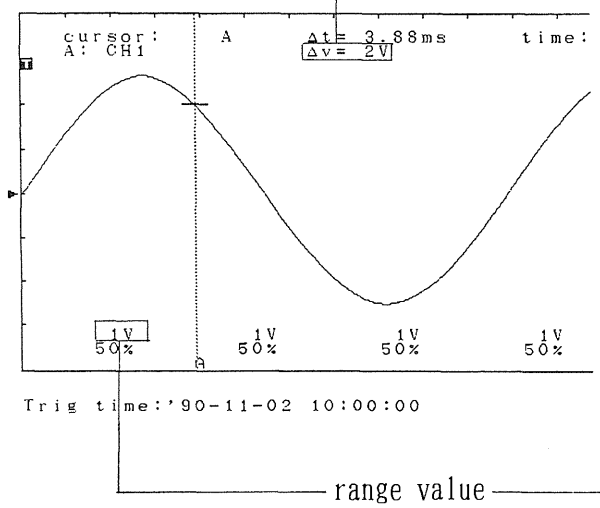
division display

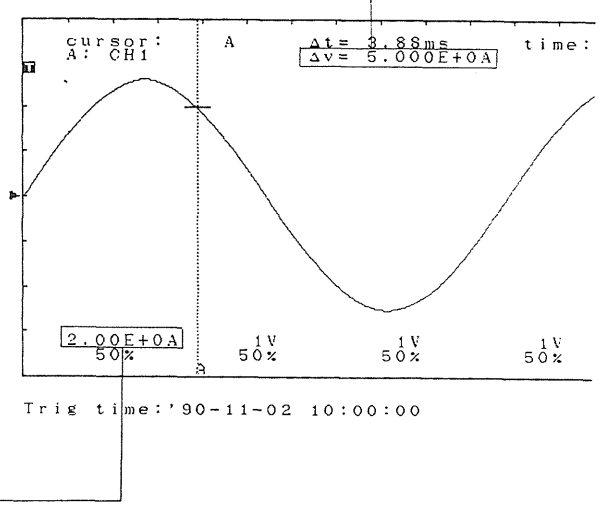




range value

value of line cursor





range value

CHAPTER 8

THE IC (RAM) CARD

8. THE IC (RAM) CARD

8 − 1 Functions of the RAM Card

(1) By storing unit settings in a RAM card, they can be used for measurement any time (this excludes the input units).
(2) Measurement data can be saved in a RAM card, then retrieved for analysis or comparison with other data (Data measured by recorder when in the continuous X-Y recorder mode cannot be stored.
(3) Waveform judgement areas can be saved for repeated use.
(4) This unit accepts RAM cards with a maximum storage capacity of 4 Mbytes.
(5) A portion of the measured waveform can be saved in the RAM card (partial save function).
(6) The measured waveform can be automatically saved in the RAM card during the start operation (auto save function).
(7) Unit settings or waveform judgement areas saved in the RAM card can be automatically set when power is turned on (auto setup function).

⚠ CAUTION

- Use only RAM cards specified by Hioki. The manufacturer cannot accept responsibility for problems arising from the use of other cards.
- The RAM card or the unit itself may be damaged if the card is forciblyin serted upside down or in the wrong direction.
- Read the RAM card instruction manual thoroughly.
- When using a new RAM card, be sure to format it first (the same applies to a card whose contents were erased when removing its battery).
- Do not remove the RAM card during command execution.
- Always remove the RAM card when transporting the unit.

(8) The following commands are available:
[SAVE] : To save data in the RAM card.
[LOAD] : To retrieve data from the RAM card.
[KILL] : To erase RAM card contents.
[COPY] : To copy RAM card contents onto another RAM card.
[TEST] : To check the RAM card.
[INIT] : To format the RAM card.

8 — 2 Storable Items and Capacity

(1) Unit Settings (FUNC)

① Settings can be saved for the recorder, memory recorder, high-speed XY recorder and continuous XY recorder functions.

② When saved settings are loaded to the 8832, it will be automatically set according to them.

Note: Input unit settings are saved, but they cannot be changed.

Storage capacity for each input function

Recorder ····· 317 bytes
Memory recorder ····· 327 bytes
High-speed XY recorder ····· 318 bytes
Continuous XY recorder ····· 313 bytes

(2) Measurement Data (WAVE)

① Measurement data read in the memory recorder and high-speed XY recorder modes can be saved.

② When saved data are loaded to the 8832, waveform data in the RAM card are sent into the memory of the specified channel (refer to the LOAD section in 8.5. Detailed Command Explanation).

③ Units settings at the time of waveform recording are saved along with measurement data. When measurement data are loaded to the unit, it is set to the conditions at the time of recording, which can be checked on the lists.

Measurement data storage capacity

{recording length (DIV)× 50 +32} × No. of channels+ 81 bytes

(3) Waveform Judgement Area (AREA)

① The waveform judgement area designated in the memory recorder mode is saved.

② Among unit settings at the time of area designation, only those necessary for waveform judgement are saved.

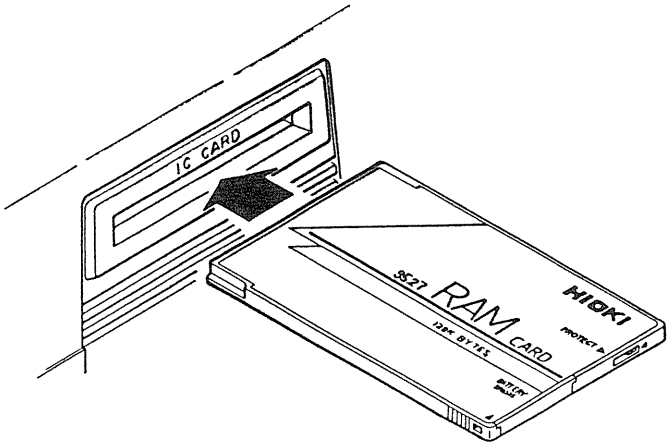
Waveform judgement area storage capacity

{recording length (DIV)×50+ 1} × 2 + 46 bytes

8 — 3 Using the RAM Card

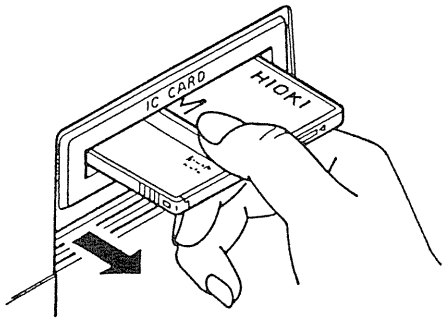
RAM Card Insertion

Push the card in as far as it will go, will the **printed side up.**



RAM Card Removal

Pull the card out in the direction of the arrow.

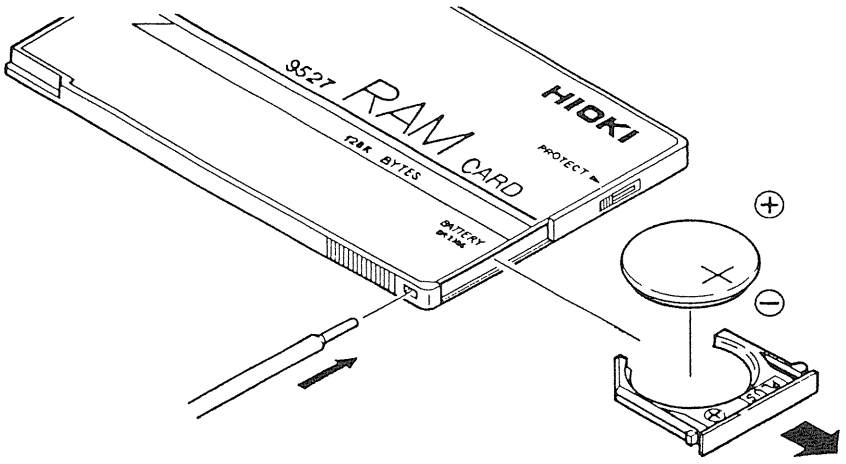


Replacing the RAM Card Lithium Battery

If the indication

*** WARNING 36 : Change card battery ***

is displayed when setting the IC CARD display mode, it means that the RAM card lithium battery is worn out. Replace the battery following instructions in the RAM card manual.



8 — 4 The IC Card Display Mode

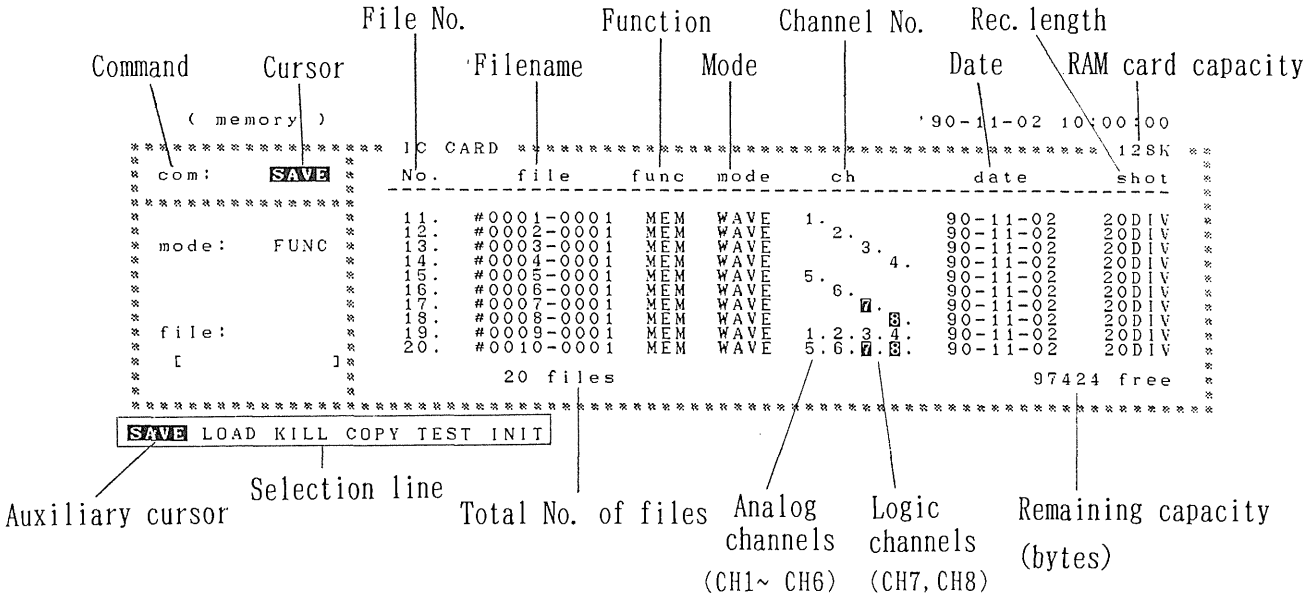
This section gives a general description of the IC card display. For details on the particular commands, see 8.5. Detailed Command Explanation.

Note: By "IC card" we refer to memory cards such as RAM and ROM cards. The explanation in this manual will center on RAM cards.

① Insert the RAM card.

② Press the IC CARD key. The display will be set to the IC CARD mode.

Note: This mode cannot be set from the SYSTEM menu. Select another function first.



Notes: ● When using a new RAM card, be sure to format it first with the INIT command. Refer to the INIT section in 8.5. Detailed Command Explanation)

● In case an error indication blinks in the selection line, press the STOP key to release the error condition.

・Filename　The name specified when executing the SAVE command is displayed. The following names have special meanings:

WAVE－○○○○○　File created using the automatic filename function.
FUNC－○○○○○　See the explanation on the SAVE command.
AREA－○○○○○
　　Number

#○○○○－○○○○　File created using the auto save function.
Number　Number

AUTO-SET　Files used for the auto setup function.
AUTO-SET-A　Refer to 8-8. Automatic Setup Function.

・Mode　Indicates the type of data contained in the file.

FUNC　Unit settings
WAVE　Measurement data
AREA　Waveform judgement area

・Function　Indicates the recording mode in which data were saved.

REC　Recorder mode
MEM　Memory recorder mode
XYM　High-speed XY recorder mode
XYC　Continuous recorder mode

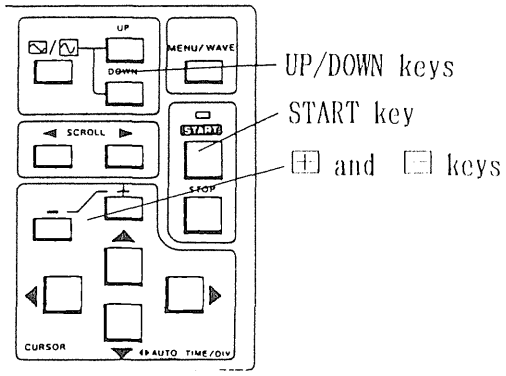
・Channel No.　For files containing measurement data (WAVE), indicates to which channel do data belong.

1. 2.　Analog unit data
7. 8.　Logic unit data

・Recording length

Indicates the recording length for measurement data and waveform judgement areas. For storage capacity, refer to 8-2. Storable Items and Capacity. For files containing unit settings, ――― is displayed.

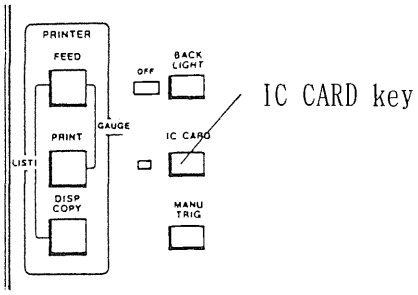
③ In case there are more than 10 files saved in the RAM card, use the UP/DOWN keys to scroll the list up and down.



④ Use the ⊞ and ⊟ keys to select commands. For particular command instructions, see 8-5. Detailed Command Explanation.

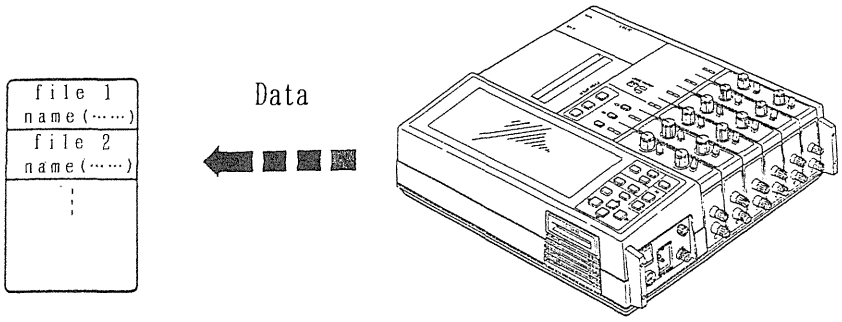
⑤ Press the START key for executing the selected command.

⑥ To exit the IC CARD display mode, press the IC CARD key again.



[SAVE]: Saves unit settings, measurement data and waveform judgement areas in the RAM card.

The SAVE command is executed by pressing the START once setting has been completed.



mode: Selects data to be saved. It can only be set for the memory recorder and high-speed XY recorder functions. In the recorder and continuous XY recorder modes, it is fixed to the [FUNC] setting.

[FUNC] To save unit settings

[WAVE] To save measurement data and conditions. Select the source channel at the ch: indication.

Note: When the PART indication is displayed, it means that the partial save function is set. Refer to 8.6. Partial Save Function.

[AREA] To save waveform judgement areas.

ch: Specifies the channel whose measurement data is to be saved.

[1] to [8]

Only data for the specified channel No. is saved.

[1-4], [5-8]:

FOR channel numbers [1-4] and [5-8], data measured for all channels whose waveforms are displayed are saved with the WAVE disply. Data for channels which are turned OFF are not saved.

In the high-speed X-Y recorder mode. data for CH1 are always saved for channel numbers [1-4] .

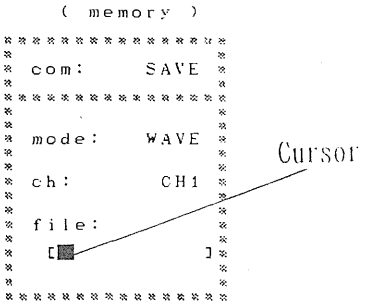
Notes: ● Storage is limited to 4 channels at a recording length of 1200 DIV, and to 2 channel at a recording length of 2500 DIV.

● When the waveform judgement function is ON (MODE 1 to MODE 4), ch: is fixed to CH1.

file: Sets the filename. If no name is entered, the filename is automatically set by the unit (auto filename function).

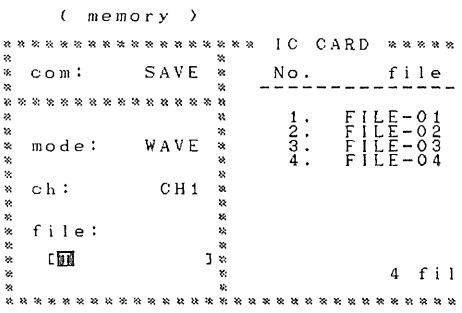
● Entering the Filename

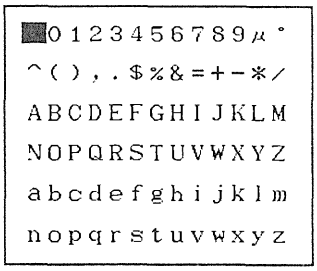
Let's create a file named TEST-1.



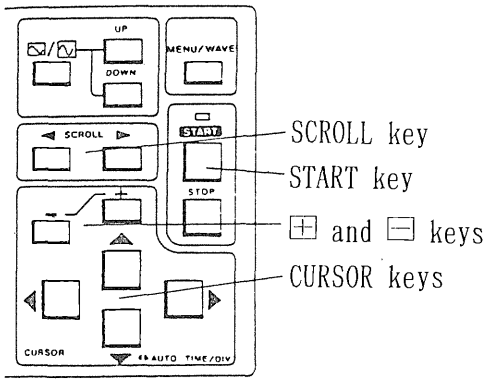
① Using the CURSOR keys, move the cursor to the file: position.

② Press the ⊞ key to move the window cursor to the T position (to enter a space, press both ⊞ and ⊟ keys simultaneously).



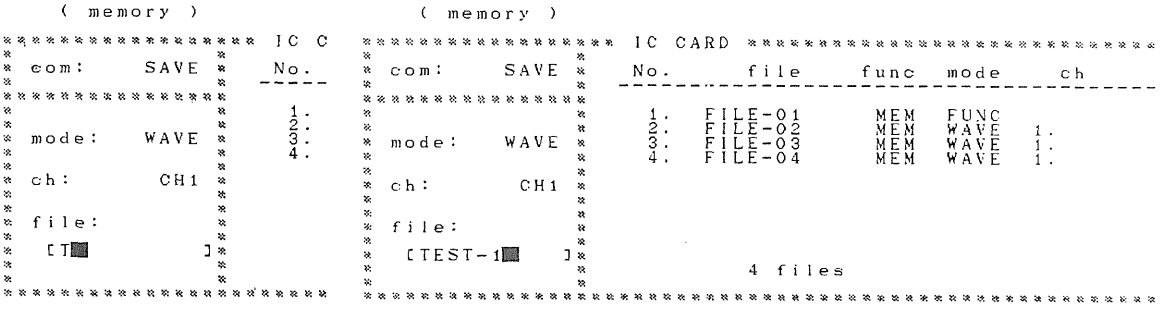


window

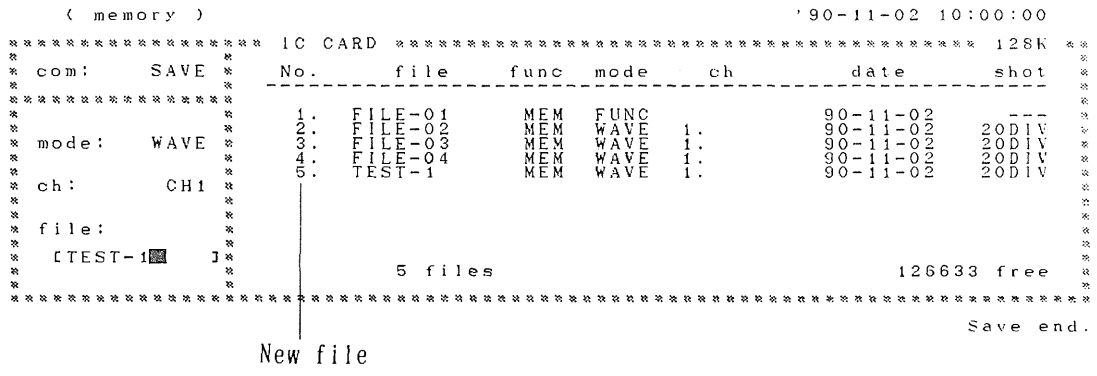


③ Move the cursor one space to the right with the CURSOR ▶ key.

④ Repeat steps 2 and 3 to enter the remaining letters.



⑤ Press the START key to execute the SAVE command. A file named TEST-1 will be created.



Note: In case a file with the same name already exists, the following message will appear:

File exist: Are you sure? (START/STOP)

Press the START key to erase the old file and create a new one with the same name.

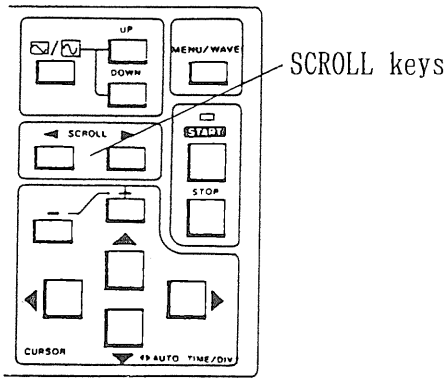
Auto filename function

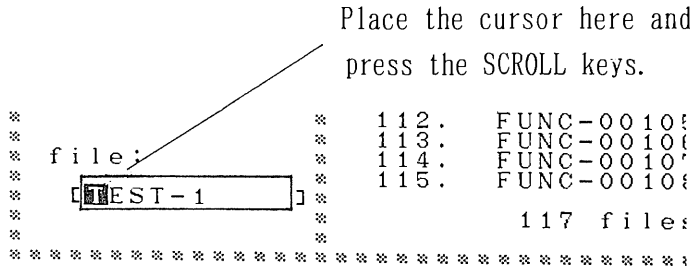
If the START key is pressed to execute the SAVE command with the file: indication empty, the filename will be automatically set by the unit, as follows:

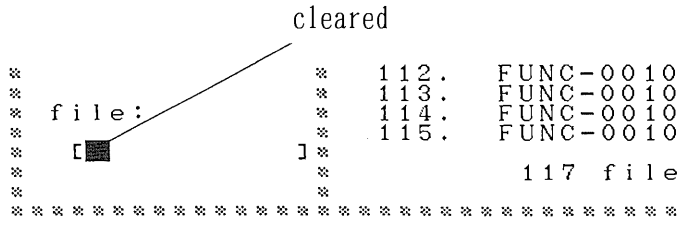
FUNC-00001 —— When the "mode" indication reads "FUNC"
WAVE-00001 —— When the "mode" indication reads "WAVE"
AREA-00001 —— When the "mode" indication reads "AREA"
File numbers are counted independently for each mode.

*Clearing the file: indication

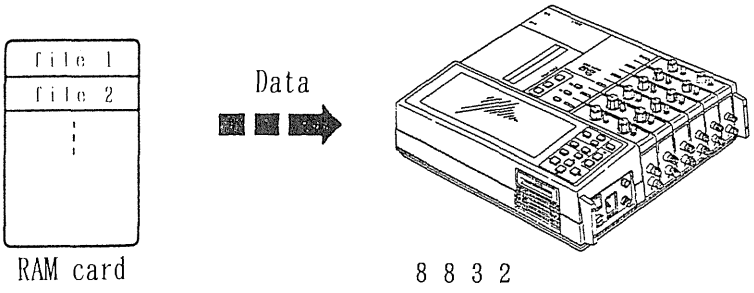
Move the cursor to the file: indication, then press both SCROLL keys simultaneously. The file: indication will be cleared. If then you press the START key, the filename will be set by the auto filename function.







[LOAD] : To retrieve data from the RAM card.



Once setting is completed, press the START key to execute the LOAD command and exit the IC CARD display mode.

No. : Specifies the number of the file to be loaded.

Notes: ● When loading a file containing measurement data (WAVE mode) or a waveform measurement area (AREA mode), the "shot" (recording length) setting of the main unit must coincide with that in the file.

● When loading measurement data (WAVE mode), up to 4 channels can be used at a recording length of 1200 DIV, and only 2 channel at a recording length of 2500 DIV.

● When unit settings (FUNC mode) are loaded, data currently memorized in the unit will be partially or totally altered.

ch 1 → CH 1 This can be set only when loading a measurement

ch 2 → none data (WAVE) file. RAM data saved as channel-1 measurement data are loaded to the main unit channel-1 RAM. Available settings are CH1 to CH8 and "none". If "none" is selected, data for that channel are not loaded.

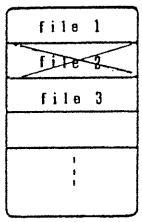
Notes: ● Loading logic unit data to an analog unit channel or vice versa will result in meaningless data. Always load data to a channel used for the same unit type.

Logic unit data

No.	file	func	mode	ch	date	shot
1.	#0001-0001	MEM	WAVE	1.2.3.4.	90-11-02	20DIV
2.	#0001-0002	MEM	WAVE	5.6.7.8.	90-11-02	20DIV
3.	#0001-0003	MEM	WAVE	1.2.3.4.	90-11-02	20DIV
4.	#0001-0004	MEM	WAVE	5.6.7.8.	90-11-02	20DIV
5.	#0001-0005	MEM	WAVE	1.2.3.4.	90-11-02	20DIV
6.	#0001-0006	MEM	WAVE	5.6.7.8.	90-11-02	20DIV
7.	#0001-0007	MEM	WAVE	1.2.3.4.	90-11-02	20DIV
8.	#0001-0008	MEM	WAVE	5.6.7.8.	90-11-02	20DIV

● When loading two or more channels, they are sent in the channel No. order inside the file. When the numbers of the sent data and the receiving channel coincide, sent data are overwritten on the former data. To keep existing data, select "none".

[KILL] : To erase a specific file in the RAM card.



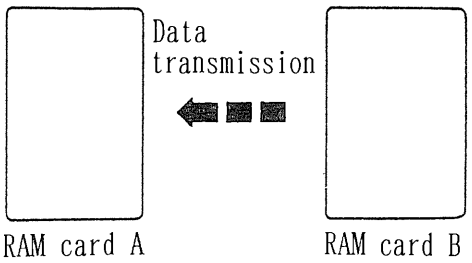
Erased

RAM card

The KILL command is executed by pressing the START key.

No. : Specifies the number of the file to be erased.

[COPY] : To copy RAM card contents onto another RAM card.



⚠ CAUTION

The COPY command uses main unit memory. When executed, waveform data in the unit are lost.

● Executing the COPY command

To copy the contents of RAM card B to RAM card A.

① Insert RAM card B in the unit.

② Select the COPY command and press the START key. The message "Storage will be lost OK? (START/STOP)" will be displayed to warn you that waveform data will be lost.

③ Press the START key. The message "Change to 2nd CARD" will be displayed.

④ Remove RAM card B and insert RAM card A. The message "Copy to 2nd RAM card OK? (START/STOP)" will be displayed.

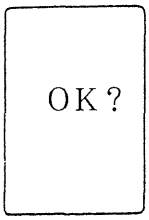
⑤ Press the START key. The "Copy end" message will be displayed, indicating the end of the copy operation.

Notes: ● To abort a command halfway, press the STOP key.

● It is not possible to copy from a RAM card of more capacity to one of less capacity.

● The copy operation is performed in lots of 128 Kbytes. When copying a RAM card with a capacity over 128 Kbytes, repeat the above steps following displayed instructions.

[TEST] : To check whether the RAM card is operating normally.

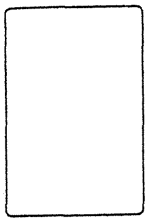


RAM card

Select the TEST command and press the START key.
The TEST command will be executed.
If the RAM card is in good condition, the message "OK, this RAM card is good" will be displayed.
Otherwise, the message "Sorry, this RAM card is broken!" will be shown.

Notes: ● Write-protected cards cannot be tested. Release the write protection before executing the TEST command.
● Data in the main unit memory and in the RAM card are not affected by the TEST command.

[INIT] : To format the RAM card. Use it for new cards, and for those whose contents were lost when removing the battery.


RAM card

Formatting
data clear

Select the INIT command
and press the START key.

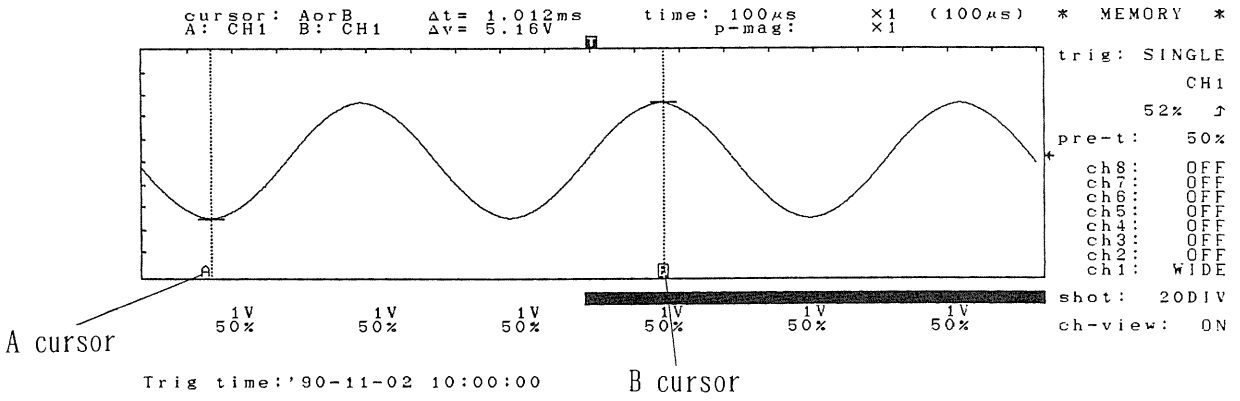
Note: ● Write-protected cards cannot be formatted. Release the write protection before executing the INIT command.

The message "Initialize: Are you sure? (START/STOP)" will be displayed. Press the START key to format the card.

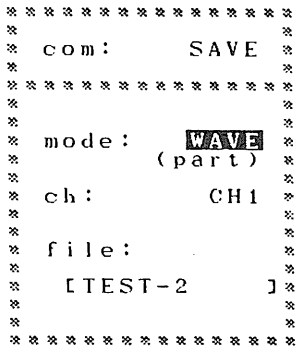
8 – 6 Partial Save Function (only for memory recorder)

A portion of the waveform, specified with the line cursors, can be saved in the RAM card as measurement data.

① Read the waveform with the memory recorder function.
② At the WAVE display, select the line cursor mode (A, AorB or A&B).
③ Enclose the portion of the waveform you want to save between the A and B line cursors.
Note: When only the A cursor is used, the portion from the A cursor to the end of the waveform will be saved.

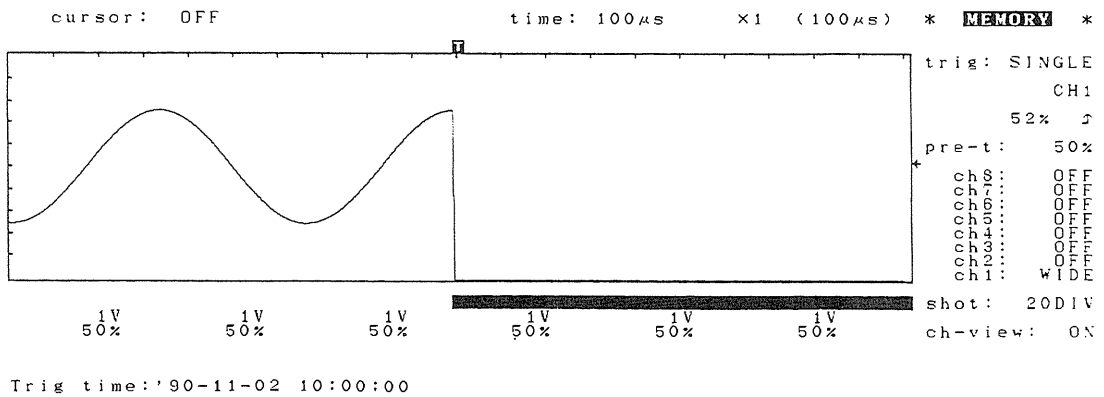


④ Press the IC CARD key to set the IC CARD display mode, then send measurement (WAVE) data to the RAM card with the SAVE command (save procedures are the same as for conventional measurement data). In the partial save mode, the (part) indication appears below WAVE on the IC CARD display.



Note: The recording length of a waveform saved using the partial save function changes to the minimum value enough to include the specified range. Data in the excess portion are replaced by 0s.

Result of partial save



8 — 7 Automatic Save Function

(1) Function Description

- Waveform data read during the start operation are automatically saved in the RAM card.
- This function can be used in the memory recorder and high-speed XY recorder modes.
- When the RAM card capacity is full, operation of the main unit continues without storing data on the RAM card.
- A total of 2 files, one for channels 1-4 and one for channels 5-8, can be created using the automatic save function.
- This function saves data for only those channels whose WAVE displays are set to SLIM or WIDE.

(2) Operation Example

The memory recorder function will be used in this example. Procedures are the same for the high-speed XY recorder function.

① Setting the memory recorder function menu

Set the memory recorder function menu as follows:

The REPEAT and MANU settings will be used in this example.

Auto save function

```
MENU      **  MEMORY  **                                           '90-11-02 10:00:00
*****STATUS*************TRIGGER**************PRINT***************SPECIAL********
* time/div:      1ms * mode:       REPEAT * ch8:           OFF * RAM card:      ON *
*                    * source:       MANU * ch7:           OFF *  auto-save        *
*                    *                    * ch6:           OFF *                   *
* shot:        20DIV *                    * ch5:           OFF * wave:         OFF *
*                    *                    * ch4:           OFF *  comparison       *
*                    *                    * ch3:           OFF *                   *
*                    *                    * ch2:           OFF *                   *
* mag:            x1 *                    * ch1:          SLIM *                   *
*                    *                    *                    *                   *
*                    *                    * dot-line:     LINE *                   *
* auto-print:    OFF * pre-trig:       0% *                    *                   *
*                    * wait-less:     OFF * format:     SINGLE *                   *
*********************************************************************************
OFF ON
```

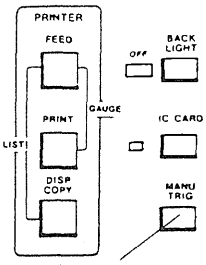
② Setting the auto save function

Set the “auto save” indication on the MENU display SPECIAL section to ON.

③ Insert the RAM card.

Notes: ● Confirm whether the waveform will fit in the remaining capacity of the RAM card.

● Release the write protection.



MANU TRIG key

④ Press the START key, and use the MANU TRIG key to trigger waveform recording several times.

⑤ Press the STOP key, then press the IC CARD to set the IC CARD display mode.

```
No.        file        func   mode
------------------------------------
1.   #0001-0001        MEM    WAVE
```

The waveform has been saved in the RAM card as a measurement data file.

Indicates that the file has been created with the auto save function.

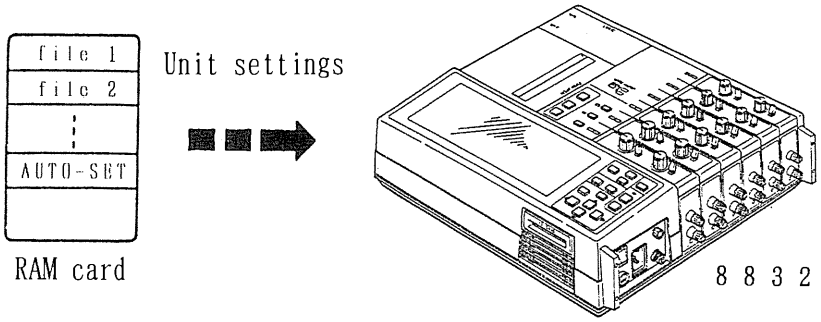
This number increases each time the auto save operation is performed.

This number increases each time the waveform is recorded during the same auto save operation.

8 − 8 Automatic Setup Function

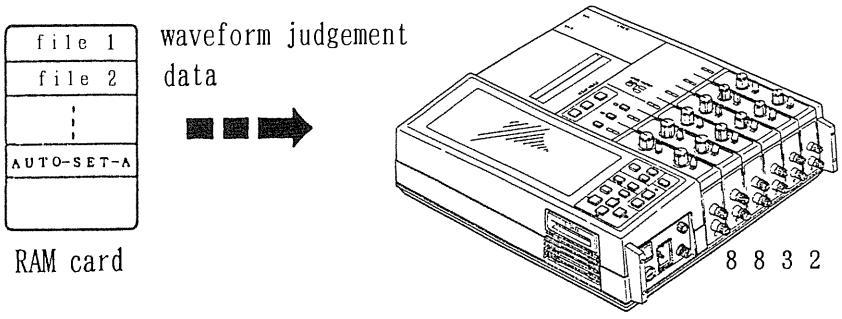
(1) Function Description

① If power is turned ON with the RAM card installed in the IC card slot, a FUNC file called AUTO-SET is automatically read, and the unit is set according to its contents. This allows for easily setting the unit to frequently used measurement parameters.



Note: Input units cannot be set with this function.

② If power is turned ON with the RAM card installed in the IC card slot, an AREA file called AUTO-SET-A is automatically read, and the unit is set according to the waveform judgement area and conditions it contains. This is a convenient function when the same judgement area is used repeatedly.



Note: Input units cannot be set with this function.

(2) Auto Setup of Measurement Parameters

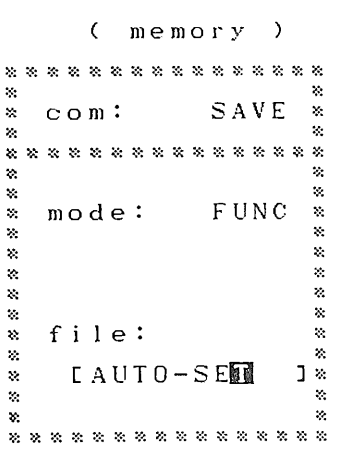
To automatically set the unit according to data saved in a RAM card, proceed as follows.

① Set the unit as desired using the MENU and WAVE display modes.

Note: Auto setup of input units is not possible.

② Insert a RAM card.

③ Press the IC CARD key to to set the IC CARD display mode.



④ Select as follows:
com: SAVE
mode: FUNC

⑤ Enter the AUTO-SET filename.

⑥ Press the START key to execute the SAVE command.
The AUTO-SAVE file will be saved in the RAM card .

This completes auto setup function setting.

Now let's actually apply the function.

⑦ Press the IC CARD key again to set the MENU or WAVE display mode.

⑧ Change settings at will.

⑨ Confirm that the card is still inserted, turn power off, then turn it on again. The unit will be set as specified in step 1.

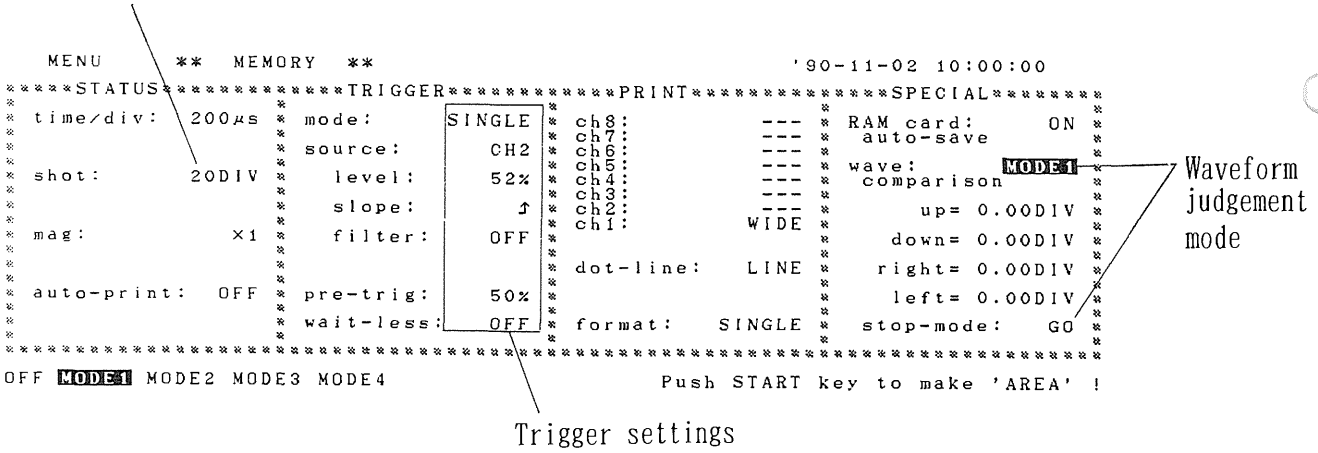
(3) Auto Setup of Waveform Judgement Areas

To automatically set the unit according to waveform judgement data saved in a RAM card, proceed as follows.

① Specify the desired waveform judgement area. Refer to 9-2. Waveform Judgement Setting.

② Once the area is displayed, specify the parameters to used for waveform judgement. Set the "shot" (recording length) to match the waveform judgement area. Select also the trigger and waveform judgement mode settings.

Should match the waveform judgement area.



Note: Auto setup of input units is not possible.

③ Set the IC CARD display mode.

④ Select as follows:
com: SAVE
mode: AREA

⑤ Enter the AUTO-SET-A filename.

⑥ Press the START key to execute the SAVE command. The AUTO-SAVE-A file will be saved in the RAM card.

This completes auto setup function setting.

Now let's actually apply the function.

⑦ Press the IC CARD key again to set the MENU or WAVE display mode.

⑧ Change the settings in ② above to different settings.

⑨ Confirm that the card is still inserted, turn power off, then turn it on again. This procedure, then, performs automatic loading of setting conditions for waveforms and the judgement area set in ② above, not the setting changed in ⑧ above.

(4) Input Unit Setting with the RAM Card

Input unit settings (range, zero position, filter, etc.) cannot be changed by loading setting data (FUNC file) from a RAM card. However, input unit data are saved in the RAM card when the SAVE command is executed.

Therefore, when settings are loaded using the LOAD command, input unit settings are also sent to the main unit. Then they can be shown on the WAVE display by setting the "ch-view" indication to ON, and used as a reference for resetting the input units if necessary.

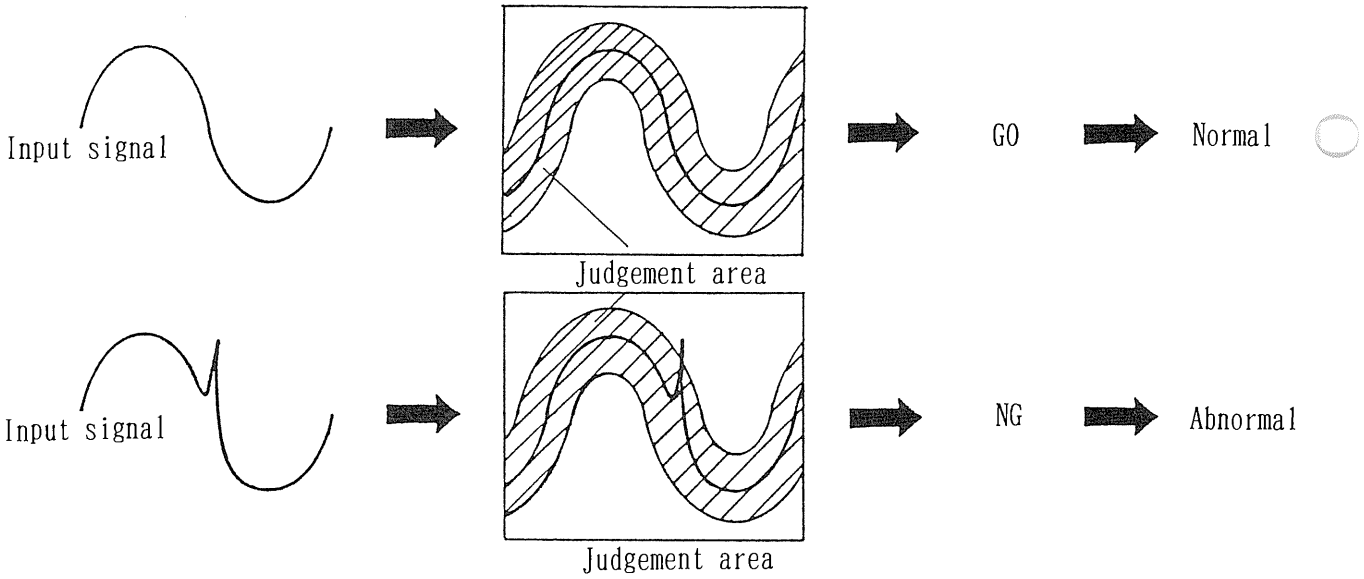
CHAPTER 9

USING THE WAVEFORM JUDGEMENT FUNCTION

9. USING THE WAVEFORM JUDGEMENT FUNCTION

9 − 1 The Waveform Judgement Function

- Evaluates the input signal according to an judgement area specified on the basis of a reference waveform (GO/NG judgement).
- It can be used for abnormal waveform detection, etc.
- The result of judgement is output from the rear panel, making it applicable to production lines.



- The evaluated signal input channel is fixed to channel 1.
- Judgement area data are stored in the memories of channels 3 and 4. Waveforms for other channels can not be displayd.
- The judgement area is specified by reading a reference waveform into channel 1, then setting horizontal and vertical allowances around it.
- Judgement is applied not only to the displayed portion of the waveform, but to the whole recording length.
- Judgement is possible on a recording length of up to 600 DIV.

9 − 2 Waveform Judgement Setting

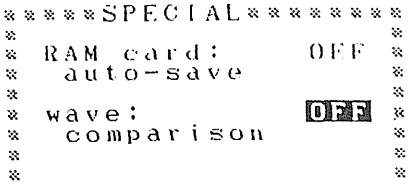
(1) Basic setting procedures are explained here. For an actual example of waveform judgement, see section 9-4.

● Specifying the Judgement Area

① At the memory recorder function MENU display, set the "wave comparison" indication to OFF. Then read the reference waveform into channel 1.

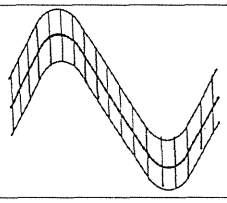
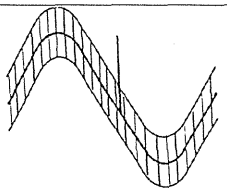
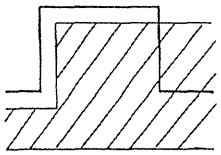
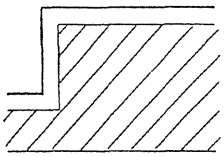
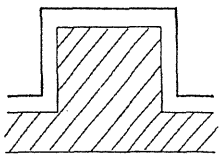
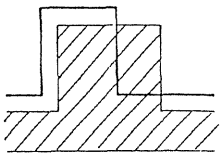
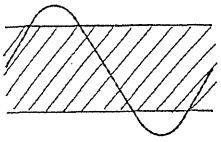
Note: ● The reference waveform can only be read into channel 1.

● Waveform judgement cannot be performed on recording lengths over 1200 DIV.

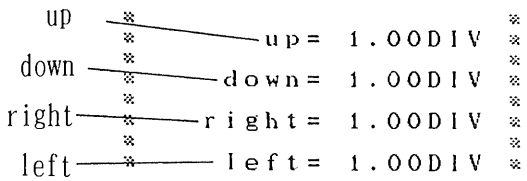


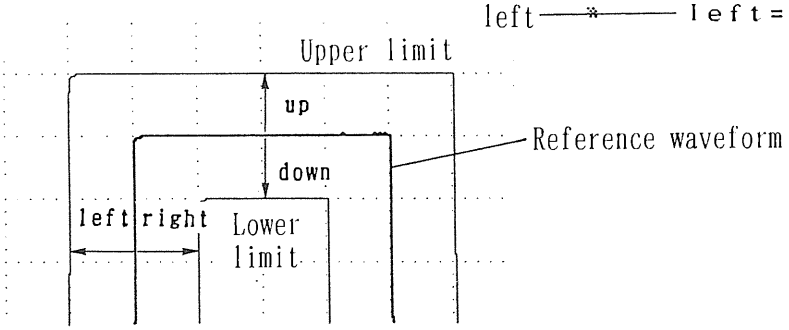
② Call the MENU display again to set waveform judgement conditions.

③ Set the MODE.

	GO Judgement		NG Judgement	
MODE 1		When the entire waveform is in the area.		When at least some part of the waveform is outside the area.
MODE 2		When at least some part of the waveform is in the area.		When the entire waveform is outside the area.
MODE 3		When the entire waveform is outside the area.		When at least some part of the waveform is in the area.
MODE 4		When at least some part of the waveform is outside theare.		When the entire waveform is in the area.

④ Set the judgement area width, in DIV units.





⑤ Set the stop mode.

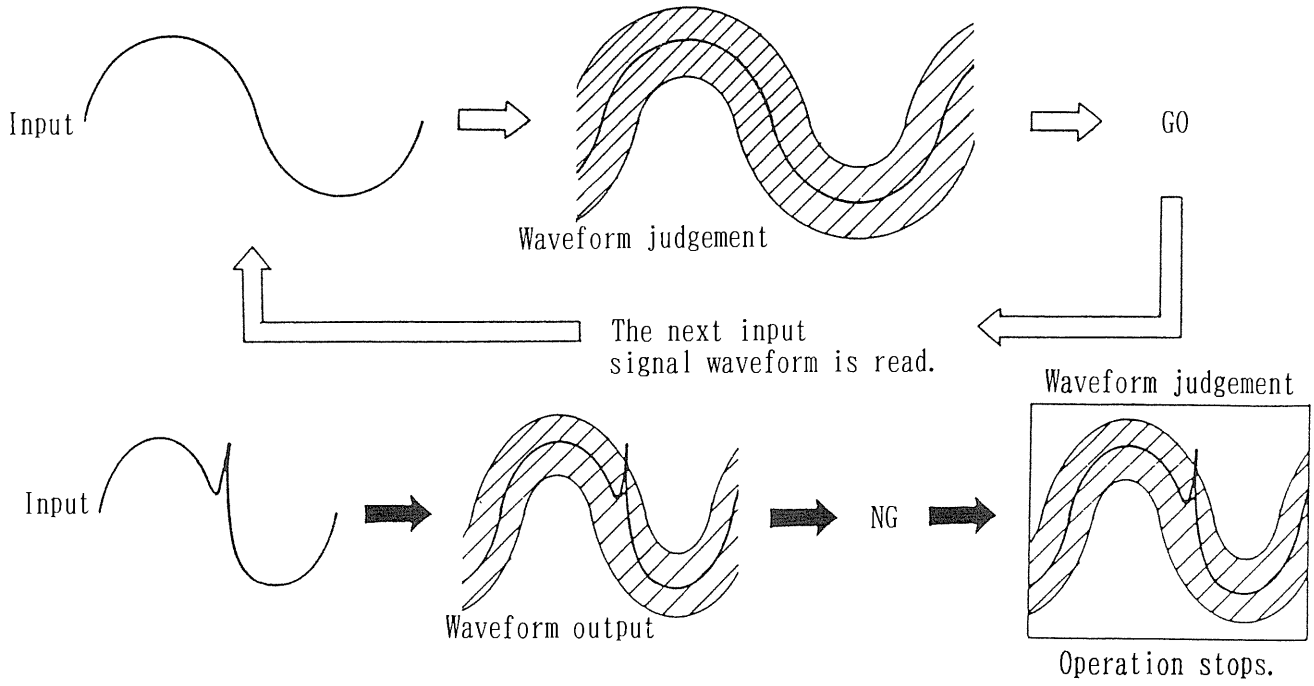
- This determines whether operation is to be stopped by a GO or an NG judgement.
- In the SINGLE trigger mode, the waveform is continuously read until the stop point, then the waveform is output and operation concluded.
- In the REPEAT trigger mode, the SINGLE operation is performed repeatedly.

[GO]: When the result of judgement is GO, the waveform is output and the SINGLE operation is concluded. If the result is NG, the waveform is not output.

[NG]: When the result of judgement is NG, the waveform is output and the SINGLE operation is concluded. If the result is GO, the waveform is not output.

[GO&NG]: The waveform is output regardless of the result of judgement, then the SINGLE operation is concluded.

(Example) The input signal waveform is monitored in the [SINGLE] trigger mode, [MODE1] judgement mode and [NG] stop mode until an NG judgement result is obtained.



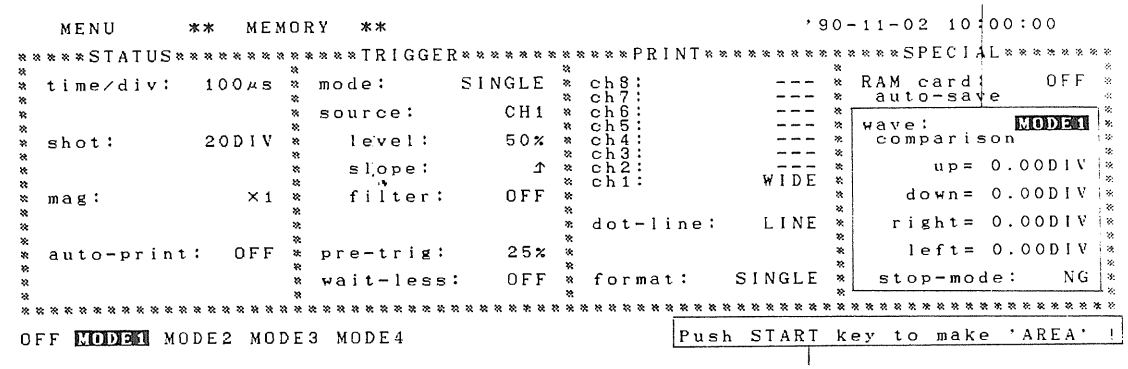
⑥ Finally, press the START. The judgement area will be established taking the waveform read into channel 1 as a reference, then the WAVE display mode will be automatically set and the area displayed.

Notes: ● Confirm that the cursor is in the waveform judgement function setting position. If it is, the message "push START Key to make 'AREA'! should be displayed on the bottom right of the screen.

● If the cursor is not in proper position when pressing the START button, the judgement area will not be established.

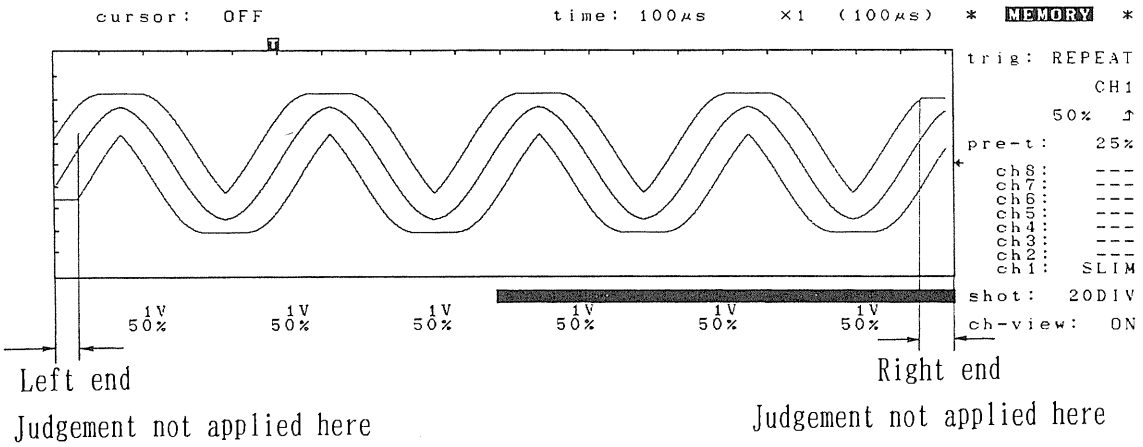
● In case an judgement area has already been established, the message "Old 'AREA' broken OK?" will be displayed when pressing the START key. To replace the old area with the new one, press the START key.

Waveform judgement function setting position



Indicates that the unit is ready for area setting.

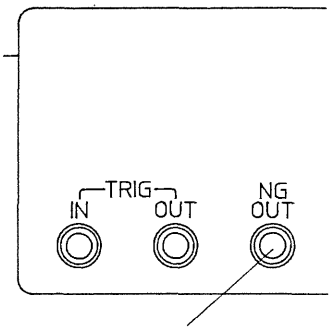
Note: The judgement function is not applied to both end portions of the waveform.



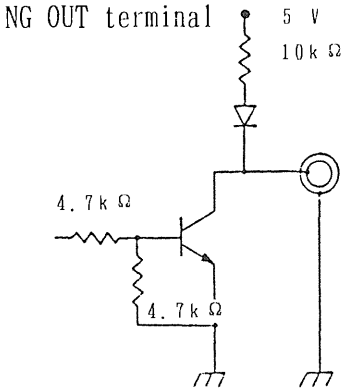
Note: Waveform judgement is not possible when the wait-less mode is set.

9 — 3 Using the NG Judgement Output

The NG result of waveform judgement is delivered as a signal (open collector, active low) from the rear panel of the unit. This output is maintained until operation is started or the judgement function is applied again.



NG OUT terminal



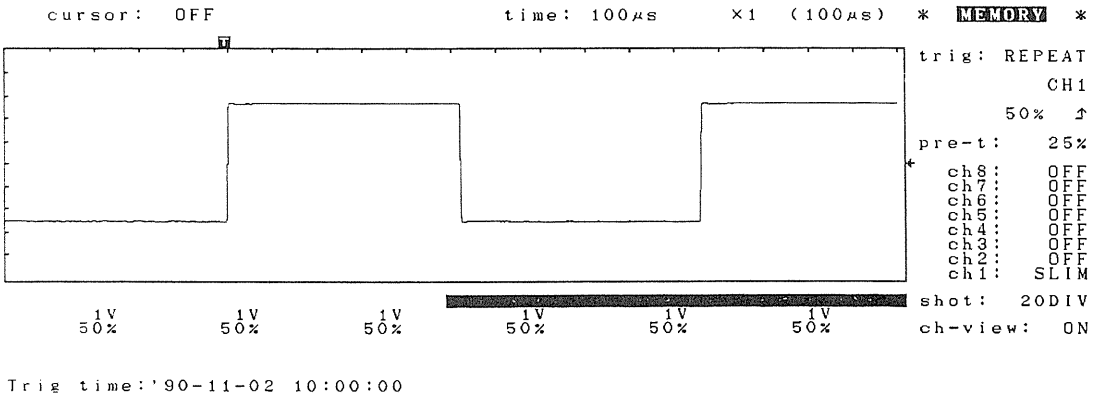
NG OUT terminal
Open collector (with voltage output)
Pulse width: 18 ms or over
3.5-mm-dia. minijack

Load voltage: -20 to +30 V
Max. load current: 300 mA_{MAX}
Max. load power: 200 mW_{MAX}

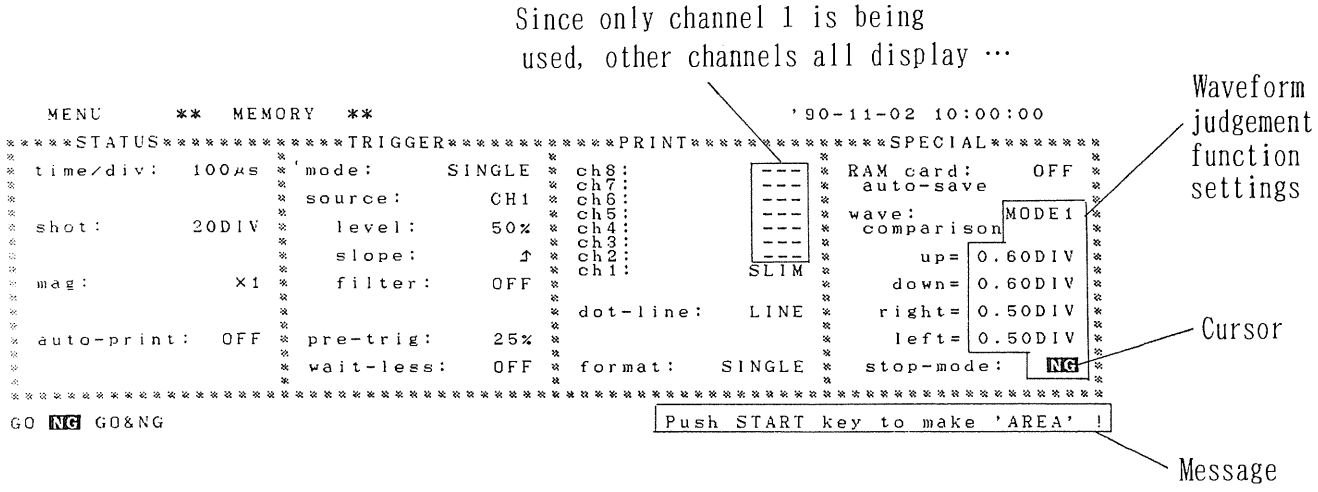
9 — 4 Waveform Judgement Setting Examples

- In this example, a rising/falling logic IC waveform will be input and used as reference for establishing the judgement area, then an IC output with overshoots and undershoots will be evaluated.

① The reference waveform is read into channel 1. Set the trigger so that the waveform can be read at a constant timing.

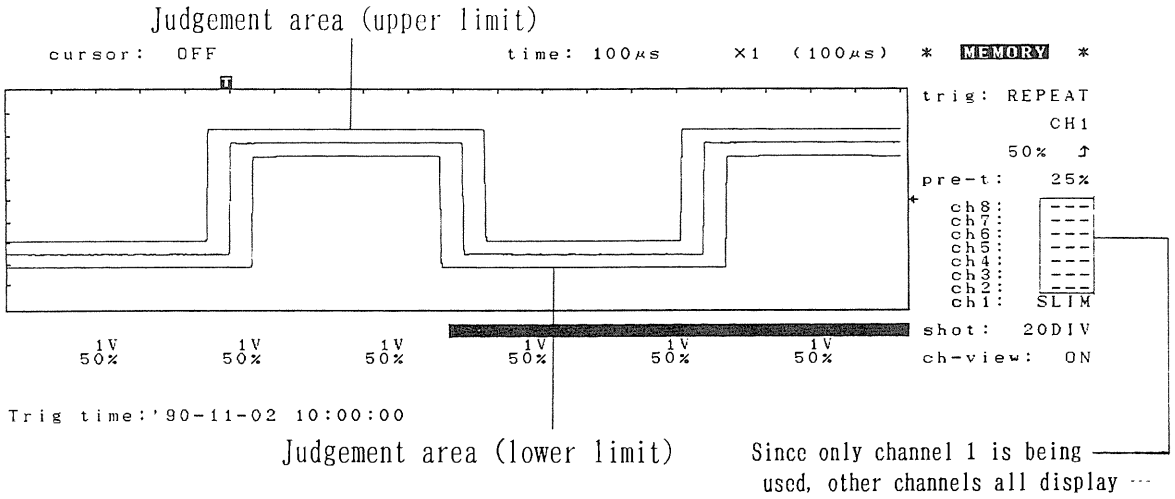


② Set the MENU display mode with the MENU/WAVE key, then set waveform judgement items as follows:



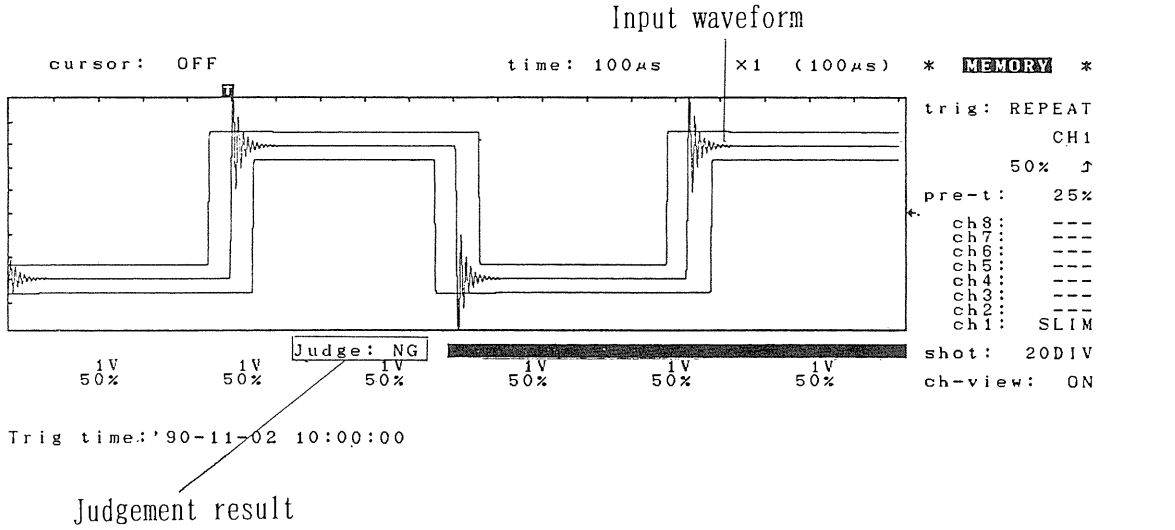
③ With the cursor still in the judgement function setting position and the message "Push START Key to make 'AREA'"! displayed, press the START key.

④ The judgement area will be established on the basis of the reference waveform read in step 1, and the WAVE display mode will be set.



⑤ Connect the output of an IC with overshoots and undershoots to channel 1 input.

⑥ Press the START key to execute waveform judgement.



⚠ CAUTION

Waveform judgement consists of two steps, namely ① Data read-in, and ② Judgement. Since these two steps are performed alternately, data read-in is not performed during judgement. Therefore, keep in mind that the input signal is not continuously monitored. Time required for judgement is approx. 30 ms for a recording length of 20 DIV/cycle (data read-in time not included). Judgement time is proportional to recording length.

CHAPTER 10

MAINTENANCE AND SERVICE

10－1　Fuse Replacement

⚠ WARNING

To prevent electric shocks, always unplug input cords and the power cord before removing or installing input units or opening the case. Alse, be sure to close the case before use. To prevent fire hazard, etc., use a fuse that meets the ratings indicated on the side panel.

CAUTION

- Before replacing the fuse, be sure to disconnect the power cord from the AC power connector and the input cords from the input terminals.
- Be sure to use a new fuse of the specified rating.

Fuse for 8832

LINE VOLTAGE (±10% MAX 250V 50/60Hz)	FUSE	SIZE
☐ 100 V ☐ 120 V	2.5 A/250 V	5.2 (dia.)×20 mm
☐ 200 V ☐ 220 V ☐ 240 V	1.5 A/250 V	5.2 (dia.)×20 mm

- If the 8832's fuse blows, identify and remedy the cause before replacing it.

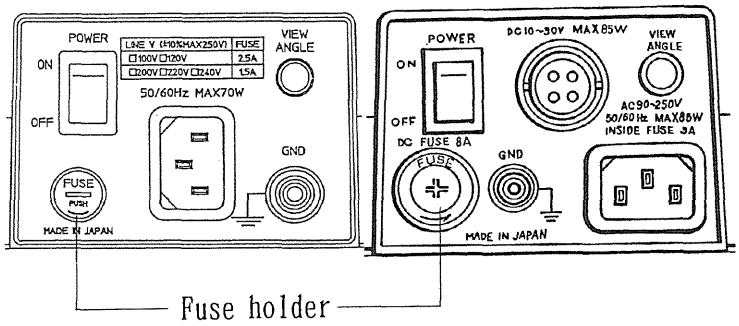
Fuse for 8833

	FUSE	SIZE
DC 10～30 V	8.0 A/250 V	6.4 (dia.) ×30 mm

- The 8833's fuse holder on the power unit panel contains a fuse for the DC power supply. The fuse holder for the AC power supply is built into the unit.
- If the 8833's AC power supply does not operate, the built-in AC fuse may be blown. This may indicate that the internal circuit is defective. In such cases, contact your dealer or other Hioki representative.

① Turn the POWER switch off.
② Unplug the power cord.
③ Remove the old fuse from the fuse holder, using a screwdriver.
④ Install a new fuse of the specified rating.
⑤ Reconnect the power cord.

8832 Power unit panel　8833 Power unit panel



10－2 Troubleshooting

If the unit does not operate normally, check the following.

The LCD does not light when power is turned on.	○The power cord is not properly connected. ○The fuse is blown. ○The battery voltage is low, when voltage drops below approx. 95V, the DC power is autmatically disconnected. (8833 only) ○If the 8833's AC power supply does not operate, the built-in AC fuse may be blown. This may indicate that the internal circuit is defective. In such cases, contact your dealer or other Hioki representative.
The paper starts moving when power is turned on.	○The POWER switch was turned off during the recording operation. ○Operation starts automatically when turning power on again after turning it off with the "start backup" indication ON.
The DC power fuse blows when the power switch is turned on after connecting a battery. (8833 only)	○The battery polarity is reversed.
No key entries are accepted.	○The unit is being remote-controlled from the optional GP-IB or RS-232C.
The printer does not work.	○No printer paper is loaded. ○The head is up.
The recording paper does not come out when pressing the START key.	○Check trigger settings. When performing memory recording before the trigger point, triggering is not acknowledged during that recording period.
Nothing is printed on the recording paper, or printout is too light.	○The recording paper has been loaded upside down. ○You are not using genuine Hioki recording paper.

The recorded waveform does not change at all.	○Check the measurement range. ○The low-pass filter is on.
The waveform run away from the recording paper.	○Check the range and the zero position.
Recording line too thick in the recorder mode.	○The signal contains a ripple component. Set the input unit filter setting to ON.
The recording paper advances intermittently.	○Paper feed is normally intermittent in the recorder mode.
The waveform is displayed at a frequency much lower than the real one in memory recorder mode.	○Aliasing error is occurring. Select a faster recording speed.
The waveform is not printed in the XY_{MEM} or XY_{CONT} mode.	○Y-axis (channels 2-6) does not perform printing unless the printer is set to SLIM or WIDE. ○In the XY_{MEM} mode, printout is not performed if there is no data in channel 1.
The recording paper does not move when pressing the START key in XY_{CONT} mode.	○The proper procedure is: Press the STOP key, then press the PRINT key.
In XY_{CONT} mode, the previous waveform remains on the display.	○Overlapped display is possible in this mode. To clear the waveform, set the "LCD clear" indication to ON.
An external device connected to the TRIG OUT jack misoperated when pressing the AUTO TIME/DIV key.	○The trigger signal is output through the TRIG OUT jack when the AUTO TIME/DIV key is pressed. This is normal.
LCD indications are hard to see.	○Turn the EL backlight ON. ○Adjust the VIEW ANGLE knob (refer to 3.5. LCD Viewing Angle Adjustment)

In case the cause of trouble cannot be detected, try resetting the system. All settings will be reset, so enter them again.

System Reset
Turn power on while pressing the STOP key.

10－3　Printer Maintenance

10－3－1　Printer Head Cleaning

Normally, the printer does not require maintenance. Depending on use conditions, however, particles and paper dust may adhere to the thermal head after long periods of use. This may cause printouts to become lighter or blurred. In such a case, clean the head using one of the following methods:

(1) Make a recording of input noise in the recorder mode at a range of 1 s/DIV, printing 100% black for at least 10 seconds. If this does not improve printing quality sufficiently, proceed with step 2 below.
(2) Pour anhydrous alcohol, freon or normal hexane onto the recording paper, lower the head-up lever, and clean the head manually by sliding the recording paper back and forth.

Alcohol will discolor recording paper, so use it upside down.

⚠ CAUTION

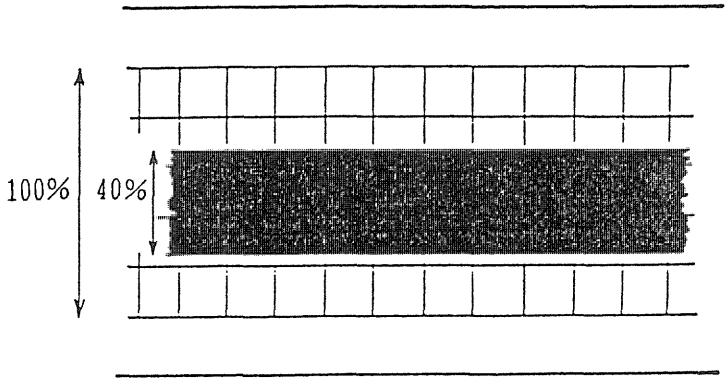
- Never use thinner or benzene.
- After using a solvent for cleaning, let the printer dry thoroughly before use.

10－3－2 Head Temperature Protection

The printer is provided with a head temperature protection circuit. When head temperature goes beyond a certain limit, printing is interrupted. Therefore, depending on use conditions, printout may be temporarily stopped, with only blank paper being advanced.
Head temperature tends to increase with the area of black printed portions and with paper feed speed. For example, if recording is performed in the recorder mode for several minutes with a black area beyond the ranges shown in the table below, printout will be interrupted. Printout may be interrupted even within those ranges if ambient temperature is high.
After the protection circuit works, printing will be restarted automatically when the head cools down. If printing is interrupted too frequently, try adjusting the input unit range so as to reduce the black area, setting the printing style to [SLIM] or [DOT], etc.

Permissible Black Area Ratio for Continuous Printing (recorder function, 23℃)

TIME/DIV	Black Area Ratio
1 s	Approx. 100%
2 s	Approx. 85%
3 s	100%

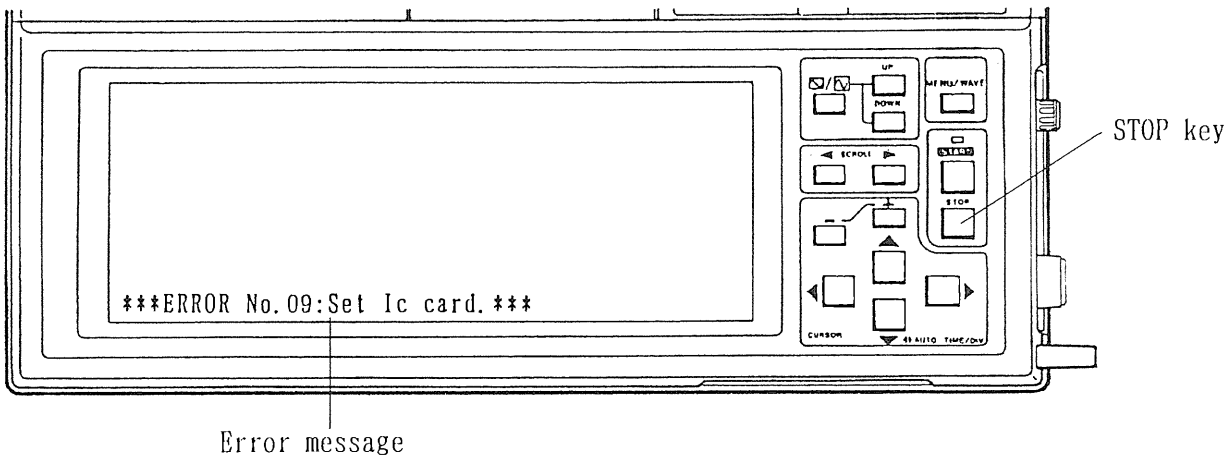


Printout example

Note: Figures on this table depend heavily on actual conditions. They are included just for reference.

APPENDICES

1. Error Messages



ERROR and WARNING messages are displayed in the position shown above on the LCD.

While an ERROR message is on the screen, no key entries will be accepted by the unit, except the STOP key. Press the STOP key to release the error condition.

Key entries are accepted when a WARNING message is displayed. WARNING messages can be cleared by pressing any key.

ERROR No. 01: Set printer paper … No recording paper is loaded.
Load recording paper.

ERROR No. 02: Set printer lever … The head-up lever is in the up position.
Lower the head-up lever.

ERROR No. 03: No wave data. … No waveform data available.
Execute the start operation to read data in.

ERROR No. 04: No analog data in CH1. … There is no analog waveform data in channel 1, so printing is not possible (XY_{MEM}) or a waveform judgement area cannot be established.
Read data into channel 1. (MEM)

ERROR No. 05: Bad A&B cursor position. … A and B line cursors are not properly placed for partial printing or partial save.
Correct the position of line cursors.

ERROR No. 06: No comparison AREA. … The waveform judgement area has not been established.
Establish the judgement area.

ERROR No. 07: Shot length of AREA is 20DIV. … The set recording length does not match the waveform judgement recording length.
Set both lengths to the same value.

ERROR No. 08: Set analog unit to CH1. … An analog unit must always be assigned to channel 1 (XY_{MEM} XY_{CONT}, waveform judgement).
Assign an analog unit to channel 1.

ERROR No. 09: Set IC card. … No IC card is loaded.
Insert an IC card.

ERROR No. 10: File is not found. … The specified file does not exist, so the LOAD and KILL commands cannot be executed.

ERROR No. 11: Card memory is full. … RAM card memory is full.
Use a new RAM card.

ERROR No. 12: Card is write-protected. … The RAM card is write-protected, so the SAVE and other commands cannot be executed.
Release the write protection.

ERROR No. 13: Card size is unmatched. … The COPY command cannot be executed because RAM card size does not match unit settings.
Use a card of proper capacity.

ERROR No. 14: File data is defective. … Data in an IC card file is deteriorated, preventing the LOAD operation.

ERROR No. 15: Input unit is not set. … There is no input unit mounted for the specified channel.
Use another channel.

ERROR No. 16: No data in this channel. … There is no data in the channel you tried to save.
Specify another channel.

ERROR No. 17: Shot length is unmatched. ··· Recording length of data to be loaded does not match the unit settings, or it is above 1200 DIV preventing waveform judgement area setting.
Reset the recording length.

ERROR No. 18: Cannot copy this card. ··· The loaded IC card cannot be copied.
Replace the card.

ERROR No. 19: Cannot do wave-comp at wait-less. ··· Waveform judgement cannot be performed in the wait-less mode.

ERROR No. 20: Please initialize (INIT) this card. ··· The loaded RAM card is not formatted.
Format the card with the INIT command.

WARNING 31: Set trigger source. … The trigger source is OFF in the AUTO TIME/DIV mode.
Set a trigger source.

WARNING 32: Cannot set time/DIV. … In the AUTO TIME/DIV mode, a trigger was not detected, thus time/DIV setting was not possible.

WARNING 33: No storage data. … In the MEM or XY_{MEM} mode, the STOP key was pressed during data storage, so there is no storage data.

WARNING 34: Cannot change wave size at START. … Vertical axis scaling cannot be changed during the recording operation.

WARNING 35: Cannot move A&B cursor at START. … The A and B line cursors cannot be moved during the recording operation. (REC)

WARNING 36: Change card battery. … The RAM card battery is worn out. Replace it with a new one.

WARNING 37: Card memory is full. … RAM card capacity was filled up during the auto save operation.

WARNING 38: Cannot change ch-view at START. … Since the recording function is in operation, ch-view cannot be changed. (REC)

WARNING 39: Use less than 2channels (2500DIV) … When the recording length is 2500 DIV, recording is possible for a maximum of 2 channels. Turn off all channels except the 2 channels used for measurement.

WARNING 40: Use less than 4channels (1200DIV) … When the recording length is 1200 DIV, recording is possible for a maximum of 4 channels. Turn off all channels except the 4 channels used for measurement.

WARNING 41: Use less than 1 Y-axis … In the XY_{MEM} mode, recording on the Y axis is possible for only 1 channel when the recording length is 2500 DIV. Turn all channels off except the channel used for measurement.

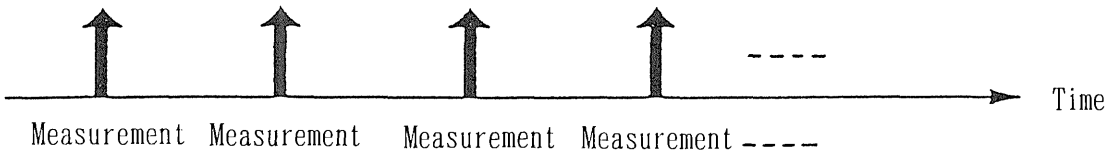
WARNING 42: Use less than 3 Y-axis … In the XY_{MEM} mode, recording on the Y axis is possible for only 3 channels when the recording length is 1200 DIV. Turn all channels off except the 3 channels used for measurement.

WARNING 43: No data in this ch. … Waveform data are not available for the channel being displayed. (MEM, XY_{MEM})

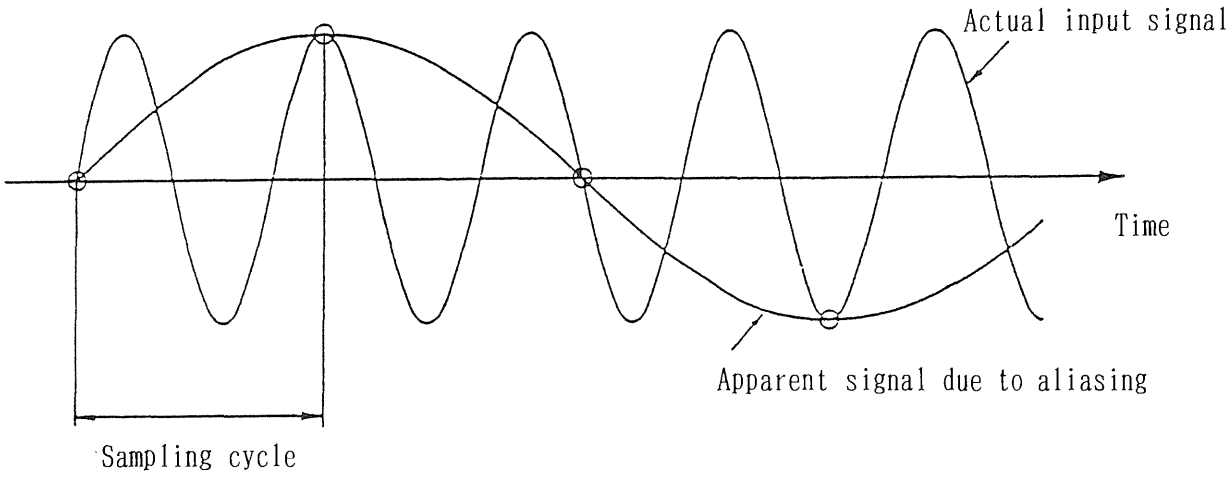
2. Area Sync Distortion

- The 8832 converts input signals from analog to digital values, and all downstream internal processing is handled digitally. This process of A/D conversion is called sampling.

- This sampling process measures signal size at fixed intervals.



- When signal fluctuations are faster than the sampling cycle above, non-existent signal changes may be recorded. This is known as aliasing distortion.

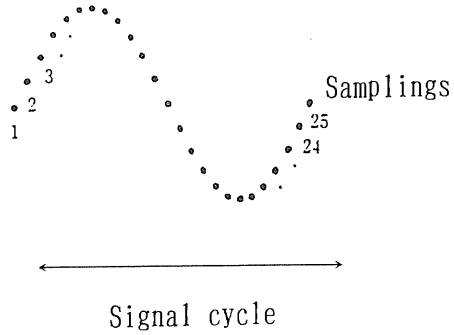


- With measurement methods such as the memory recorder function, in which sampling rate depends largely on the time-axis range, aliasing distortion cannot be avoided.

- In the memory and high-speed XY recorder modes, the limit measurement frequency is determined by the time-axis range. Therefore, it is advisable to start measuring from higher-speed ranges.

- When recording a repeating signal, the AUTO TIME/DIV function is also effective. Refer to 4-3-9. or 4-4-7. Automatic Time Axis Setting.

● To reproduce a sine wave, for example, using the sampled values without missing signal peaks, about 25 samplings per cycle are required.

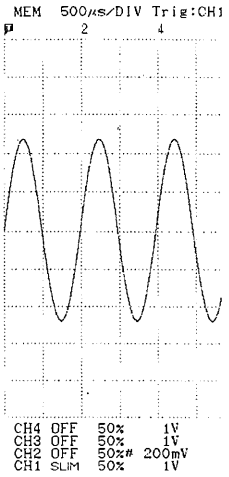


Memory and high-speed XY recorder functions

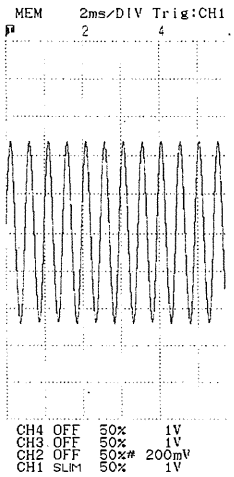
TIME/DIV	TIME/WORD	Measurement limit frequency
100μs/DIV	2 μs	20kHz
200	4	10
500	10	4
1ms/DIV	20	2
2	40	1
5	100	400Hz
10	200	200
20	400	100
50	1ms	40
100	2	20
200	4	10
500	10	4
1 s /DIV	20	2
2	40	1
5	100	0.4

(Frequencies for each range when setting a limit of 25 samplings per cycle.)

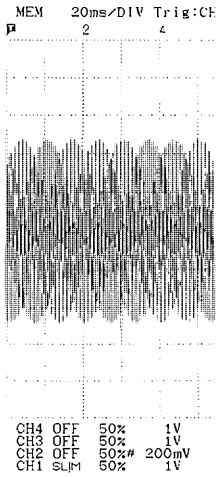
〔Example〕 Recording a 1,010-Hz sine wave at different time axis settings.



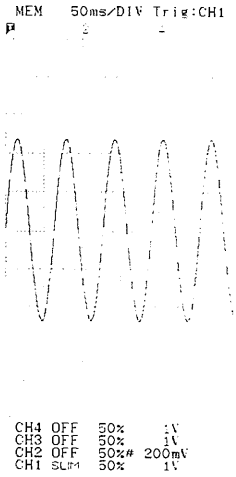
500μs/DIV
Correct waveform



2ms/DIV
Close to the measurement limit frequency



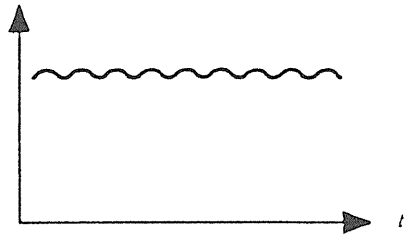
20ms/DIV
Peaks are lost.



50ms/DIV
Aliasing error
(taken for a 10-Hz signal)

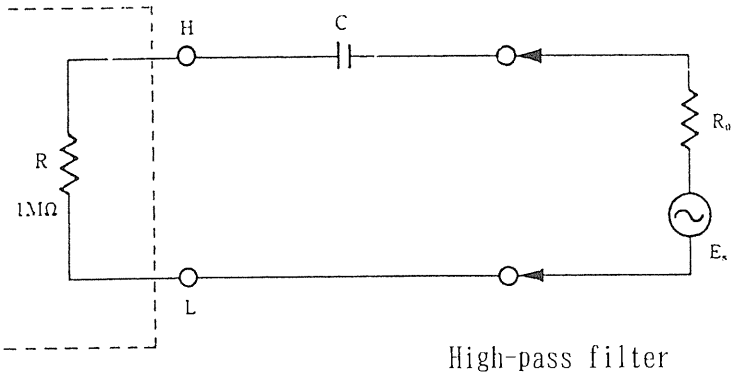
3. DC Components Superposed to the Input Signal

In case a DC component is superposed to the signal as shown below, peak values may go beyond the scale limit if input unit sensitivity is increased.



Waveform with superposed DC component

The AC component of such a waveform can be magnified for observation by including the circuit below at the input.



High-pass filter

Cutoff frequency

$$fc = \frac{1}{2\pi CR}$$

R : Input impedance

Ro: Negligible compared with R

This method cuts off the input signal DC component, allowing for measurement of the AC component only. For example, if C = 0.1 μF, R_0 = 1MΩ, therefore

$$fc = \frac{1}{2\pi \times 0.1\times10^{-6}\times 1\times10^{6}} \fallingdotseq 1.59(Hz)$$

4. Terminology

Adapter : The temperature adapter is a device to convert temperature into voltage.

Aliasing error : Inability to obtain an accurate waveform due to aliasing distortion (see Appendix 2).

Analog : Continuous physical quantity such as voltage, current, etc.

Attenuator : Divider that reduces signal amplitude.

A/D : Analog-to-digital conversion.

Beep : Sound generated when an error or warning condition occurs or when waveform judgement is not successful.

Bit : Minimum binary unit. Takes values of 0 and 1.

Byte : Binary unit. Usually composed of 8 bits.

Case : Metallic chassis of the unit.

Channel marker : Channel number printed together with waveform.

Channel (CH) : Signal path into the input unit.

Comment : Measurement conditions and function status printed on the chart, or user-entered comments printed on the chart.

Common-mode rejection : Capability of a differential device to cancel the effect of a (in-phase) signal equally applied to two inputs of the device.

Cutoff frequency : Frequency at which filter output amplitude becomes $1/\sqrt{2}$ (−3dB) of the input.

Digital : A quantity that can be expressed in numbers.

Division (DIV) : Unit equivalent to one square of the recording paper grid.

Envelope : Locus of a signal drawn on the chart.

File : Each set of data stored in a RAM card.

Input level monitor : Display of the input signal level on the LCD.

Isolation : The circuit is electrically independent for any other, and is insulated from them.

LCD : Liquid Crystal Display.

LED : Light-Emitting Diode

Line dip detector : Power supply failure detector.

Logic signal : Binary expression of the input signal consisting of high and low levels.

Low-pass filter : A filter that allows only frequencies below a certain threshold to pass.

Maximum floating voltage : Maximum voltage that can be applied between the ground terminal and an input unit.

Position : Position on the chart grid.

PT : Voltage converter

Ripple component : AC noise component.

Sampling : Conversion from an analog waveform to a digital string.

Sampling rate	: Speed at which sampling is repeated.
Scaling	: Correlation of volts to millimeters so that voltages can be recorded on a chart.
Shot length	: Total sampling length expressed in number of divisions.
Timer trigger	: Generation of trigger pulses at specified intervals after the specified starting time.
Threshold	: A level below which an analog signal is converted into a Low level digital signal, and above which it is converted into a High level digital signal.
Trigger	: Signal condition that makes operation start.
Unbalanced input	: Signal input method that uses one of the two input terminals as reference.
Word	: Digital data unit. Amount of data obtained by sampling the input signal once, converting it into digital.
XY matrix RAM	: Memory area used to display XY waveforms.

Appendix 5. Table for Key Operation

[UP] + [DOWN]	Input level monitor display
◀ + ▶ (SCROLL)	Used for setting the present hour for timer triggering, for all clear when inputting comments, for all clear when inputting file names.
⊞ + ⊟	Used as the space key when inputting comments, and as the space key when inputting file names.
◀ + ⊟	Waveform automatically scrolls to left.
▶ + ⊞	Waveform automatically scrolls to right.
◀□ + □▶ (CURSOR)	Used for automatic setting of the time axis. (MEM, XY MEM)
[FEED] + [DISP COPY]	Used for printing a list only.
[FEED] [PRINT]	Used for printing a gauge only.

A

8934

ANALOG UNIT(RMS TYPE)

INSTRUCTION MANUAL

— TABLE OF CONTENTS —

SAFETY PRECAUTIONS

- This manual contains information and precautions intended to ensure a safe operation of the unit and to keep it in a safe condition. Please read the following notes on safety before using the unit.

Safety Symbols

⚠	Refer to the related section(s) of the manual when handling a part of the unit bearing this symbol. When found in this manual, read the accompanying explanation.
⏚	Indicates a protective ground terminal.

⚠ DANGER

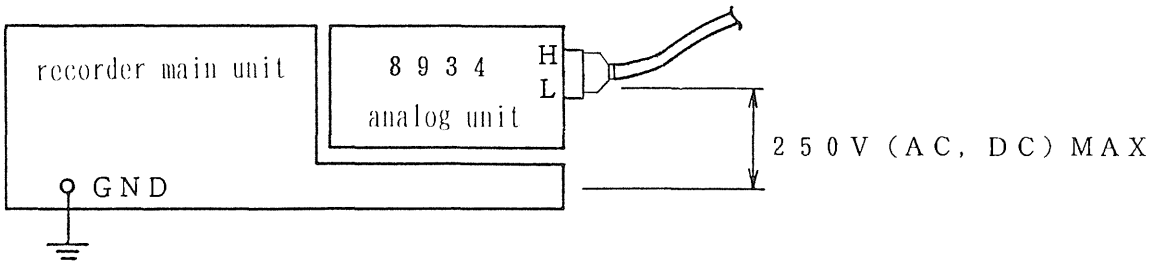
- To prevent electric shocks and unit damage, do not apply an AC or DC voltage over 250 V between an input unit and the main unit case or between input units. In particular, prevent voltage from large-current power lines from being applied. Otherwise, a short-circuit accident may occur.
- Do never connect the input terminal to an AC power line over 250 V or a ungrounded DC power line over 250 V.
- Use the unit with all input units installed. If measurement is performed with an input unit missing, you may suffer an electric shock.

CAUTION

- The maximum permissible input voltage for the input terminal is 500 Vdc, 250 Vac. Take care to avoid voltage levels this limit.
- Use only the attached 9152 input cord.

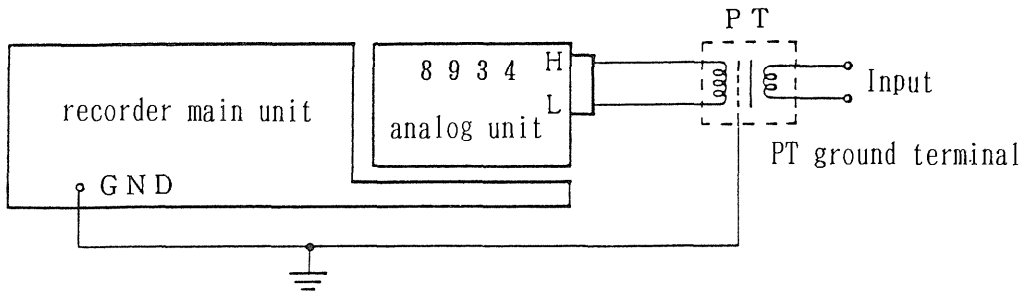
CAUTION

Recorder main unit and 8934 analog unit are mutually insulated.

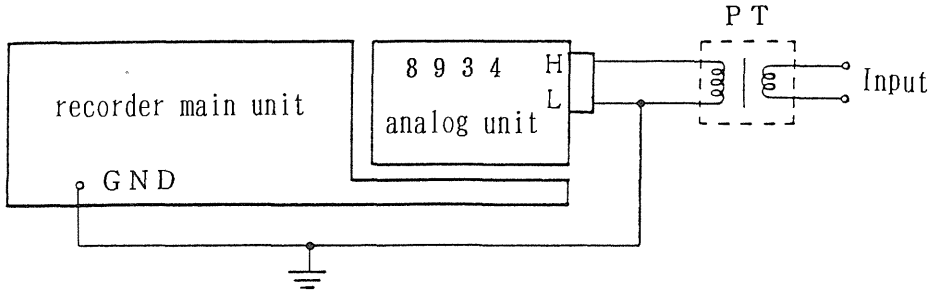


CAUTION

- Always use a PT when measuring over floating voltage.
- When using a PT for measurement of AC power lines, etc., be sure to ground it.



(a) PT with ground terminal



(b) PT without ground terminal

2. Specifications

8934 Analog Unit (at 23 ℃± 5 ℃) Accuracy assurance period : 6 months

Input method : Balanced input
(Differential input, input and output mutually insulated)

Measurement ranges : 2, 5, 10, 20, 50, 100V/DIV

DC amplitude accuracy : ± 1 % f. s.

RMS accuracy : ± 2 % f. s. (DC, 40～ 1 kHz)
± 8 % f. s. (1 kHz～100kHz } 10%～200% of effective input range

Zero position adjustment : 21 settings, placed at 10 % intervals on the 100 % recording width and fine adjustment
When the zero position is set between 0 and -100 %, input levels up to twice the set range level can be recorded in wither the DC or RMS mode. However, the input level must not exceed the rated input voltage.

Zero position accuracy : ± 1 % f. s.

Frequency characteristic : DC to 200kHz (-3dB)

RMS response time : ↑100ms (TYP.) (0 →90% f. s) ↓200ms (TYP.) (100 →10% f. s)

RMS crest-factor : 4 (The input level must not exceed the exceed the rated input voltuge in maximum peak voltage.)

Input RC : 2MΩ approx. 2pF at 100 kHz

Low-pass filter : Cutoff frequency (-3dB) approx. 5Hz, approx. 500Hz, and OFF setting
Add 100 msec to the response time when the 5Hz filter is ON (0→90% f. s., 100→10% f. s);
Add 1 msec to the response time when the 500Hz filter is ON (0→90% f. s., 100→10% f. s).

A/D conversion resolution : 8 bits

Maximum sampling speed : 500kS/s (sampling interval 2μs)

Permissible input voltage : AC 250V, DC 500V Continuous

Maximum floating voltage : AC/DC 250V (between input unit and case, and between input units)

Insulation resistance and dielectric strength : 100MΩ minimum/DC 500V, AC 1.5kV/1 minute (between input unit and case, and between input units)

Common mode masking ratio : 80dB min. (s ource impedance 100 Ωmax. at 50 or 60 Hz)

Temperature characteristic : ±0.1% f. s./ ℃ (for both zero position and gain)

Operation environment : Temperature 0℃ to 40℃ Humidity 35% to 80% (no condensation)

Storage environment : Temperature -10℃ to 50℃ Humidity 10% to 80% (no condensation)

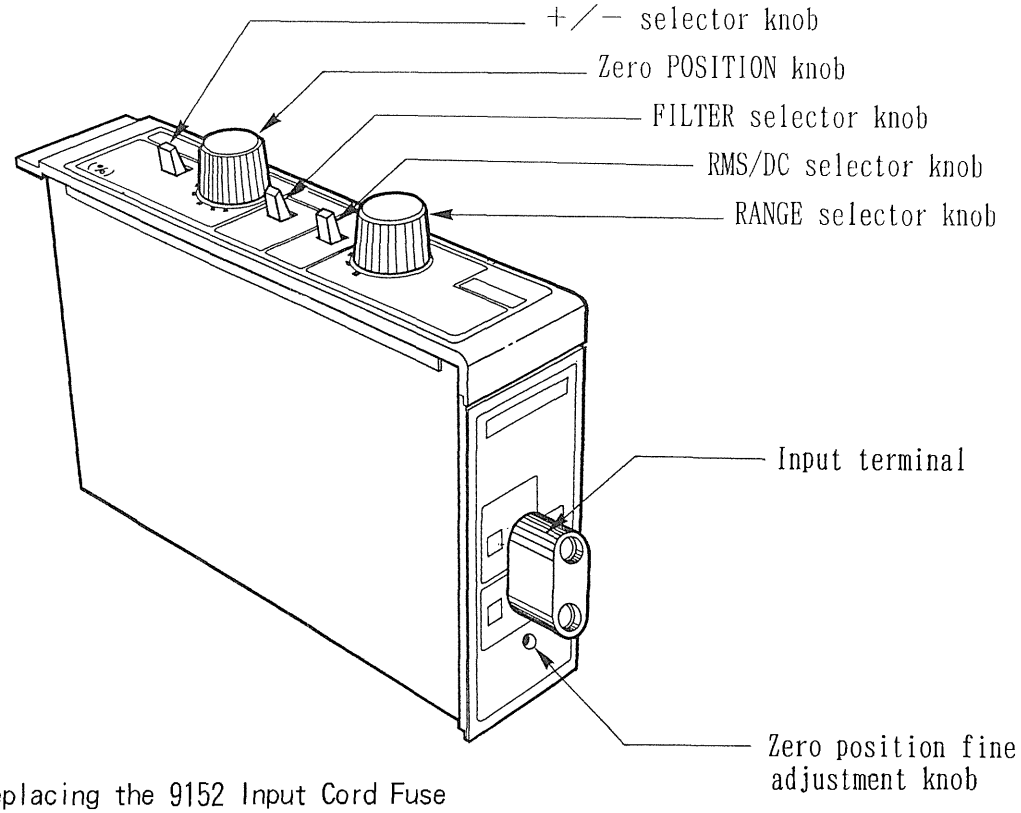
Dimensions and weight : Approx. 34H×124W×82D(mm) (excluding protrusions) ; approx. 230g

Accessories : 9152 input cord
Fixing screws of input unit 2
Spare fuse (0.5A/250V non-arcing type 5.2 dia×20mm)2

3. Outlint

This is an analog unit for the 8815 and 8830 series Memory Hi-corders. It makes it possible to use the recorder for direct recording of voltage waveforms on 200 Vac lines. It also allows recording of RMS voltage levels.

4. Part Names

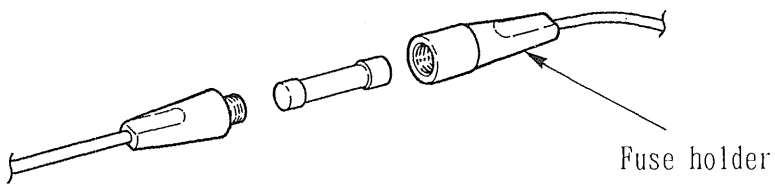


5. Replacing the 9152 Input Cord Fuse

CAUTION

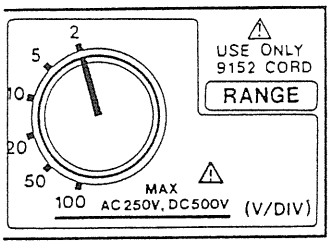
- When replacing the fuse, be sure to disconnect the input cord from both the measurement object and analog unit.
- The new fuse must be of the specified rating.

  0.5A 250V, with non-arcing type 5.2 dia × 20mm



6. Operations

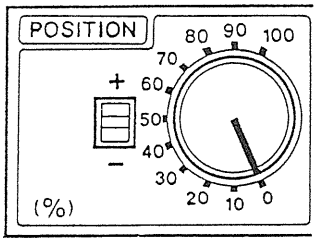
6－1. Measurement RANGE



Sets the voltage corresponding to one square (1 division) on the recording paper voltage axis. Since the voltage axis is ten-squares long, the maximum voltage that can be recorded is equal to ten times this setting.
However, the maximum voltage must not exceed 500 Vdc 250 Vac.

[Setting Range]
2 V to 100V/DIV (6 settings)

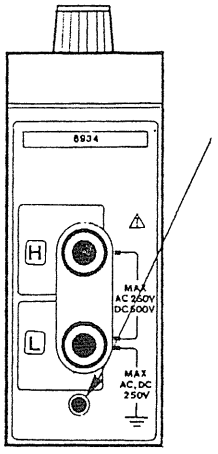
6－2. Zero POSITION



Selects the 0 V position on the recording paper.
The zero position can be set at 10% intervals over the range from 0 to+100%.

[Setting Range]

(+ side) 0 % to +100%
(− side) 0 % to -100%
} 21 settings



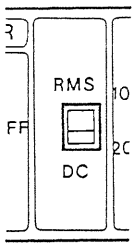
Zero position fine adjustment knob

When the zero position does not coincide with a square on the recording paper, turn the fine adjustment potentiometer with a flathead screw-driver until they align. If this adjustment does not wark, contact your dealer.

NOTE

- During waveform recording do not change the setting of the POSITION switch rapidly or set the switch to a position between the clicks. Doing so may result in display of erroneous values; however, such errors are not a sign of trouble with the instrument.

6 − 3. RMS/DC Selector



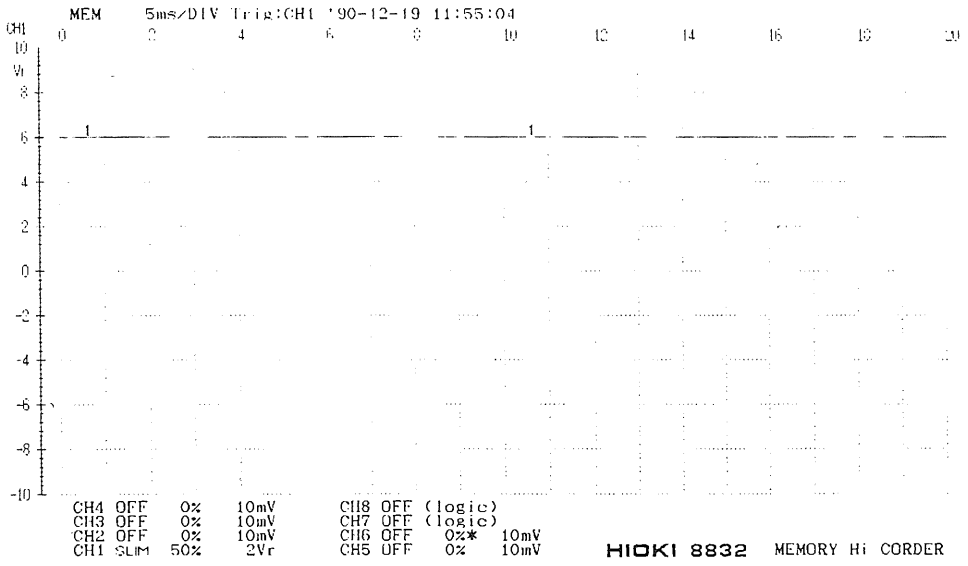
RMS : The input voltage is converted to true RMS value before recording.

DC : The input voltage is recorded as it is.

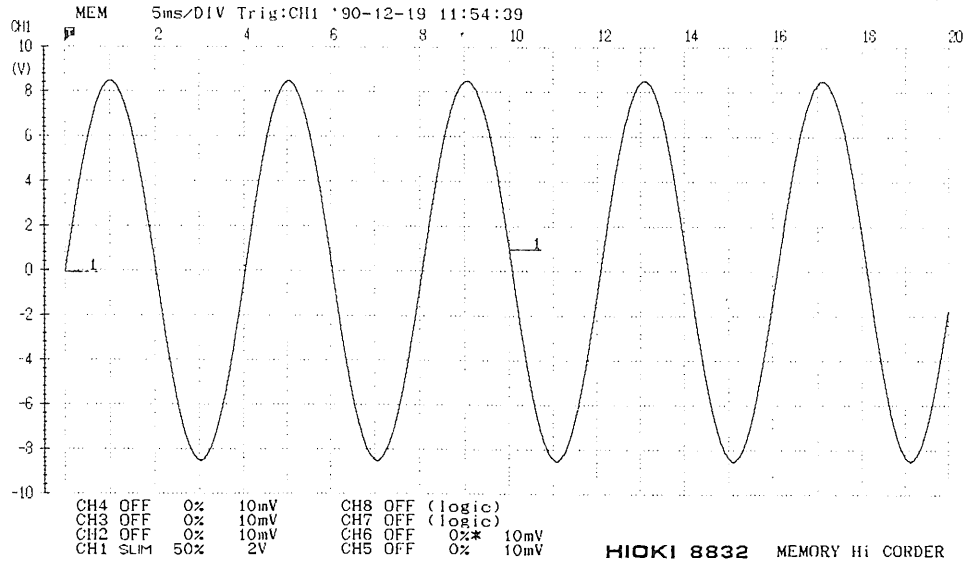
Note: The symbol Vr is displayed during RMS measurement.

[Waveform Example]

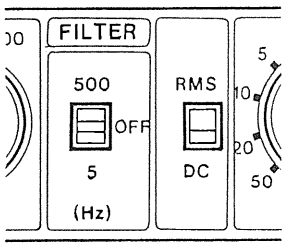
RMS mord



DC mord



6 – 4. FILTER



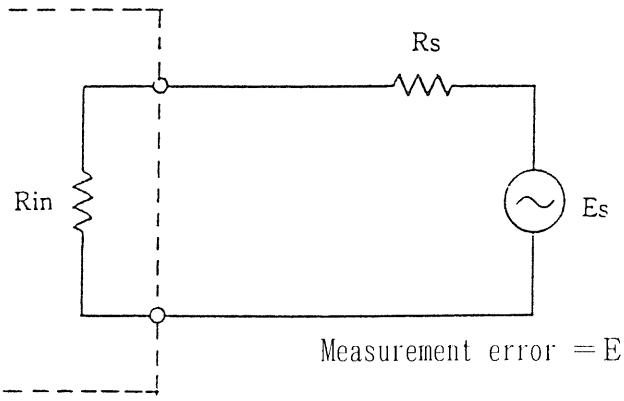
The frequency band is limited by the built-in low-pass filter.
Attenuation gradient: -6 dB/oct.
Cutoff frequency: Approx. 5 Hz/500 Hz

This filter is effective for preventing the following phenomena:

- Thickening of the recording line caused by signal ripple components and noise during level recording in the recorder mode, because of the use of high-speed sampling and a high-frequency amplifier.
- Thickening of the recording line due to ripple contained in the output from a transducer, etc.
- The filter also prevents pulse noise from affecting RMS measurements.

6 – 5. Measurement Error Due to Source Impedance

- Source impedance is not a problem when sufficiently low compared to the unit's input impedance. It affects measurement, however, if it is above a certain level.



E_S : Signal voltage
R_S : Source impedance
R_{in} : Input impedance

$$\text{Measurement error} = E_S \left(1 - \frac{R_{in}}{R_S + R_{in}} \right)$$

[Example] Since the unit's input impedance is 2MΩ, a source impedance of 10 kΩ will cause an error of approx. 0.5%.

7. Unit Replacement

The input unit removal method will be explained next. For unit installation, reverse this procedure.

① Remove input cords from all input units.

② Turn the main unit power off and unplug its power cord.

CAUTION

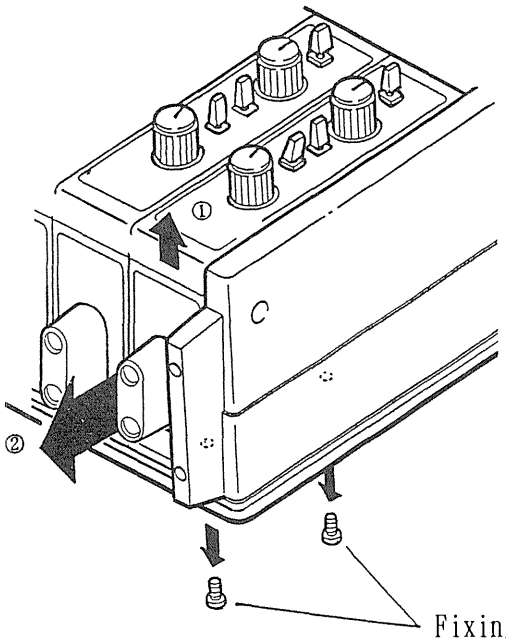
Always confirm that input cords are disconnected and turn power off before detaching the input unit.

③ Remove the two fixing screws securing the input unit with a Phillips-head screwdriver as shown in the figure.

④ Push the input unit up a little in the direction of arrow ①, then put your fingers in the gap between the input and main units and pull in the direction of arrow ② to remove.

CAUTION

When pulling the input unit off, do not force the knobs and switches on its top panel.



CAUTION

- Never use the recorder with an input unit removed. If measurement is performed with an input unit missing, you may suffer an electric shock.
- If the recorder has to be used with an input unit removed, install a 9508 blank panel (optional accessory) in its place.

B

8935

TEMPERATURE UNIT

INSTRUCTION MANUAL

— TABLE OF CONTENTS —

SAFETY PRECAUTIONS

- This manual contains information and precautions intended to ensure a safe operation of the unit and to keep it in a safe condition. Please read the following notes on safety before using the unit.

Safety Symbols

⚠	Refer to the related section(s) of the manual when handling a part of the unit bearing this symbol. When found in this manual, read the accompanying explanation.
⏚	Indicates a protective ground terminal.

⚠ DANGER

- To prevent electric shocks and unit damage, do not apply an AC or DC voltage over 250 V between an input unit and the main unit case or between input units. In particular, prevent voltage from large-current power lines from being applied. Otherwise, a short-circuit accident may occur.
- Use the unit with all input units installed. If measurement is performed with an input unit missing, you may suffer an electric shock.

The following symbols appear in the manual where wrong operation can lead to a serious accident. Always follow the directions.

⚠ Danger	Wrong operation or handling may cause danger of personal injury.
NOTE	Important matter in the operation.

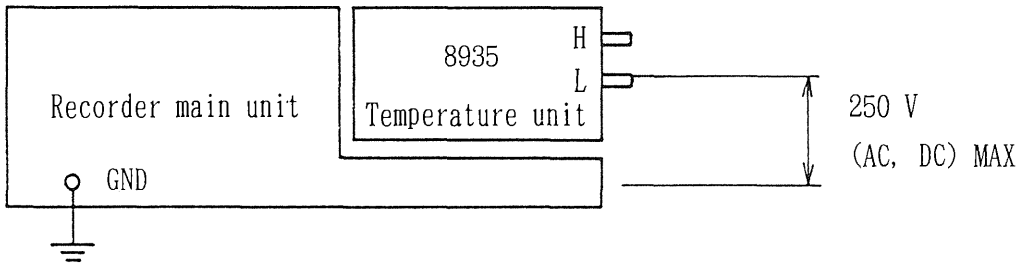
1. Safety Precautions

CAUTION

- Input of this unit is for the only thermocouple.
  Never apply any voltage except the thermocouple.
- Up to 100 V the circuit of AC and DC can be protected.
  Never apply exceeded 100 V voltage.

CAUTION

- The recorder main unit and the 8935 temperature unit are floated.



2. Specifications

8935 Temperature Unit (at 23℃±5℃) Accuracy assurance period : 6 months

Input method : Balanced input (Input and output mutually insulated)

Measurement levels : 10, 20, 50, 100℃/DIV

(Minimum resolution) : (0.4) (0.8) (2.0) (4.0℃)

Measurement input levels : K (CA) -50℃~1100℃

J (IC) -50℃~800℃

T (CC) -50℃~400℃

Standard contact compensation : Autmatic compensation (temperature IC)

Accuracy : ±1%f.s. ±2℃

(Including standard contact compensation accuracy)

Zero position adjustment : 21 settings, placed at 10% intervals on the -100% to 100% recording width.

When the zero position is set between 0 and -100%, measurement levels up to twice the set range level can be recorded. However, the input level must not exceed the rated input measurement).

Input resistance : 5MΩ approx. (OFF setting approx. 20kΩ)

Frequeucy characteristic : DC to 500Hz (-3dB, typ.)

Low poss filter : Cutoff frequency approx. 5Hz (-3dB, typ.), OFF

Response time : ↑1ms (typ.) (0 →90% f.s.)

↓1ms (typ.) (100→10% f.s.)

When low pass filter is on ↑100ms (typ.)(0→90%f.s.)

↓100ms (typ.)(100→10%f.s)

A/D conversion resolution : 8 bits

Meximum sampling speed : 50kS/s (sampling interval 20μs)

Permissible input voltage : AC/DC 100V

Maximum floating voltage : AC/DC 250V (between input unit and case, and between input units)

Insulation resistance and dielectric strength : 100MΩ minimum/DC 500V, AC 1.5kV/1 minute

Common mode masking ratio : 80dB minimum (Source impedance 100Ω maximum at 50 or 60 Hz)

Temperature characteristic : ±0.1% f.s./℃

Input terminal : Two terminals

Operation environment : Temperature 5℃ to 40℃ Humidity 70% PH maximum (no condensation)

Storage environment : Temperature -10℃ to 50℃

Humidity 70% PH maximum (no condensation)

Dimensions and weight : Approx. 34H×124W×82D(mm) (excluding protrusions) ;

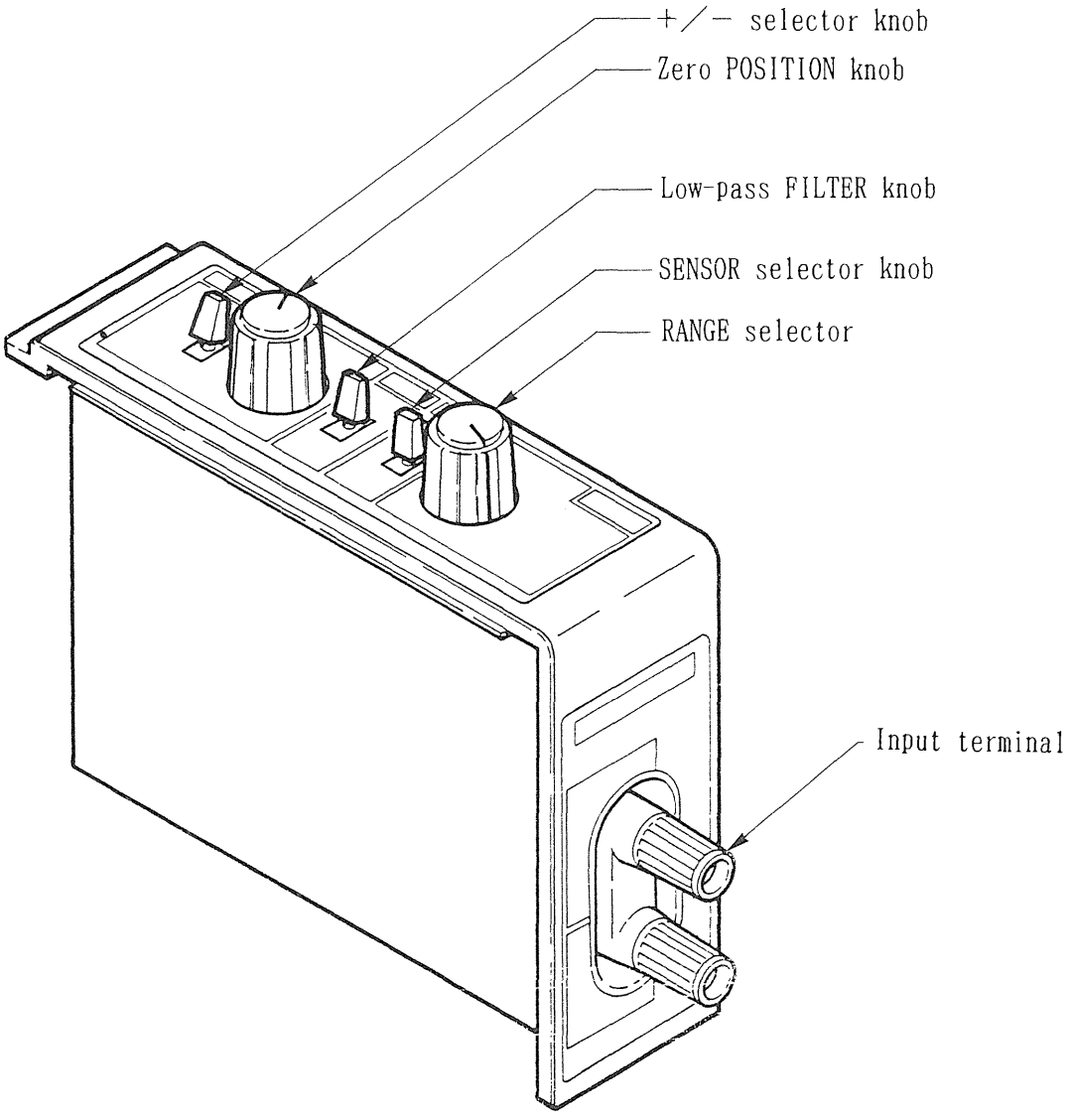
approx. 200g

Accessories : Fixing screws of input unit 2

3. Outline

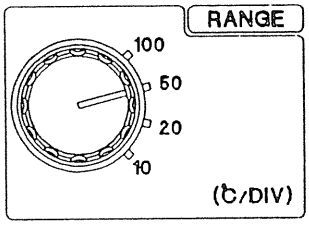
This is a thermocouple input unit for temperature measurement of the 8815 and 8830 series Memory Hi-corders. It makes it possible to use the recorder for direct connecting three kinds of temperature and temperature measurement.

4. Part Names



5. Operations

5－1. Measurement RANGE



Sets the voltage corresponding to one square (1 division) on the recording paper voltage axis. Since the voltage axis is ten-squares long, the maximum voltage that can be recorded is equal to ten times this setting.

However, if the temperature lower the measurement input range lower limit, it is recorded to the lower of the recording paper. If the temperature exceed the measurement input range higher limit, or the thermocouple is burnt out, it is recorded to the upper of the recording paper.

〔Setting range〕

10℃, 20℃, 50℃, 100℃／ＤＩＶ

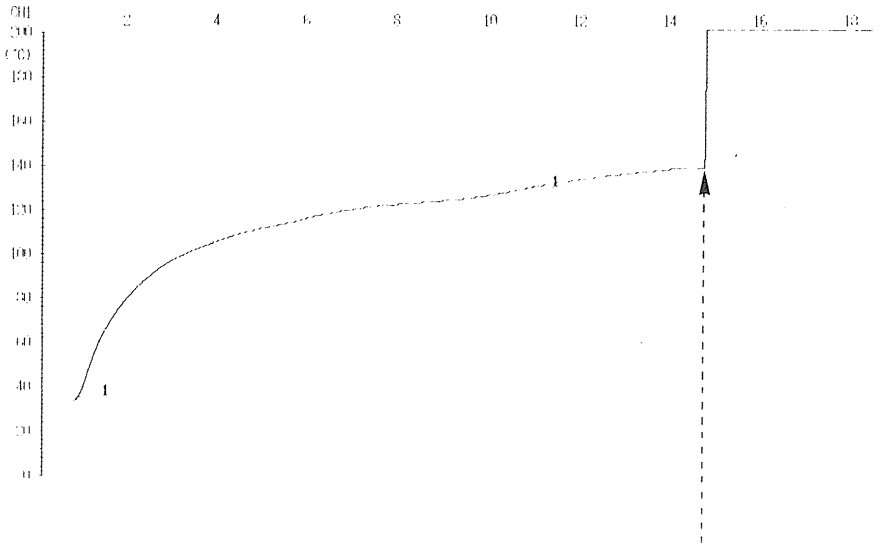
〔Measurement input range〕

Ｋ（ＣＡ）　－５０℃～１１００℃

Ｊ（ＩＣ）　－５０℃～８００℃

Ｔ（ＣＣ）　－５０℃～４００℃

〔Weveform example〕



Burnt out thermocouple

NOTE

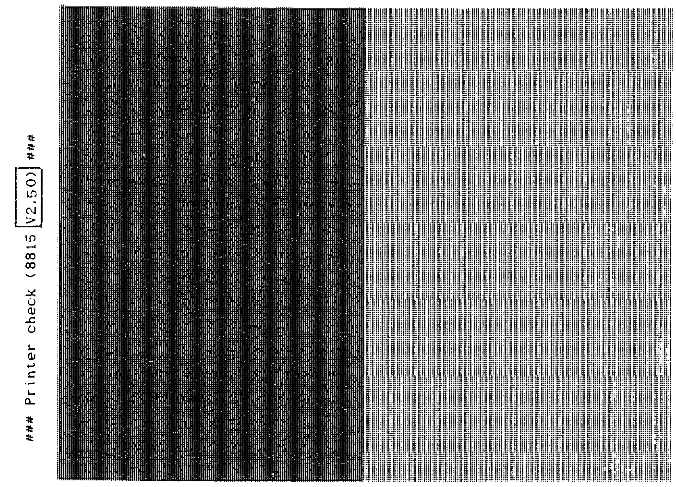
● The gauge in the 8815, 8830 series which has ROM virsion after the following are corresponded with the all measurement range. However, in the virsion before the following 8815, 8830 series, the gauge dose not correspond with 100 ℃/DIV range.

8815	V 2. 50
8830, 8831 (standard, internal GP-IB)	V 1. 50
8830, 8831 (internal RS-232C)	V 5. 50
8832, 8833	V 1. 50

Rom virsion of the 8815, 8830 series main unit is checked by the following method.

①8815 …………Turn the power on pressing PRINT key.

Display the version next Printer check



②8830, 8831, 8832, 8833……

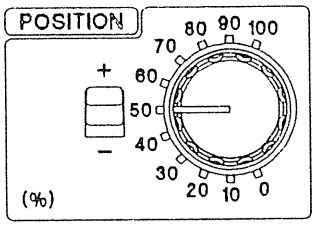
Set SYSTEM mode and check ROM/RAM.

Display a virsion next to *** ROM/RAM check ***.

(8832 example)

```
*** ROM/RAM check ***  V1.50

                        FEDCBA9876543210
  * Storage bus           oooooooooooooo    OK.
  * Bank                           ooooo    OK.
  * Work bus            oooooooooooooooo    OK.

  * ROM            OK.
  * V-RAM1         OK.
  * V-RAM2         OK.
  * Storage RAM    OK.
  * Work RAM       OK.
```

5 – 2. Zero POSITION



Selects the 0℃ position on the recording paper. The zero position can be set at 10% intervals over the range from -100%to + 100%.

〔Setting range〕

(+ side) 0 ~+100%

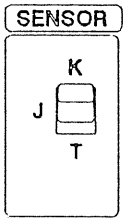
(– side) 0 ~+100%

} 21 Positions

NOTE

- During waveform recording do not change the setting of the POSITION switch rapidly or set the switch to a position between the clicks. Doing so may result in display of erroneous values; however, such errors are not a sign of trouble with the instrument.

5 – 3. Sensor selector

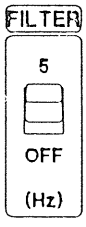


This unit corresponds three kinds of thermocouple, K(CA), J(IC), T(CC). Set the thermocouple for using.

NOTE

- If setting of the sensor selector switch and using thermocouple are different, erroneous values are displayed. Note that the sort of sensor is not displayed on the recording paper.

5 – 4. FILTER



The frequency band of the input signal is limited by built-in low-pass filter.

Attenuation gradient : –6dB/oct.

Cutoff frequency : Approx. 5Hz

This filter is effective for preventing the following phenomena.

- Influence of the ripple contained or noise of the signal in level recording (high-speed sampling) by the recorder.

6. Setting site

NOTE

- If the input terminal is exposed to a high wind, heat balance may be unstable, and it may cause an error. When making measurement in such a condition, arrange the unit or so forth to not be exposed to a high wind directly.
- Sudden changing the temperature may be cause unstable heat balance, and it may cause error. Leave around 30 minutes before making measurement.

7. Using GP-IB interface

Responded value is 6 by executing GP-IB command "QAM" (a sort of input unit).
Refer to "GP-IB interface" instruction manual for details.

8. Unit Replacement

The input unit removal method will be explained next, For unit installation, reverse this procedure.

① Turn the main unit power off and unplug its power cord.

CAUTION

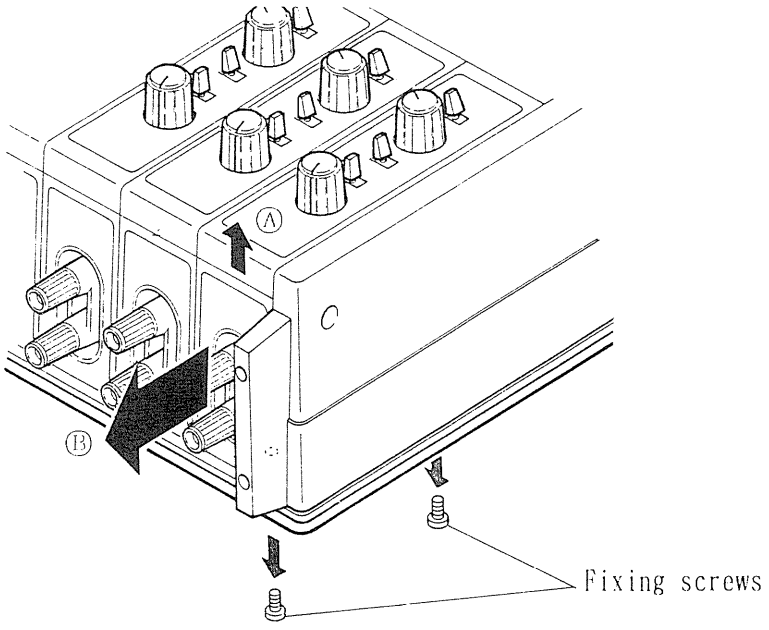
- Always confirm that input cords are disconnected and turn power off before detaching the input unit.

② Remove the two fixing screws securing the input unit a phillips + head screwdriver as shown in the figure.

③ Push the input unit up a little in the direction of arrow Ⓐ, then put your fingers in the gap between the input and main units and pull in the direction of arrow Ⓑ to remove.

CAUTION

- When pulling the input unit off, do not force the knows and switches on its top panel.



⚠ DANGER

- Never use the recorder with an input unit removed. If measurement is performed with an input unit missing, you may suffer an electric chock.
- If the recorder has to be used with an input unit removed, install a 9508 blank panel (optional accessory) in its place.

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【Q】

【R】

【S】

【Z】

A 8934 ANALOG UNIT (RMS Type)

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