HIOKI

INSTRUCTION MANUAL

8804

MEMORY HiCORDER

HIOKI E. E. CORPORATION

Contents

4
5
6
7
8
9

Introduction

Thank you for purchasing this HIOKI "8804 MEMORY HiCORDER." To get the maximum performance from the unit, please read this manual first, and keep this at hand.

Inspection

When the unit is delivered, check and make sure that it has not been damaged in transit. In particular, check the accessories, panel switches, and connectors. If the unit is damaged, or fails to operate according to the specifications, contact your dealer or HIOKI representative.

Accessories

9574 INPUT CORD	2
9232 RECORDING PAPER (roll paper)	1
Roll paper attachments	2
Instruction Manual	1

Safety

⚠WARNING **This equipment is designed to according to IEC 348 Safety Standards, and has been tested for safety prior to shipment. During high voltage measurement, incorrect measurement procedures could result in injury or death, as well as damage to the equipment. Please read this manual carefully and be sure that you understand its contents before using the equipment. The manufacturer disclaims all responsibility for any accident or injury except that resulting due to defect in its product.**

Safety symbols

This Instruction Manual provides information and warnings essential for operating this equipment in a safe manner and for maintaining it in safe operating condition. Before using this equipment, be sure to carefully read the following safety notes.

⚠	This symbol is affixed to locations on the equipment where the operator should consult corresponding topics in this manual (which are also marked with the ⚠ symbol) before using relevant functions of the equipment. In the manual, this mark indicates explanations which it is particularly important that the user read before using the equipment.
⏚	Indicates a grounding terminal.
≂	Indicates both DC (Direct Current) and AC (Alternating Current).
⎓	Indicates DC (Direct Current).

The following symbols are used in this Instruction Manual to indicate the relative importance of cautions and warnings.

⚠ DANGER	Indicates that incorrect operation presents extreme danger of accident resulting in death or serious injury to the user.
⚠WARNING	Indicates that incorrect operation presents significant danger of accident resulting in death or serious injury to the user.
⚠CAUTION	Indicates that incorrect operation presents possibility of injury to the user or damage to the equipment.
NOTE	Denotes items of advice related to performance of the equipment or to its correct operation.

Notes on Use

In order to ensure safe operation and to obtain maximum performance from the unit, observe the cautions listed below.

⚠ DANGER

- **To prevent the danger of electric shock or damage to the unit, never input more than 450 V(either AC or DC) between a pair of analog input units or between an analog input unit and the main unit.**
- **To prevent damage to the 8804, never exceed the limits in the following table for the various input connections.**

Input/output terminal	Maximum input voltage
Analog input	500 V DC＋AC peak
EXT TRIG	-5 V to ＋ 10 V
TRIG OUT	-20 V to +30 V 500 mA max 200 mW max

- **When using an AC adapter, always use the specified 9418-10 AC ADAPTER(PSA-30U-120, PHIHONG). The rated supply voltage is 100 to 240 VAC. (Voltage fluctuations of 10% from the rated supply voltage are taken into account.) The rated supply frequency is 50/60 Hz. Do not use a power supply that falls outside of this range.**

⚠

⚠WARNING

- **When using the batteries, use LR6 alkaline batteries or 9420 BATTERY PACK. In this case, do not use new batteries with old ones. Also, do not mix batteries of different types. We take no responsibility for an accident using the batteries and battery packs which are not specified.**
- **When using the 9420, always use 3 pairs of cells together. Do not use different types of batteries.**

⚠CAUTION

・The logic inputs are not floating. Although two sets of logic probes can be connected, they all have a common ground with the main unit.
・To avoid damage to the unit, do not input a voltage/current exceeding the rated maximum to the external input terminals.
・The optimal operating temperature and humidity range of the unit is 5℃ to 40℃ and 35% to 80% RH or less. Do not use the unit in direct sunlight, dusty conditions, or in the presence of corrosive gases.

NOTE

(1) Before Powering On

・Check that the correct 9418-10（PSA-30U-120, PHIHONG), 9420, or LR6 alkaline batteries are fitted.
・Be sure to connect the protective ground terminal to ground. Connect the protective ground terminal to a grounding conductor before making any other connections.
・When using an AC adapter and if properly grounded three-pin outlet is available, then using the three-core power cord provides automatic grounding.

(2) Using the Printer

- Using the printer for low-speed printing (Recorder function) in a high temperature or high humidity environment should be avoided at all costs. This can seriously reduce the printer life.
- If the recording paper is mistakenly inserted back to front, waveform recording is impossible.

(3) Recording Paper

- This unit uses a thermal printer. The recording paper supplied has characteristics finely tuned for use with the printer.
- Using recording paper of a different specification may not only result in impaired printing quality, but even prevent the printer from operating. Always use the 9232 RECORDING PAPER.

(4) Storage

If the unit will not be used for a substantial period, to protect the printer head and prevent deformation of the rubber rollers, move the head up/down lever to the head up position. If the unit is left in the state in which the head is applying pressure to the platen roller, the roller may be deformed, and the printing may become uneven.

(5) Shipment

If reshipping the unit, ensure that the recording head is in the up position and preferably use the original packing.

Chapter Summary

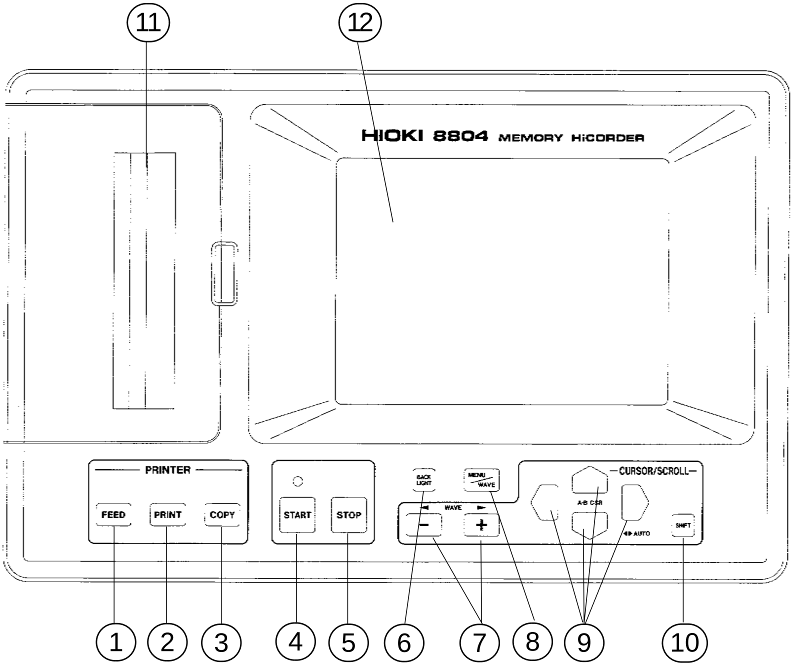
This manual consists of the following chapters.

"Introduction", "Safety", "Notes on Use" describe precautions on use, overview, and features of this unit. Be sure to read them all. Next, check the “Names and Functions of Parts" and the unit to confirm your understanding of the function.

Chapter 1	Overview Overview of the unit and its features.
Chapter 2	Specifications Specifications of the main unit, and measurement ranges.
Chapter 3	Preparation and Setup Describe preparation and setup for using the unit, loading recording paper, and important points to note during measurement.
Chapter 4	Screen Displays and Settings Describe screen displays and principal basic key operations.
Chapter 5	Basic Operation Describe the method of operation (settings, start and stop measuring, and printer operation) which is common with all function.
Chapter 6	Memory Recorder Function Mode Explain Memory recorder function mode, including examples of operation.
Chapter 7	Recorder Function Mode Explain Recorder function mode, including examples of operation.

Chapter 8	RMS Recorder Function Mode Explain RMS recorder function mode, including examples of operation.
Chapter 9	XY CONT Recorder Function Mode Explain XY CONT recorder function mode, including examples of operation.
Chapter 10	Applications Describe the A and B cursors and scrolling operations.
Chapter 11	Trigger Functions Describe the settings of trigger functions, and how to use them.
Chapter 12	System Screen Describe the system screen, and details of special function setting, the scaling function, self check function and other functions.
Chapter 13	Input Units Describe the input units, including specifications and important notes on operation.
Chapter 14	Maintenance and Service Describe maintenance, replacement of consumables, and notes on ultimate disposal.
Appendices	Describe background, error messages, glossary, and examples of waveforms for each function.

Names and Functions of Parts



Front View

① **FEED** key

While pressing this key, the recording paper is fed forward.

② **PRINT** key

Press this key to print out the waveform stored in memory.

③ **COPY** key

Press this key to print a copy of the current screen display.

④ START key

- Press this key to start measurement and analysis. During measurement, the LED is illuminated green.
- While charging the 9420 BATTERY PACK, the LED is illuminated red.

⑤ STOP key

Press this key to stop operation of the 8804.

⑥ BACK LIGHT key

- Press this key to turn the LCD back light on and off.
- When using the batteries and if any key is not pressed for about 20 seconds with the backlight on, the backlight automatically goes off.

⑦ +, − keys

- Press this key to select the measurement condition.
- Press the SHIFT key, the waveform scrolling is possible.

⑧ MENU/WAVE key

Press this key to change the screen display.

⑨ CURSOR keys

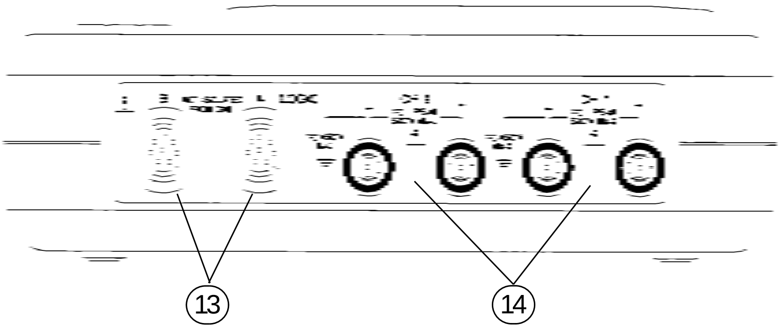
- These four keys move the flashing portion on the screen display (the flashing cursor) up, down, left, and right.
- Press the SHIFT key to move the A and B cursors.

⑩ SHIFT key

- Change the function of cursor keys and +, − keys on the waveform screen.
- Enable or disable to display the position of the waveform for the whole recording length.

⑪ Printer

⑫ LCD display screen



Right Side View

⑬ Logic probe terminals

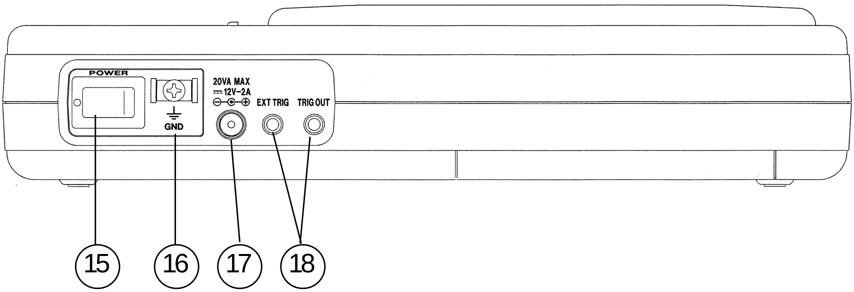
- These are the input terminals for the logic inputs, and are only to be used with the optional logic probes.
- A maximum of two logic probes can be connected (CH A, CH B).

⑭ Analog input terminals

These are input terminals for analog inputs, non-balanced input type (CH 1, CH 2).

[H] : High level input

[L] : Low level input



Lower Side View

⑮ POWER switch

Press this key to turn the power supply on and off.

⑯ Protective grounding terminal (GND)

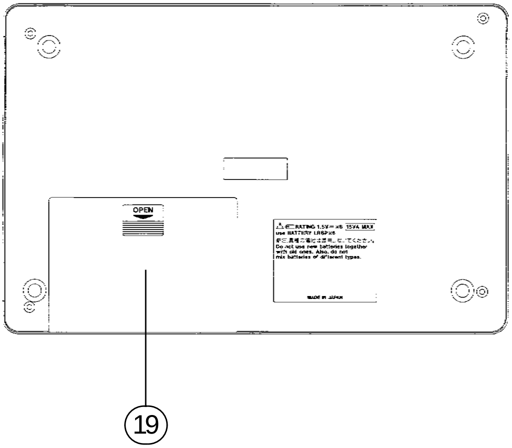
Connect to ground.

⑰ AC adapter connecting terminal

Use the specified 9418-10 AC ADAPTER(PSA-30U-120, PHIHONG).

⑱ EXT TRIG/TRIG OUT terminals

These terminals can be used to synchronize a number of the 8804 units for parallel operation.


OPEN
RATING 1.5V ⎓ x6 15VA MAX
use BATTERY LR6P x6
Do not use new batteries together
with old ones. Also, do not
mix batteries of different types.
MADE IN JAPAN
⑲

Bottom View

⑲ Battery compartment
Six LR6 alkaline batteries or the 9420 can be installed.

Chapter 1
Chapter Overview

1.1 Product Overview

The 8804 MEMORY HiCORDER is a waveform recorder that can perform observation and recording simultaneously.
It provides both analog and logic input channels, and can be used for each and every application, from low speed phenomena to high speed phenomena.

The main features of the 8804:

(1) A compact, light and portable unit

- Because the 8804 is compact and light, it is highly portable.
- The 8804 is also extremely convenient as a portable unit, since it can be powered either through an AC adapter or by batteries.

(2) Analog inputs and logic inputs

- A 8 channel logic input unit is fitted. The logic inputs all have a common ground with the main unit.
- The data for 2 channels of analog inputs and 8 channels of logic inputs can be simultaneously displayed and recorded.

(3) Powerful waveform capture capability

The 8804 can reliably capture sudden events, since it has 9-bit high resolving power, operates at the very high sampling speed of 400 kS/s, and has a maximum memory capacity of 64 K words (channel 1 only).

(4) Floating analog input units

The analog inputs are floating, and so each input can be connected to its own independent potentials.

(5) Four function modes corresponding to various types of measurement

The 8804 is provided with several function modes: a Memory recorder function mode (also providing an X-Y plot function) for reliably catching high speed phenomena such as transient phenomena; a Recorder function mode which is capable of continuous real time recording over a long time period; a X-Y CONT recorder function mode for X-Y plots; and an RMS recorder function mode which is capable of measurement of commercial power supplies voltage value by the rms value.

(6) High powered trigger capability

- A digital trigger circuit is used. Many and various settings are available, with functions such as trigger level, trigger slope or trigger filter, or types such as window-out trigger, or any other digital function.
- The trigger operation is possible at voltage drops in commercial power supplies and varying the rms value.

(7) Quick and easy to see waveform reference and observation

The unit has a 4.9 inch (320×240 dot) liquid crystal display.

(8) Recording of the required portion at the required time

- By using a fast thermal printer which has a high resolution of 10 mm/DIV, only the required portion of the recording can be taken.
- A screen copy can be easily printed at any time.

(9) High grade intelligence

The 8804 is provided with high grade auxiliary functions, such as the use of cursor measurement and a wealth of calculation functions.

(10) Scaling function

By setting the physical amount of input signal and the name of the units used, it is possible to convert measured data, which are obtained as voltage values, into values in set units.

1.2 System Operation

The following page shows a block diagram of the system.

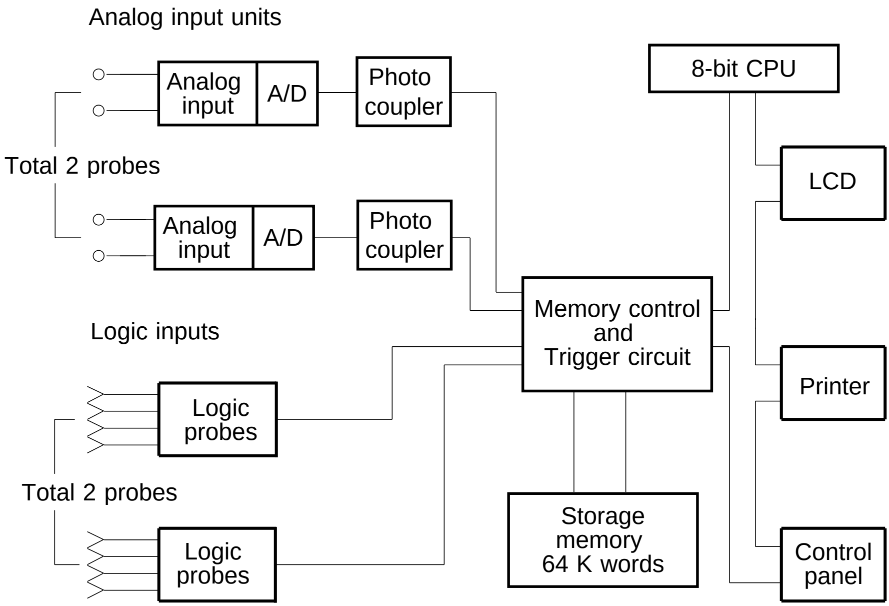
(1) The 8804 incorporates a 8-bit microcomputer (CPU), which controls the entire system.

(2) The analog input units incorporate 9-bit A/D converters, and are connected to the 8804 main unit via photocouplers. (The photocouplers are in the analog input units.) Each channel uses a separate power source, which is completely electrically insulated from the main 8804 unit.

(3) The A/D converted data is recorded in memory under control of the memory controller circuit.

(4) The 8804 main unit employs a digital trigger circuit, and in the case of an internal trigger, generates a trigger signal by comparing the digital value after A/D conversion with a set value.

(5) Measurement data stored in the memory, after being handled by the CPU, is displayed on the LCD, and is output on the graphic printer.



Block Diagram

Chapter 2
Specifications

2.1 Main Units Specifications

(For the analog inputs, refer to Chapter 13, “ Input Units.")

2.1.1 General specifications

■ Basic specification

Measurement functions	Memory recorder (high speed recording) Recorder (real time recording) RMS recorder (rms value for commercial power supplies recording) XY CONT recorder (real time continuous X-Y recording)
The number of channels	2 analog channels + 8 logic channels The logic and analog channels are both standard equipment for the 8804.
Memory capacity	64 K words (Analog 9 bits + logic 4 channels) × 64 K words/channel (when channel 1 is in use) (Analog 9 bits + logic 4 channels) × 32 K words/channel (when both channel 1 and 2 are in use)
Maximum sampling speed	400 kS/s (All channels simultaneously)
Time axis accuracy	±0.01% (difference between grid and actual time)
Operating temperature and humidity range	5℃ to 40℃ 35% to 80% RH (no condensation)

Insulation resistance and Dielectric strength	7 MΩ or more/500 VDC; one minute at 1.5 kVAC (between the main unit and the primary side of the 9418-10) 100 MΩ or more/500 VDC; one minute at 2 kVAC (between the each analog input, and between the analog input and the main unit)
Power supply	Depending on the 9418-10 AC ADAPTER (PSA-30U-120, PHIHONG) (powering at 12 VDC±10%) Rated supply voltage of the AC adapter is 100 to 240 VAC. (Voltage fluctuations of 10% from the rated supply voltage are taken into account.) Rated supply frequency is 50/60 Hz. Six LR6 alkaline batteries are used. (The AC adapter is prior to batteries when using together.) 9420 BATTERY PACK can be used.
Maximum rated power	20 VA max when using the AC adapter 15 VA max when using the batteries
Charging function	The 9420 is used. The 9420 is in the charge mode, when the AC adapter is connected and the power switch is OFF. Approx. 2 or 3 hours necessary to charge
Dimensions and mass	Approx. 245 (W) × 160 (H) × 51 (D) mm Approx. 1.2 kg

■ Recorder

Recording method	Thermosensitive recording method using a thermal line head
Printer lifetime	Withstands 5×10^7 pulses (25% printing duty factor) Wear endurance: at least 30 km
Recording paper	Roll type thermosensitive recording paper 74 mm × 10 m
Recording width	Total recording width 72 mm (576 dots) Waveform portion 60 mm f.s. (1 DIV = 10 mm, 6 DIV f.s.)
Recording speed	Approx. 2 s/cm max
Paper feed accuracy	±3%

■ Display

Screen	Approx. 4.9 inch LCD display (320 × 240 dots)
Dots spacing	0.31 × 0.31 mm

2.1.2 Trigger Unit

Trigger method	Digital comparison method
Trigger modes	In the Memory recorder function: SINGLE, REPEAT, AUTO In the Recorder function: SINGLE, REPEAT
Trigger source	Triggering ON or OFF is possible for each source of channel 1 (logic A), channel 2 (logic B), external, and timer. If all are off, the unit runs free. Trigger conditions can be set for each channel individually. With an external trigger, the triggering occurs on a falling edge of 2.5 V, or when the terminals are shorted together. With a timer trigger, the starting time, stopping time and the time interval can be set.
Trigger condition	Logical AND or OR of each trigger source
Types of trigger (analog)	Level trigger, window-out trigger, rms value level trigger, voltage drop trigger (for commercial power supplies)
Types of trigger (logic)	Pattern trigger specified by 1, 0, and × (× means that either 1 or 0 is fine.)
Trigger filter	Available The amount of filter setting possible
Trigger level resolution	1% f.s. (f.s. = 6 DIV)
Pre-trigger	0, 5, 10, 25, 50, 75, 90, 95, 100, -95% (in the Memory recorder function mode)
Trigger timing	Start and stop: Recorder, XY CONT recorder Start only: Memory recorder, RMS recorder
Trigger output	Open collector output (with 5 V output voltage, active low), pulse width 1.9 ms minimum
Trigger input and output connectors	Mini-jack (3.5 mm dia.)

2.1.3 Memory Recorder Function

Time axis (TIME/DIV)	200, 400 μs/DIV 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1, 2 min/DIV
Time axis resolution	80 line/DIV
Sampling period	1/80 of the time axis
Recording length	20, 50, 100, 200, 400 (channel 1 and 2) 800 DIV (channel 1 only)
Screen • print format	SINGLE, DUAL, XY DOT, XY LINE
Interpolation function	Available Only line display for the SINGLE and DUAL
Waveform magnification and compression ratio	×10, ×5, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50, ×1/100 (along the time axis) ×4, ×2, ×1, ×1/2 (along the voltage axis)
Waveform scrolling	Available in both the left/right and the up/down directions For the scrolling of up/down direction, change the zero position
Roll mode	ON/OFF Operating in 20 ms/DIV to 2 min/DIV
Auto-print	ON/OFF It automatically prints the memorized waveform
Manual print	Available
Partial print	Print between the A and the B cursors
Numerical print function	Record measured data as digital values

2.1.4 Recorder Function

Time axis (TIME/DIV)	200, 500 ms/DIV, 1 s/DIV (display only) 2, 5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV
Time axis resolution	80 line/DIV (with the printer)
Sampling speed	400 kS/s fixed
Recording length	20, 50, 100, 200, 400 DIV, CONT
Screen • print format	SINGLE, DUAL
Interpolation function	Line display only
Waveform magnification and compression ratio	×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50 (along the time axis) ×4, ×2, ×1, ×1/2 (along the voltage axis)
Waveform recording	Memorize and hold the last 200 DIV
Auto-print	ON/OFF Print the memorized waveform automatically (200, 500 ms/DIV, 1 s/DIV are only displayed on the screen.)
Manual print	Available
Partial print	Print between the A and B cursors
Numerical print	Record the measured data as digital values.

2.1.5 RMS recorder function

Time axis (time/div)	5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV
Time axis resolution	80 line/DIV (with the printer)
Sampling speed	4 kS/s fixed (16 rms datas/s)
RMS accuracy	±3% f.s. (at 50/60±2 Hz, DC) (f.s.=6 DIV)
Measuring object	Commercial power supplies (50/60 Hz) DC signal
Recording length	20, 50, 100, 200, 400 DIV, CONT
Screen • print format	SINGLE, DUAL
Interpolation function	Line display only
Waveform magnification and compression ratio	×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50 (along the time axis) ×4, ×2, ×1, ×1/2 (along the voltage axis)
Waveform recording	Memorize and hold the last 200 DIV
Auto-print	ON/OFF It automatically prints the memorized waveform (200, 500 ms/DIV, 1 s/DIV are only displayed on the screen)
Manual print	Available (Only the memorized data)
Partial print	Print between the A and B cursors
Numerical print function	Record the measured data as digital values

2.1.6 X-Y CONT Recorder Function

X and Y axes	X axis: channel 1, Y axis: channel 2
Sampling speed	5 kS/s (dot), 2.5 kS/s max (line)
Effective recording dimensions	60 mm × 60 mm (6 DIV × 6 DIV) with the printer
Recording time	Unlimited
Interpolation function	Available (dot, line)
Superimposition	Available
Monitor function	Monitor display on screen
Print function	Manual printing, screen copy

2.1.7 Auxiliary

Screen copy	Available
Scaling function	Available
Comment input function	Available Comment input possible for each channel (12 characters max)
Auto list • gauge	ON/OFF
Numerical calculation function	Maximum value, minimum value, peak value, average value, rms value, area value
Cursor read out	Available
Waveform back up function	Available
Setting condition storing function	Available, up to 4 Save the setting condition in file format
Starting status backup function	Available
Screen back lighting	ON/OFF Go OFF automatically when using the battery pack or LR6 alkaline batteries and printer operating.

2.1.8 A List of Optional Accessories

Accessories

9574 INPUT CORD	2
9232 RECORDING PAPER (roll paper)	1
Roll paper attachments	2
Instruction Manual	1

Accessories purchased separately

- 9232 RECORDING PAPER (10 m, 10 rolls)
- 9418-10 AC ADAPTER (PSA-30U-120, PHIHONG)
  (90 to 250 VAC free, output 12 VDC)
- 9420 BATTERY PACK (7.2 V/700 mAh)
- 9372 CARRYING CASE (for main unit and accessories)
- 9379 CARRYING CASE (can be used with this case in)
- 9305 TRIGGER CORD
  (3.5 mm dia. mini plug, approx. 1.5 m)
- 9306 LOGIC PROBE
  (4 channels, detects the ON/OFF state of a digital/contact signal)
- 9307 LINE TYPE LOGIC PROBE
  (Floating 4 channels, detects the ON/OFF state of an AC/DC voltage)
- 9010 CLAMP ON PROBE (10 to 500 A: 40 Hz to 1 kHz)
- 9018 CLAMP ON PROBE (10 to 500 A: 40 Hz to 3 kHz)
- 9132 CLAMP ON PROBE (20 to 1000 A, 40 Hz to 1 kHz)
- 9270 CLAMP ON SENSOR (20 A, 5 Hz to 50 kHz)
- 9271 CLAMP ON SENSOR (200 A, 5 Hz to 50 kHz)
- 9272 CLAMP ON SENSOR (20 A/200 A, 5 Hz to 10 kHz)
- 9277 UNIVERSAL CLAMP ON CT (20 A, DC to 100 kHz)
- 9278 UNIVERSAL CLAMP ON CT
  (200 A, DC to 100 kHz)
- 9279 UNIVERSAL CLAMP ON CT (500 A, DC to 20 kHz)
- 9555 SENSOR UNIT
  (Used with the 9270 to 9272, and the 9277 to 9279)

NOTE

The 9270 to 9272 CLAMP ON SENSORs and the 9277 to 9279 UNIVERSAL CLAMP ON CTs are used with the 9555 SENSOR UNIT. They cannot be used by themselves.

Chapter 3
Preparation and Setup

3.1 Setup

(1) AC adapter

⚠ DANGER

Always use the specified 9418-10 AC ADAPTER(PSA-30U-120, PHIHONG). The rated supply voltage of an AC adapter is 100 to 240 VAC. (Voltage fluctuations of 10% from the rated supply voltage are taken into account.) The rated supply frequency is 50/60 Hz. Do not use the unit out of this range.

NOTE The AC adapter is prior to the battery when using together.

(2) Battery

⚠WARNING

- **Use the specified 9420 BATTERY PACK or LR6 alkaline batteries. Do not use old and new batteries or batteries of different types together. The manufacturer disclaims all responsibility for any accident or injury except that resulting due to defect in its specified batteries or battery packs.**
- **The 9420 are used in sets of three. Do not use with batteries together.**
- **Do not use old and new batteries or batteries of different types together. If intend to, performance of the unit may suffer. Especially do not use the 9420 batteries together with different types.**

NOTE

- If not recharge, the 9420 can not be used.
- If the battery voltage drops while the unit is running off of battery power, the 8804 will automatically switch off the power supply. If the unit is left in this state for an extended period of time, the battery pack may be discharged too much. Be sure to turn OFF the power switch on the unit.
- When the battery capacity is reduced, the power is automatically turned off. Before turning on the power again with AC adapter or new batteries, turn the power off and leave for about 30 seconds.
- When not in use for a long time, to prevent possible corrosion caused by battery leakage, remove the batteries before storage.
- For the details on changing and charging batteries, refer to Section 14.1, "Changing the Battery" and Section 14.3, "Recharging the Battery."

Effective Battery-Powered Operating Time
(typical value at normal temperature)

Operating condition	Alkaline battery	9420 BATTERY PACK
Printer not operating (waiting for trigger, etc.)	Approx. 160 min	Approx. 90 min
Printer operating recorder function 2 s/DIV 1 Hz sinewave	Approx. 90 min	Approx. 50 min

NOTE

Actual performance will change from values indicated in this table according to the types of batteries, temperature, and printing rate.

(3) Protective grounding (GND)

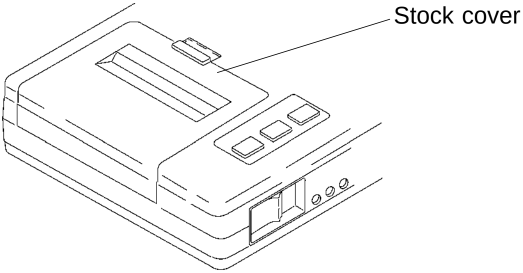
- When using the AC adapter and if a grounded power plug cannot be used, connect the unit to a proper ground.
- Be sure to ground the 8804 properly even when using batteries.

(4) Environment for use

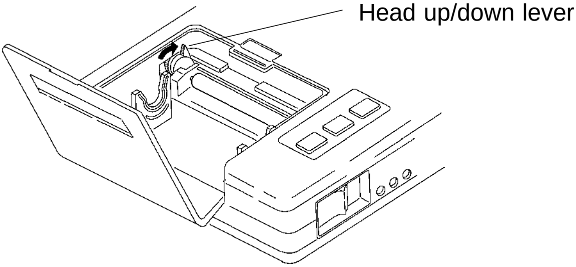
The operating temperature and humidity range for the 8804 is 5℃ to 40℃ and 35% to 80% RH. Also, do not expose the unit to direct sunlight, dust, or corrosive gas.

3.2 Loading Recording Paper

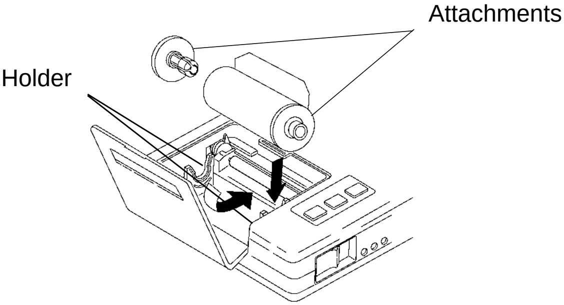
(1) Pull the stock cover to open.



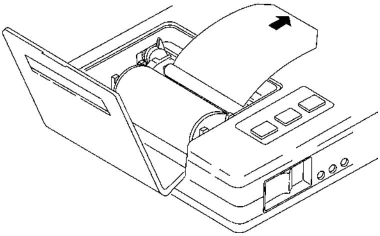
(2) Raise the head up/down lever.



(3) Insert the attachments into the hole of the roll of 9232 RECORDING PAPER. Insert the leading edge of the paper from under into the gap behind the printer roller, and pull it out upward.



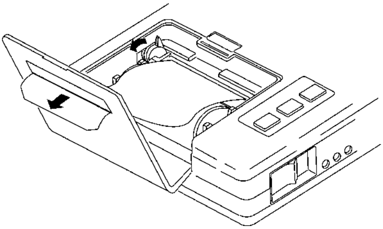
(4) Set the paper into its holder and pull it out about 10 cm, and make sure that it is positioned quite straight.



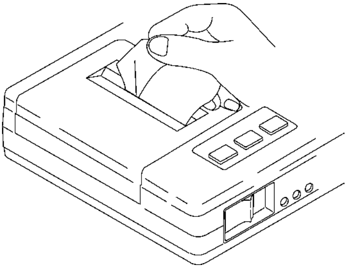
NOTE There is a possibility of a paper jam if the recording paper is slanted against to the roller. Be sure to set the paper correctly.

(5) Put down the head up/down lever.

(6) Pull the recording paper to the outside through the printer exit slot in the stock cover.



(7) Close the stock cover, and finish by tearing off the recording paper at the edge of the printer exit slot.



NOTE

- Always put the unit in the head up condition when it is to be transported or stored for a long period of time. If the unit is left in the state in which the head is applying pressure to the platen roller, the roller may be deformed, and the printed characters may become uneven.
- If the recording paper is set in back to front by mistake, the waveform cannot be drawn. Make sure to set the paper correctly.
- This unit uses a thermal printer. The recording paper supplied has characteristics finely tuned for use with the printer.
- Using recording paper of a different specification may not only result in impaired printing quality, but even prevent the printer from operating. Always use the HIOKI specified product.

3.3 Care of Recording Paper

- Thermosensitive recording roll paper which until use is kept in normal conditions will not be affected by the environment. However the paper should not be kept for a long time at a temperature higher than 40℃. Low temperatures cause no problems.
- There is a tendency for the texture of the paper to be discolored if the paper is strongly illuminated for a long time. Therefore, after taking off the wrapping paper be careful not to leave the roll paper in strong light.

3.3.1 Storing data

The recording paper uses a thermochemical reaction.

Note the following points:

- To avoid discoloration, do not leave recording paper in direct sunlight.
- Store at not more than 40℃ and 90% RH or less.
- To keep definitive data, make photocopies of the recordings.
- Thermal paper changes color if it comes into contact with organic solvents such as alcohols, esters, and ketones.
- If the thermal paper absorbs an organic solvent such as alcohols or ketones it may no longer develop properly, and recorded information may fade. Soft PVC film and transparent contact adhesive tape contain such solvents, so avoid using them with recordings.
- Avoid interleaving the thermal recordings with damp diazo copies.

3.4 During Measurement

⚠ DANGER

- **The maximum rated voltage at the input terminals of the analog input is 500 V (DC + AC peak). In order to avoid electric shock accident and damage to the unit, do not exceed this range.**
- **The maximum floating voltage for the analog inputs is 450 V AC/DC. In order to avoid an electric shock accident and damage to the unit, do not input voltage in excess of these limitations, either between any two channels, or between a channel and the main unit.**

⚠WARNING

The logic inputs and the 8804 have a common ground. When measuring input which has different reference potential, beware of electric shock.

Chapter 4
Screen Displays and Settings

4.1 Screen Displays

For each function the screen displays can be divided into three screens: waveform, status, and trigger; and there are also three system screens. The Memory recorder function mode also has a numerical calculation screen.

4.2 Types of Screen Display

(1) The status (stts) screen

The general settings, such as time axis and recording length, can be set.

(2) The trigger (trig) screen

The trigger condition can be set.

(3) The waveform screen

This is the screen for displaying the measurement results. The main setting items can be also set in this screen.

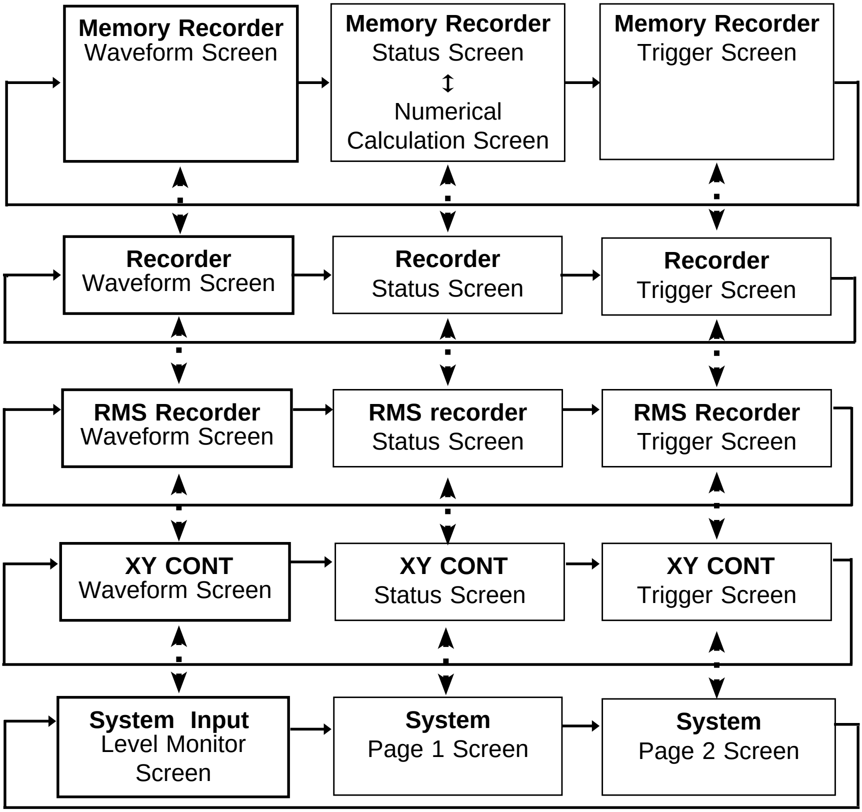
(4) The system (SYSTEM) screen

System screen contains 3 screens: Input level Monitor screen, Page 1 screen, and Page 2 screen.
Input level monitor screen displays level monitor.
In page 1 screen, system variable, comment setting, and clock setting are performed.
In page 2 screen scaling, saving the setting condition, and each checking are performed.

(5) The numerical calculation screen (Memory recorder)

The numerical measurement is performed.

4.3 Screen Configuration


Memory Recorder Waveform Screen
Memory Recorder Status Screen ↕ Numerical Calculation Screen
Memory Recorder Trigger Screen
Recorder Waveform Screen
Recorder Status Screen
Recorder Trigger Screen
RMS Recorder Waveform Screen
RMS recorder Status Screen
RMS Recorder Trigger Screen
XY CONT Waveform Screen
XY CONT Status Screen
XY CONT Trigger Screen
System Input Level Monitor Screen
System Page 1 Screen
System Page 2 Screen

→ : Press the **MENU/WAVE** key, and the screen displays change in the arrow direction.

⇕ : Press the + key after moving the flashing cursor to the function item, the function changes in the lower direction, and also press − key, the function changes in the upper direction.

↕ : Press the + key after moving the flashing cursor to the numerical calculation screen, it changes to the numerical calculation screen. (Refer to Section 6.7, “ Numerical Calculation.")

4.4 Changing the waveform, status, trigger, and system screens

Method

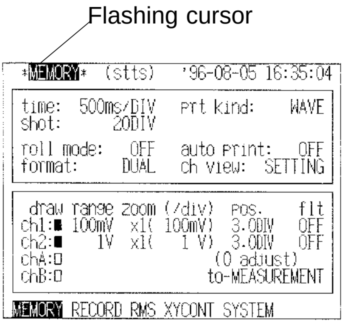
Press the **MENU/WAVE** key, and the screen display changes as shown in the Screen Configuration in the previous page.

NOTE Press the **START** key, the measurement will start on any screen except the system screen, and changes to the waveform screen.

4.5 Function Changing

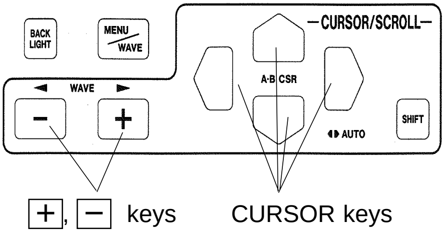
Method

1. Using the CURSOR keys, move the flashing cursor to the function item.
2. Select the function by using the + and − keys.
   These functions are basic measurement function, and there are the Memory recorder, Recorder, RMS recorder, and X-Y CONT recorder functions.



Flashing cursor

```
 *MEMORY*  (stts)   '96-08-05 16:35:04

time:  500ms/DIV   prt kind:    WAVE
shot:      20DIV

roll mode:   OFF   auto print:   OFF
format:     DUAL   ch view:  SETTING

 draw range zoom (/div)  pos.    flt
ch1:■ 100mV  x1( 100mV)  3.0DIV  OFF
ch2:■    1V  x1(   1 V)  3.0DIV  OFF
chA:□                 (0 adjust)
chB:□              to-MEASUREMENT
MEMORY RECORD RMS XYCONT SYSTEM
```



NOTE Turn on the power supply with pressing the **SHIFT** key. The language to be displayed can be changed. (JAPANESE to ENGLISH)

Chapter 5
Basic Operation

5.1 Setting Method

By using the CURSOR keys, + and − keys, and MENU/WAVE key, all settings can be made.

5.1.1 Setting Procedure

(1) Using the MENU/WAVE key, change the screen display to the screen of setting item.

(2) Using the CURSOR keys, move the flashing cursor to the item to be set.

(3) Using the +, − keys, select or change the settings.

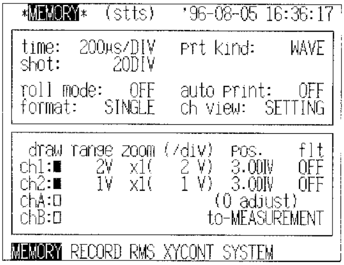
NOTE

- When making a setting on the screen except the waveform screen, the selectable setting contents are displayed on the lower screen.
- On the waveform screen if the SHIFT key is pressed (the SHIFT mark indication), the setting can not be changed by using the CURSOR keys and +, − keys. Release the SHIFT key so that the mark indication goes out.

5.1.2 Example Settings

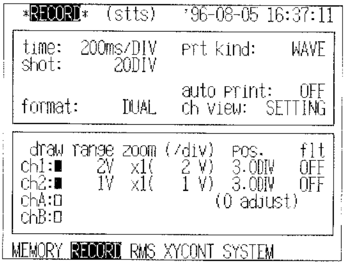
Settings for Recorder function on the status (stts) screen.

(1) Press the MENU/WAVE key, and select the status screen (stts).



```
*MEMORY* (stts)   '96-08-05 16:36:17
time:  200µs/DIV   prt kind:    WAVE
shot:      20DIV
roll mode:   OFF   auto print:   OFF
format:   SINGLE   ch view:  SETTING

 draw range zoom (/div)  pos.   flt
ch1:■    2V  x1(  2 V)  3.0DIV  OFF
ch2:■    1V  x1(  1 V)  3.0DIV  OFF
chA:□              (0 adjust)
chB:□             to-MEASUREMENT
MEMORY RECORD RMS XYCONT SYSTEM
```

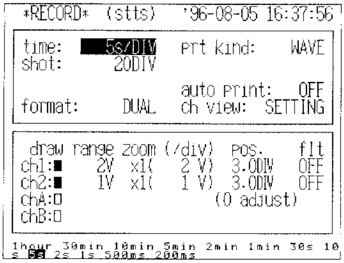
(2) Set the function to RECORD.



```
*RECORD* (stts)   '96-08-05 16:37:11
time:  200ms/DIV   prt kind:    WAVE
shot:      20DIV
                   auto print:   OFF
format:     DUAL   ch view:  SETTING

 draw range zoom (/div)  pos.   flt
ch1:■    2V  x1(  2 V)  3.0DIV  OFF
ch2:■    1V  x1(  1 V)  3.0DIV  OFF
chA:□              (0 adjust)
chB:□
MEMORY RECORD RMS XYCONT SYSTEM
```

1. Using the CURSOR keys, move the flashing cursor on the function item.
2. By using the + and − keys, select "RECORD"

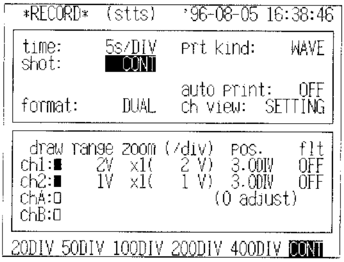
(3) Set the time axis range to 5 s/DIV.



```
*RECORD* (stts)   '96-08-05 16:37:56
time:    5s/DIV   prt kind:    WAVE
shot:      20DIV
                   auto print:   OFF
format:     DUAL   ch view:  SETTING

 draw range zoom (/div)  pos.   flt
ch1:■    2V  x1(  2 V)  3.0DIV  OFF
ch2:■    1V  x1(  1 V)  3.0DIV  OFF
chA:□              (0 adjust)
chB:□
1hour 30min 10min 5min 2min 1min 30s 10
s 5s 2s 1s 500ms 200ms
```

1. Using the CURSOR keys, move the flashing cursor to time.
2. By using the + and − keys, set to "5 s/DIV"

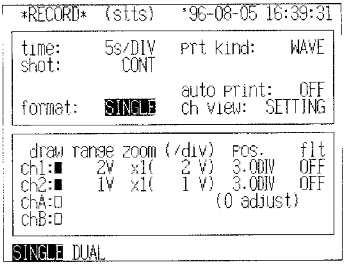
(4) Set the recording length to CONT.



```
 *RECORD*  (stts)   '96-08-05 16:38:46
 time:       5s/DIV   prt kind:    WAVE
 shot:         CONT
                      auto print:   OFF
 format:       DUAL   ch view:  SETTING

  draw range zoom (/div)  pos.     flt
 ch1:■    2V  x1(   2 V)  3.0DIV   OFF
 ch2:■    1V  x1(   1 V)  3.0DIV   OFF
 chA:□                 (0 adjust)
 chB:□
 20DIV 50DIV 100DIV 200DIV 400DIV CONT
```

1. Using the CURSOR keys, move the flashing cursor to shot.
2. By using the + and – keys, set to "CONT".

(5) Set the screen setting to single (SINGLE).



```
 *RECORD*  (stts)   '96-08-05 16:39:31
 time:       5s/DIV   prt kind:    WAVE
 shot:         CONT
                      auto print:   OFF
 format:     SINGLE   ch view:  SETTING

  draw range zoom (/div)  pos.     flt
 ch1:■    2V  x1(   2 V)  3.0DIV   OFF
 ch2:■    1V  x1(   1 V)  3.0DIV   OFF
 chA:□                 (0 adjust)
 chB:□
SINGLE DUAL
```

1. Using the CURSOR keys, move the flashing cursor to format.
2. By using the + and – keys, set to "SINGLE".

Set the rest of items following the same procedures above.

5.2 Basic Setting Items of Each Function

Function Selection	Memory recorder	Recorder	RMS recorder	X-Y CONT recorder
(1) Time axis range	●	●	●	–
(2) Magnification/compression along the time axis range	●	○	○	–
(3) Recording length	●	●	●	–
(4) Screen setting (format)	●	●	●	–
(5) Frequency	–	–	●	–
(6) Waveform clear	–	–	–	●
(7) Line style	–	–	–	●
(8) Channel information	●	●	●	●
(9) Waveform display	●	●	●	–
(10) Voltage axis (X, Y axis) range	●	●	●	●
(11) Input coupling	●	●	●	●
(12) Magnification/ compression along the voltage axis range	●	●	●	●
(13) Position	●	●	●	●
(14) Filter	●	●	●	●
(15) Trigger setting	●	●	●	●
(16) Print types	●	●	●	–
(17) Roll mode	●	–	–	–
(18) Automatic printing	●	●	●	–
(19) Numerical calculation	●	–	–	–
(20) Zero adjust	●	●	●	●

●: setting possible, —: cannot be set, ○: partly possible

(1) Time axis range

Show the time interval along the time axis direction for 1 DIV (a scale of the recording paper).

Selection

Memory recorder	200, 400 μs/DIV 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1, 2 min/DIV
Recorder	200, 500 ms/DIV, 1 s/DIV (Display only) 2, 5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV
RMS recorder	5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV

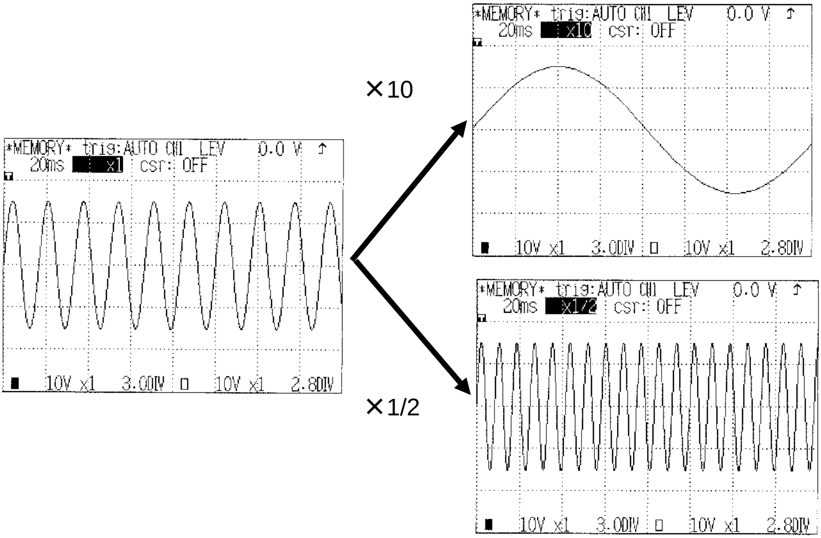
NOTE In the Memory recorder function, the sampling period is 1/80th of the set value for the time axis range.

(2) Magnification/compression along the time axis

- Set the magnification/compression ratio along the time axis.
- By magnifying the waveform, detailed observations is possible. By compressing the waveform, an entire change can be promptly apprehended.
- In the Recorder and RMS recorder function modes, the magnification setting is not possible.
- The waveform is magnified or compressed from the end of the left on the screen.

Selection

Memory recorder	×10, ×5, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50, ×1/100
Recorder RMS recorder	×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50


×10
×1/2
MEMORY trig:AUTO CH1 LEV 0.0 V ↑
20ms x1 csr: OFF
10V x1 3.0DIV 10V x1 2.8DIV
MEMORY trig:AUTO CH1 LEV 0.0 V ↑
20ms x10 csr: OFF
10V x1 3.0DIV 10V x1 2.8DIV
MEMORY trig:AUTO CH1 LEV 0.0 V ↑
20ms x1/2 csr: OFF
10V x1 3.0DIV 10V x1 2.8DIV

(3) Recording length

The length of recording for one measurement operation (number of DIV) can be set.

Selection

Memory recorder	20, 50, 100, 200, 400 DIV (channel 1, 2) 800 DIV (channel 1 only)
Recorder RMS recorder	20, 50, 100, 200, 400 DIV, CONT

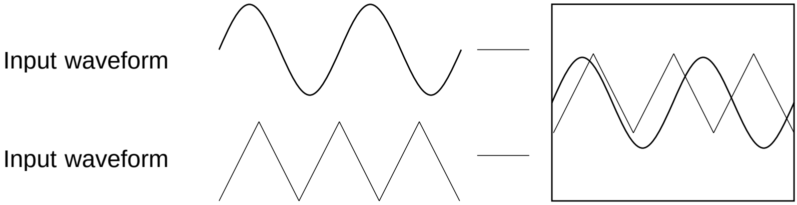
(4) Screen setting

- The style can be set for showing input signal waveforms on the screen display and recording them on the printer.
- The styles SINGLE and DUAL are available. X-Y DOT and X-Y LINE are available only in the Memory recorder function.

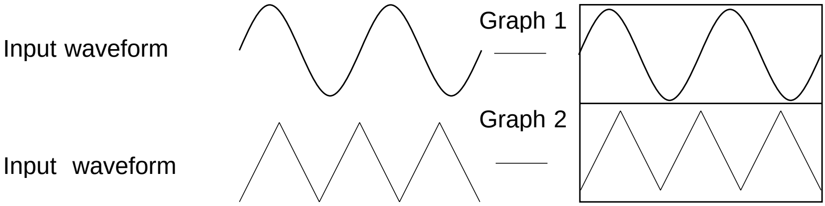
Selection

Memory recorder	SINGLE, DUAL, X-Y DOT, X-Y LINE
Recorder RMS recorder	SINGLE, DUAL

1. SINGLE
   Display and record as one graph (2 analog signals and 8 logic signals max).

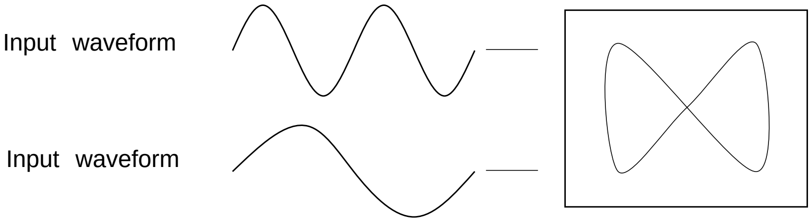


2. DUAL
   - Display and record as two graphs (on each graph, an analog signal and 4 logic signals max).
   - Input waveform for channel 1(A) is displayed on the graph 1, and the data for channel 2(B) is displayed on the graph 2.



3. X-Y DOT, X-Y LINE

- Display the X-Y combination of waveforms. (Refer to Section 6.6, " Using X-Y Waveform Plots.")
- The channel 1 is X-axis and the channel 2 is Y axis.
- Display and record as one graph.



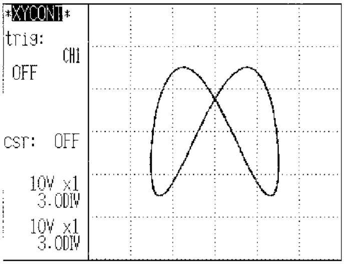
NOTE The difference between X-Y DOT and X-Y LINE is whether linear interpolation is performed or not.

(5) Frequency (RMS recorder only)

Set the frequency of commercial power supplies (50/60 Hz).

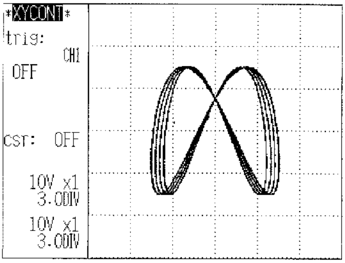
(6) Waveform clear (X-Y CONT recorder only)

- It sets whether clear the waveform or not when pressing the **START** key to start measurement and the previous waveform is left.
- If the waveform is not cleared, the waveform is superimposed.



XYCONT
trig: CH1 OFF
csr: OFF
10V x1 3.0DIV
10V x1 3.0DIV

Waveform clear: ON

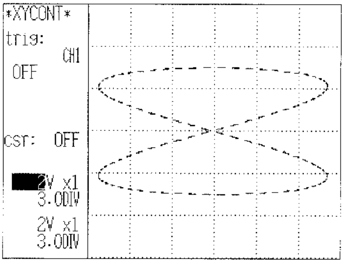


XYCONT
trig: CH1 OFF
csr: OFF
10V x1 3.0DIV
10V x1 3.0DIV

Waveform clear: OFF

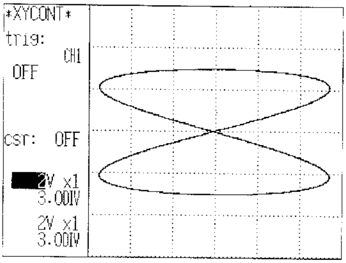
(7) Line style (X-Y CONT recorder only)

It sets to display and record the input signal (the sampled data) either just as it is, or after subjecting it to linear interpolation.



Dot display

- Linear interpolation is not performed.
- The sampled data is faithfully displayed just as it comes.



Line display

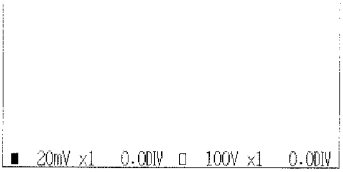
- Linear interpolation is performed.
- The display is easier on the eye.

(8) Channel information

It displays the information of the input setting or upper and lower limit values on the waveform screen.

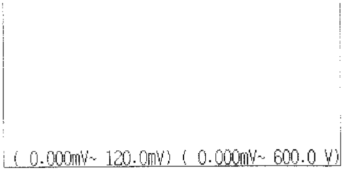
Selection

SETTING	It displays the setting items, such as waveform displays and the voltage axis range, of the input.
UP & LOW	It displays the range of the voltage value. (Upper and lower limit value).



■ 20mV x1 0.0DIV □ 100V x1 0.0DIV

SETTING

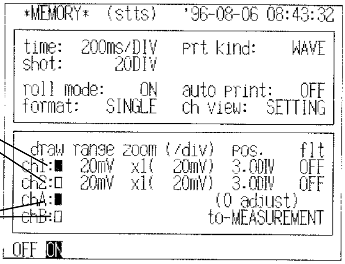


(0.000mV~ 120.0mV) (0.000mV~ 600.0 V)

UP & LOW

(9) Waveform display

It sets the channel to be displayed or recorded to ON (■) or OFF (□).



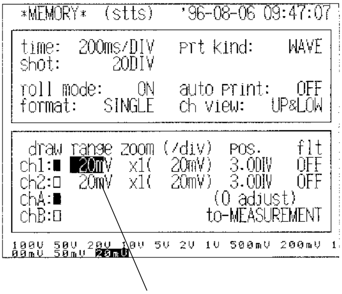
```
 *MEMORY*  (stts)   '96-08-06 08:43:32

 time:  200ms/DIV   prt kind:    WAVE
 shot:       20DIV
 roll mode:     ON  auto print:   OFF
 format:   SINGLE   ch view:  SETTING

  draw range zoom (/div)  pos.    flt
 ch1:■  20mV  x1(  20mV)  3.0DIV  OFF
 ch2:□  20mV  x1(  20mV)  3.0DIV  OFF
 chA:■                 (0 adjust)
 chB:□               to-MEASUREMENT
 OFF ON
```

Analog channel 1, 2

Logic channel A, B

(10) Voltage axis (X, Y axis) range

- Set the voltage value for 1 DIV along the voltage axis direction (vertically).
- The channel 1 is shown along the X axis and the channel 2 is shown along the Y axis (at X-Y plot).



```
 *MEMORY*  (stts)   '96-08-06 09:47:07

 time:  200ms/DIV   prt kind:    WAVE
 shot:       20DIV
 roll mode:     ON  auto print:   OFF
 format:   SINGLE   ch view:  UP&LOW

  draw range zoom (/div)  pos.    flt
 ch1:■  20mV  x1(  20mV)  3.0DIV  OFF
 ch2:□  20mV  x1(  20mV)  3.0DIV  OFF
 chA:■                 (0 adjust)
 chB:□               to-MEASUREMENT
 100V 50V 20V 10V 5V 2V 1V 500mV 200mV 1
 00mV 50mV 20mV
```

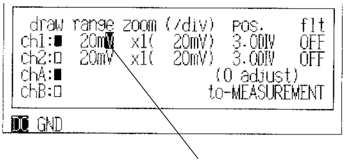
Flashing cursor

Selection

Memory recorder Recorder	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50 V/DIV 100 V/DIV
RMS recorder	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50 V/DIV

(11) Input coupling

It sets the coupling condition of the input signal.



```
 draw range zoom (/div)  pos.   flt
ch1:■  20mV  x1(  20mV) 3.0DIV  OFF
ch2:□  20mV  x1(  20mV) 3.0DIV  OFF
chA:■                (0 adjust)
chB:□             to-MEASUREMENT
DC GND
```

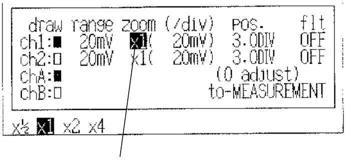
Flashing cursor

Selection

DC (V)	The input signal is directly connected to the input amplifier. This allows a DC component to be measured.
GND (⏚)	The input signal is not connected. This allows the zero position to be checked.

(12) Magnification/compression along the voltage axis range

For each channel, set the magnification/compression ratio along the voltage axis.



```
 draw range zoom (/div)  pos.   flt
ch1:■  20mV  x1(  20mV) 3.0DIV  OFF
ch2:□  20mV  x1(  20mV) 3.0DIV  OFF
chA:■                (0 adjust)
chB:□             to-MEASUREMENT
x½ x1 x2 x4
```

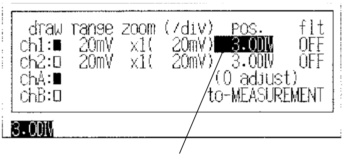
Flashing cursor

Selection

Memory recorder Recorder RMS recorder	×4, ×2, ×1, ×1/2

(13) Position

- Set the zero position for each channel.
- When the magnification/compression ratio is set to ×1, the selections are from -0.4 DIV to 6.4 DIV. Refer to the table on the next page for other selections.
- When the position setting is 3 DIV, 0 V appears at the center of the screen (50% position).
- When the magnification/compression ratio is set to ×1, if set the position to 0 DIV, 0 V appears at the 0% position of the screen, and if set the position to 6 DIV, 0 V appears at the 100% position of the screen.
- The range for the position varies according to the magnification/compression ratio along the voltage axis.



```
 draw range zoom (/div)  pos.    flt
ch1:■  20mV  x1(  20mV) 3.0DIV   OFF
ch2:□  20mV  x1(  20mV) 3.0DIV   OFF
chA:■                  (0 adjust)
chB:□                  to-MEASUREMENT
3.0DIV
```

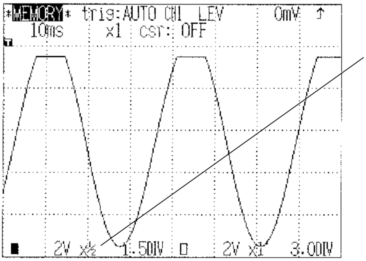
Flashing cursor

Magnification/ compression ratio	×1/2, ×1	×2	×4
Position (DIV)	-0.4 to 6.4	-6.8 to 12.8	-19.6 to 25.6

(DIV)

NOTE

If the applied voltage to the analog inputs exceeds the maximum input voltage, at ×1/2 compression setting, the waveform is displayed as figure below. Change the voltage axis range.



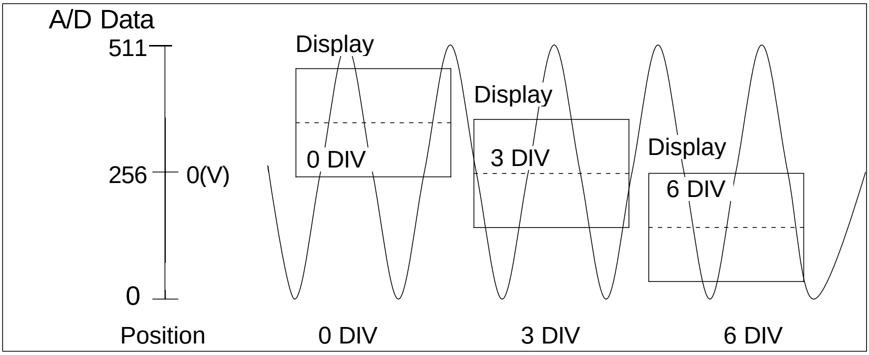
MEMORY trig:AUTO CH1 LEV 0mV ↑
10ms x1 csr: OFF
■ 2V x½ 1.5DIV □ 2V x1 3.0DIV

Magnification/compression ratio

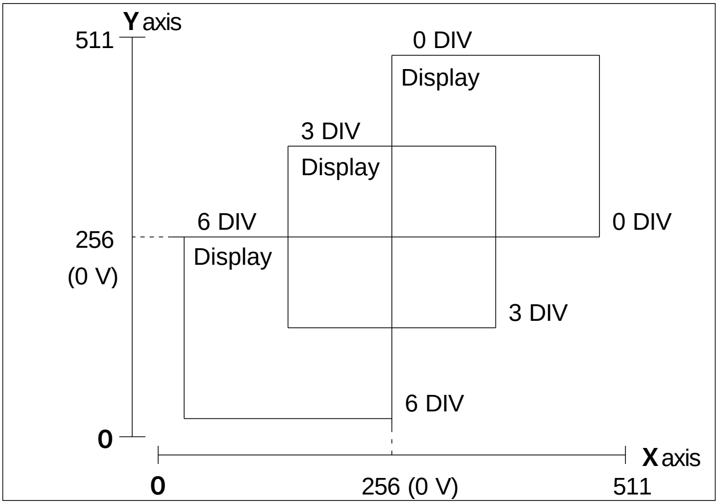
NOTE

The position has the significance shown in the figure below. It is possible to display the hidden portion of the waveform, according to the relative position of the displayed section at which 0 V appears.

Time axis waveform



The X-Y combination of waveforms

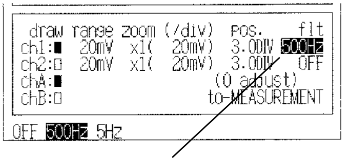


NOTE

In the X-Y CONT recorder function, since the time axis waveform for each channel is not stored, even if the position is changed after the measurement, the hidden portion of the waveform can not be seen.

(14) Filter

- Set low-pass filters (cut-off frequency) which is inside of the analog inputs and restricts frequency.
- This filter has the good effect of getting rid of the following phenomena:
  1. In case of level recording in the Recorder function mode, because of high speed sampling and wide band amplification, the influence of ripple components and noise in the signal can thicken the recording line.
  2. The case in which the recording line becoming thick because ripples are present in the output such as transducers.
  3. Pulse type noise in the RMS recorder function.



```
 draw range zoom (/div)  pos.    flt
ch1:■  20mV  x1(  20mV)  3.0DIV 500Hz
ch2:□  20mV  x1(  20mV)  3.0DIV   OFF
chA:■                  (0 adjust)
chB:□                 to-MEASUREMENT

OFF 500Hz 5Hz
```

Flashing cursor

Selection

Memory recorder Recorder RMS recorder	OFF, 500 Hz, 5 Hz

(15) Trigger setting

Refer to Chapter 11, “ Trigger Function" to find out about the trigger setting.

(16) Print types

Set either print out the measured data in waveform or in numerical form. Refer to Section 5.4.2, “ Setting the Style for Recording on the Printer."

(17) Roll mode (Memory recorder only)

It is possible to see the waveform rolled like the Recorder function in slow time-axis ranges below 20 ms/DIV. Refer to Section 6.5, “ Roll Mode Function."

(18) Automatic printing

It automatically records into the printer. Refer to Section 5.4.3, “ Recording on the Printer."

(19) Numerical calculation (Memory recorder only)

It is possible to calculate the waveform data. Refer to Section 6.7, “ Numerical Calculation."

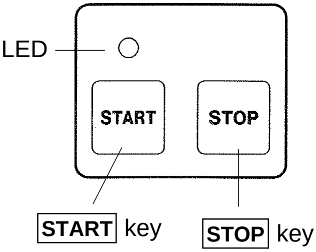
(20) Zero adjustment

It adjusts the waveform position at the position value when the input voltage is 0 V. Refer to Section 5.5, “ Zero Adjustment."

5.3 Starting and Stopping Measurement

Pressing the START key starts measurement. While measurement is taking place, the LED above the START key is illuminated green. When measurement has finished, the LED goes out.

Method



1. Press the START key.
   Measurement will start.
2. Press the STOP key.
   Measurement will stop.

5.3.1 Measurement Starting and Stopping in the Three Trigger Modes

(1) When the trigger mode is SINGLE:

- Press the START key and if the trigger conditions hold, an amount of data of length equal to the recording length will be read in and stored.
- Without pressing the STOP key, the system will go into the measurement finished state.

(2) When the trigger mode is REPEAT:

- Press the START key, and if the trigger conditions hold, an amount of data of length equal to the recording length will be read in and stored.
- Thereafter, every time the trigger conditions hold, data will be read in and the contents of the memory will be overwritten.
- Press the STOP key or change the trigger mode to SINGLE to terminate measurement.

(3) When the trigger mode is AUTO:

- Press the START key and wait one second for the trigger conditions to hold. After that whether or not the trigger conditions hold, an amount of data of length equal to the recording length will be read in and stored.
- Thereafter, repeatedly, data will be read in and the contents of the memory will be overwritten.
- Press the STOP key or change the trigger mode to SINGLE to terminate measurement.

5.3.2 Stopping Measurement (in the Memory Recorder Function)

- During reading the waveform data in the range which the setting of the time axis range is more than 20 ms/DIV, even if the STOP key is pressed, the LED above the START key is illuminated and measurement operation continues until reading in and storage of waveform data has finished.

- If the time axis range is 20 ms/DIV or less, the waveform is displayed to the sampled point. When setting the trigger mode to REPEAT or AUTO and stopping the operation after reading the waveform data, change the trigger mode to SINGLE without pressing the STOP key.

- When waiting for the trigger, press the STOP key, and this stops the reading in and storage of the waveform. The last waveform is displayed at this time. If the trigger mode is SINGLE or the recording length is more than 400DIV, the waveform is not displayed.

5.4 Printer Operations

5.4.1 Types of Recording and Functions

Function / Recording method	Memory recorder	Recorder	RMS recorder	X-Y CONT recorder
Manual print	●	●	●	●
Partial print	●	●	●	−
Auto print	●	●	●	−
Screen copy print	●	●	●	●

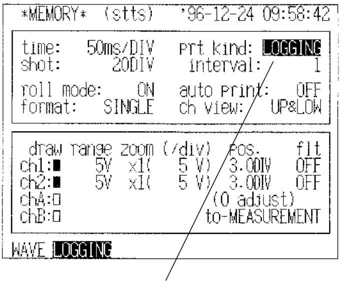
●: Can be executed, −: Cannot be executed

NOTE While printing out, the back light forcibly goes off.

5.4.2 Setting the Style for Recording on the Printer (Types of print)

- There are two styles of recording on the manual and partial print; waveform (WAVE) and numerical values (LOGGING). Either of these can be selected.
- In the X-Y CONT recorder function, the recording as numerical values is not possible.

Method (on the status screen)



```
*MEMORY*  (stts)   '96-12-24 09:58:42

time:    50ms/DIV   prt kind: LOGGING
shot:       20DIV    interval:       1

roll mode:     ON   auto print:    OFF
format:    SINGLE   ch view:    UP&LOW

 draw range zoom (/div)  pos.    flt
ch1:■    5V  x1(   5 V)  3.0DIV  OFF
ch2:■    5V  x1(   5 V)  3.0DIV  OFF
chA:□                 (0 adjust)
chB:□               to-MEASUREMENT

WAVE LOGGING
```

Flashing cursor

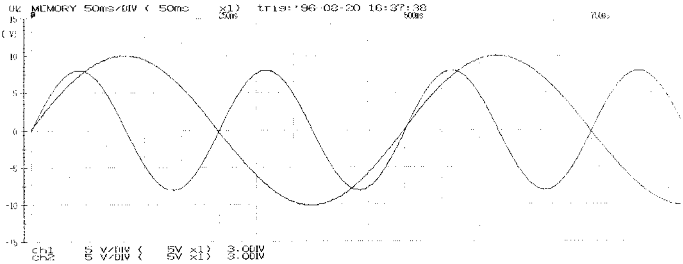
1. Move the flashing cursor to prt kind.
2. By using the + and − keys, select WAVE or LOGGING.
3. When LOGGING is selected in step 2., move the flashing cursor to interval and set the data sampling interval to be printed out.

Selection

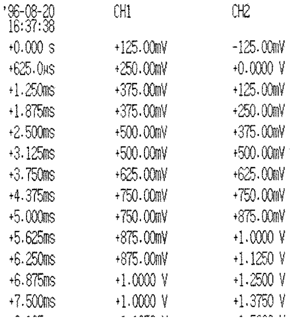
Memory recorder Recorder RMS recorder	1, 8, 16, 40, 80, 160, 400, 800, 1600 samples

NOTE 1 DIV equals to 80 samples.

Waveform



Numerical



```
'96-08-20
16:37:38       CH1          CH2
+0.000 s    +125.00mV    -125.00mV
+625.0μs    +250.00mV    +0.0000 V
+1.250ms    +375.00mV    +125.00mV
+1.875ms    +375.00mV    +250.00mV
+2.500ms    +500.00mV    +375.00mV
+3.125ms    +500.00mV    +500.00mV
+3.750ms    +625.00mV    +625.00mV
+4.375ms    +750.00mV    +750.00mV
+5.000ms    +750.00mV    +875.00mV
+5.625ms    +875.00mV    +1.0000 V
+6.250ms    +875.00mV    +1.1250 V
+6.875ms    +1.0000 V    +1.2500 V
+7.500ms    +1.0000 V    +1.3750 V
```

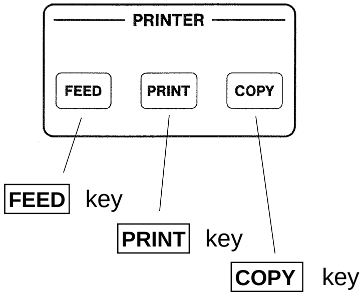
NOTE In the Recorder and RMS recorder function, however the maximum and minimum values are saved in memory as data, the maximum value is printed out as numerical printing.

5.4.3 Recording on the Printer

(1) Manual printing (all function)

- This prints out the stored data from one measurement for its entire recording length.
- Since the measurement data is saved in memory, it can be reprinted as many times as required.

Method



1. When measurement is finished, press the **PRINT** key. (The A and B cursors displayed on the screen are not printed.)

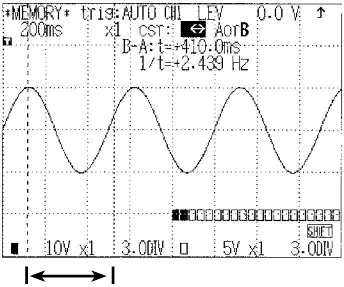
NOTE

- The recording as numerical values can not be performed in the X-Y CONT recording function.
- Pressing the **FEED** key except during measuring, the recording paper is fed.

(2) Partial printing (Memory recorder, Recorder, RMS recorder function)

- Using the A and B cursors, print out only the desired portion of the entire length of the recording. The part of the waveform delimited by the two cursors is printed.
- When only A cursor is used, the waveform data from the A cursor is printed out.

Method (on the Waveform screen)



This portion is printed out

1. Using the A and B cursors, indicate the part of the waveform which is desired to record. (Refer to Section 10.1, “ Using the A and B cursors."
2. Press the **PRINT** key.

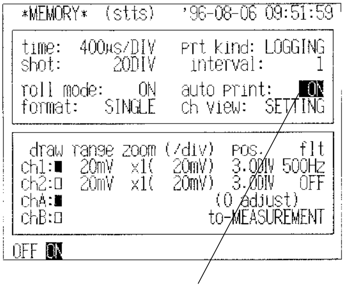
NOTE

- Partial printing can be used for both waveform printing (WAVE) and numerical printing (LOGGING).
- When the roll mode is set to ON (only Memory recorder function) at the auto-printing, the partial printing is not possible. (Refer to Section 6.5, "Roll Mode Function.")

(3) Auto print (Memory, Recorder, RMS recorder function)

- When the view is enlarged along the voltage axis, printouts on the printer will also be enlarged in the same manner. The auto printing can be used for both waveform printing (WAVE) and numerical printing (LOGGING).
- After reading the waveform data, the data is automatically printed out. (Memory recorder)
- Printing out simultaneously with the reading data. (Recorder, RMS recorder)
- Printing is not possible in the time axis range which is faster than 2 s/DIV. (Recorder)
- The intermittent printing rate differs depending on whether power is being supplied through the AC adapter or from batteries. (Refer to Section 12.3.4 "Intermittent Printing").

Method (on the status screen)



```
 *MEMORY*  (stts)   '96-08-06 09:51:59
 time:  400μs/DIV   prt kind: LOGGING
 shot:      20DIV    interval:      1
 roll mode:    ON   auto print:    ON
 format:   SINGLE   ch view:  SETTING
  draw range zoom (/div)  pos.    flt
 ch1:■  20mV  x1(  20mV)  3.0DIV 500Hz
 ch2:□  20mV  x1(  20mV)  3.0DIV   OFF
 chA:■                 (0 adjust)
 chB:□               to-MEASUREMENT
OFF ON
```

Flashing cursor

1. Using the CURSOR keys, move the flashing cursor to auto print.
2. By using the + and − keys, select to ON. If OFF is selected, the printing out is not performed.
3. Press the **START** key. It prints out simultaneously with the data reading.

NOTE In the Recorder and RMS recorder function, if the printing interval is set to less than 80 at the start of auto printing (auto print ON), the following warning message appears and the interval is forcibly set to 80.
"WARNING 23: Can't set interval to 1-40"

(4) Screen copy printing (all function)

It is possible to make a direct hard copy of the screen display when in the waveform screen, status screen, trigger screen, or system screen.

Method

Press the **COPY** key.

NOTE It is possible to supplement manual or auto printing of a waveform with a listing or gauge. (Refer to Section 12.3.3, "Listing and Gauge Functions.")

5.4.4 Head Up and Paper End

- When the printer head is up, the printer will not operate. An attempt to print produces the following error message: "ERROR 2: Lower the printer lever."
- If the printer paper runs out, printing stops. An attempt to print produces the following error message: "ERROR 1: Reload the printer paper."

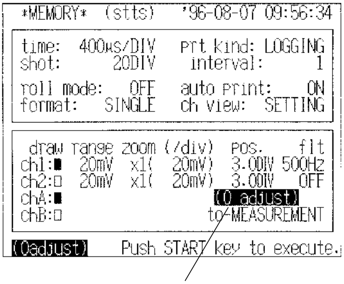
5.4.5 Head Temperature Protection Function

- The printer has a thermal head equipped with a temperature protection circuit. This cuts out operation of the printer if the head temperature reaches a certain level. It is therefore possible for the printer to stop operating while in use, and temporarily feed blank paper.
- The tendency of the head temperature to rise is exacerbated by a greater black area being printed, and by a faster paper feed speed. Additionally, higher ambient temperatures make it more likely that the head temperature will rise and trip the protective mechanism.
- When the temperature protection circuit operates and printing is disabled, once the head temperature has cooled enough printing is able to restart.
- If printing stops repeatedly, adjust the ranges to reduce the area of black printed.

5.5 Zero Adjustment

This function provides for accurate adjustment of the waveform to the origin position when inputting a zero voltage. Use it for reading precise values from the screen, a printed recording or to ensure accurate results from waveform computations.

Method (on the status screen)



```
 *MEMORY*  (stts)    '96-08-07 09:56:34

 time:  400ms/DIV   prt kind: LOGGING
 shot:       20DIV    interval:       1

 roll mode:    OFF   auto print:     ON
 format:    SINGLE   ch view:   SETTING

  draw range zoom (/div)  pos.     flt
 ch1:■  20mV  x1(  20mV)  3.0DIV 500Hz
 ch2:□  20mV  x1(  20mV)  3.0DIV   OFF
 chA:■                  (0 adjust)
 chB:□                 to MEASUREMENT

 (0adjust)     Push START key to execute.
```

Flashing cursor

1. Using the CURSOR keys, move the flashing cursor to (0 adjust).
2. Press the **START** key.

NOTE

- Zero adjustment should be performed after about 30 minutes of warm-up at the powering on.
- Zero adjustment cannot be performed while measurement is taking place.

Chapter 6
Memory Recorder Function Mode

6.1 What is the Memory Recorder Function?

6.1.1 Introduction

In this function mode, once the input signal has been stored in the memory of the 8804, it can be subjected to various forms of processing. By recording the data, a great number of useful ways become possible.

(1) Once an input signal has been stored in the memory, it can be displayed and recorded.

(2) Recording can be performed for all input channels along the same time axis. Allowing the signals to overlap makes it easier to see their relative relationships.

(3) The maximum sampling speed is 400 kS/s.

(4) The maximum recording capacity (recording length) is 64 K words divided by the number of channels. (Corresponding to 800 DIV, when channel 1 is in use.)

(5) The time axis range scale can be set to any of 18 levels, from 200 μs/DIV to 2 min/DIV.

(6) Magnified and compressed display and recording are available, both along the time axis and along the voltage axis.

Along the time axis	×10, ×5, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50, ×1/100
Along the voltage axis	×1/2, ×1, ×2, ×4

(7) Three types of display format can be chosen from. For a time axis waveform, SINGLE, DUAL, and for X-Y display and recording are available.

(8) Partial printing is available. From a recorded waveform, it is possible to extract and print only the section which one desires to see.

(9) Reprinting is available. Once a waveform has been recorded, it can be printed as many times as desired.

(10) With the pre-trigger function, it is possible to inspect the signal before the trigger point.

(11) The conversion to the X-Y waveform plot is possible.

(12) With the calculation functions, a captured waveform can be analyzed.

6.1.2 Finding Reference Material in This Manual

(1) Basic setting items (refer to Section 5.2, "Basic Setting Items of Each Function").
There are time axis range, magnification/compression along the time axis range, recording length, waveform display, voltage axis range, input coupling, magnification/compression along the voltage axis range, position, and filter.

(2) Start/stop measurement operation. (Refer to Section 5.3, "Starting and Stopping Measurement.")
Measurement is started by pressing the **START** key and finished by pressing the **STOP** key.

(3) Printing function (Refer to Section 5.4, "Printer Operations.")
There are two styles of recording; waveform (WAVE) and numerical values (LOGGING).
There are four methods of printing, manual printing, partial printing, auto printing, and screen copy printing.

(4) Zero adjustment function (Refer to Section 5.5, "Zero Adjustment.")
This function provides for accurate adjustment of the waveform to the origin position when a zero voltage is input.

(5) A and B cursors operations (Refer to Section 10.1, "Using the A and B Cursors.")
The time differences, frequencies, and voltage differences getting a direct digital can be readout on the waveform screen.

(6) Waveform scrolling function (Refer to Section 10.2, "Waveform Scrolling.")
The waveform can be scrolled vertically and horizontally.

(7) Roll mode (Refer to Section 6.5, "Roll Mode Function.")
In the time axis range which is less than 20 ms/DIV, after triggering, it is possible to start waveform display simultaneously with the waveform readout, scrolling just as during operation in the Recorder function mode.

(8) Screen setting (Refer to Section 5.2, "Basic Setting Items of Each Function" - (4).)
Three types of screens (display format) can be selected.

(9) Waveform X-Y plot (Refer to Section 6.6, "Using X-Y Waveform Plots.")

(10) Channel information function (Refer to Section 5.2, "Basic Setting Items of Each Function" - (8).)

(11) Trigger function (Refer to Chapter 11, "Trigger Function.")
It is possible to select a suitable trigger from the many types of triggers available. Level trigger, window-out trigger, logic trigger, voltage drop trigger can be used as the internal trigger.

(12) Numerical calculation function (Refer to Section 6.7, "Numerical Calculation.")
Waveform parameter calculation can be performed.

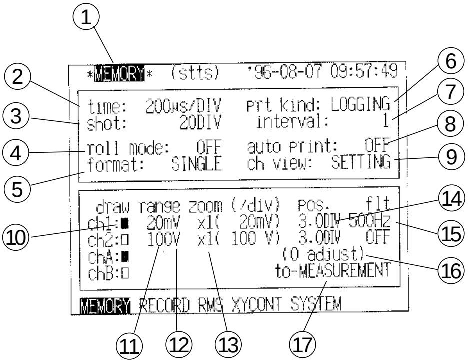
(13) Scaling function (Refer to Section 12.4.1, "Scaling Function.")
The scaling function allows the units and numerical values for the input voltages to be converted, so that they can be directly read out as physical values of the parameters which are being measured.

(14) Comment input function (Refer to Section 12.3.9, "Appending Comments.")
Instead of making handwritten memos on recordings, comments can be input.

(15) List and gauge functions (Refer to Section 12.3.3, "Listing and Gauge Functions").
These functions provide voltage axis scales and listings of settings on printed recordings.

6.2 Display Screens

(1)Status screen

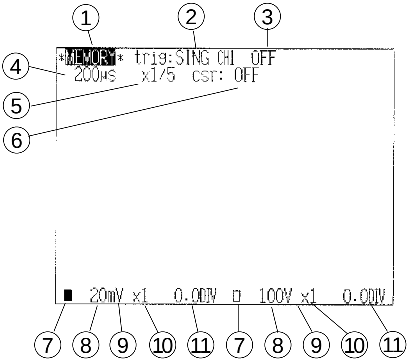


```
*MEMORY*  (stts)   '96-08-07 09:57:49

time:  200µs/DIV   prt kind: LOGGING
shot:      20DIV    interval:      1
roll mode:   OFF   auto print:   OFF
format:   SINGLE   ch view:  SETTING

 draw range zoom (/div)  pos.    flt
ch1:■  20mV  x1(  20mV)  3.0DIV 500Hz
ch2:□  100V  x1( 100 V)  3.0DIV   OFF
chA:■                  (0 adjust)
chB:□                to-MEASUREMENT

MEMORY RECORD RMS XYCONT SYSTEM
```

① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Time axis range	200, 400 µs/DIV 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1,2 min/DIV	Set the time for 1 scale (1 DIV). The sampling period is 1/80th of the set value for the time axis range.
③ Recording length	20, 50, 100, 200, 400 DIV (channel 1, 2) 800 DIV (ch 1 only)	The length of recording for one measurement operation (the number of DIV) can be set.
④ Roll mode	OFF, ON	Display simultaneously with waveform reading.
⑤ Screen setting	SINGLE, DUAL, X-Y DOT, X-Y LINE	Set the style for displaying waveforms on the waveform screen and recording them on the printer.
⑥ Types of print	WAVE, LOGGING	Select whether the printer output should be waveforms (WAVE) or numerical values (LOGGING).

⑦ Print interval	1, 8, 16, 40, 80, 160, 400, 800, 1600	When recording as numerical value, set the printing interval.
⑧ Auto-print	OFF, ON	Print simultaneously with displaying the waveform.
⑨ Channel information	SETTING, UP & LOW	Display information for the input setting or upper and lower limit values on the waveform screen.
⑩ Waveform display	OFF, ON	Select whether display waveforms or not.
⑪ Voltage axis range	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50, 100 V/DIV	Set the voltage axis range for each channel.
⑫ Input coupling	V (DC), ⏚ (GND)	Select the connection for the input.
⑬ Magnification/ compression along the voltage axis	×4, ×2, ×1, ×1/2	Set the magnification/ compression ratio along the voltage axis for each channel.
⑭ Position	-0.4 to 6.4 DIV (magnification ratio; ×1)	Set the position for each channel.
⑮ Filter	OFF, 500 Hz, 5 Hz	Set the low-pass filters to restrict the frequency bands .
⑯ Zero adjustment	0 adjust	Perform the zero adjustment.
⑰ Numerical calculation screen	to-MEASUREMENT	Display the numerical calculation on the screen.

(2) Waveform screen



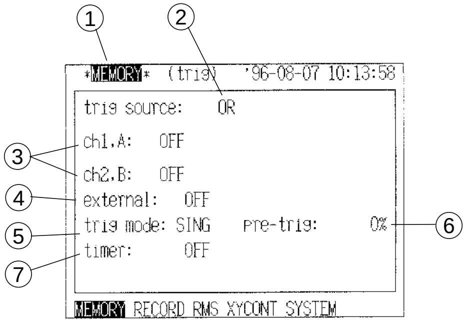
① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Trigger mode	SINGLE, REPEAT, AUTO	Select whether to stop after a single recording, or carry out repeated recording.
③ Internal trigger	OFF, LEVEL, OUT, LOG, DIP	Set the internal trigger.
④ Time axis range	200, 400 μs/DIV 1, 2, 5, 10, 20, 50, 100, 200, 500 ms/DIV 1, 2, 5, 10, 30 s/DIV 1, 2 min/DIV	Set the time for 1 scale (1 DIV). The sampling period is 1/80th of the set value for the time axis range.
⑤ Magnification/ compression along the time axis	×10, ×5, ×2, ×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50, ×1/100	Set the magnification/ compression ratio along the time axis.
⑥ A and B cursors	OFF, ↔, ↕, +	The A and B cursors can be used.
⑦ Waveform display	OFF, ON	Select whether or not display waveforms.
⑧ Voltage axis range	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50, 100 V/DIV	Set the voltage axis range for each channel.

⑨ Input coupling	V(DC), ⏚ (GND)	Select the connection for the input.
⑩ Magnification/ compression along the voltage axis	×4, ×2, ×1, ×1/2	Set the magnification/ compression ratio along the voltage axis for each channel.
⑪ Position	-0.4 to 6.4 DIV (magnification ratio; ×1)	Set the position for each channel.

NOTE

By level meter function, (Refer to Section 11.10, "Level Meter Function.") the level of the analog input signal is displayed on the waveform screen during waiting for the trigger.

(3) Trigger screen



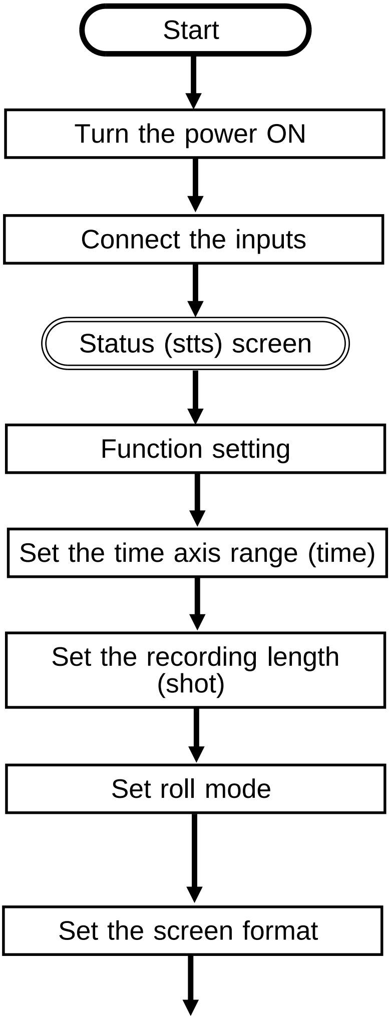
```
*MEMORY* (trig)   '96-08-07 10:13:58
trig source:   OR
ch1.A:   OFF
ch2.B:   OFF
external:   OFF
trig mode: SING    pre-trig:    0%
timer:     OFF
```

① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Trigger source AND/OR	AND, OR	Set whether the triggers are AND or OR.
③ Internal trigger	OFF, LEVEL, OUT, LOGIC, DIP	Set the internal trigger.
④ External trigger	OFF, ON	Using of the external input as a trigger source is possible .
⑤ Trigger mode	SINGLE, REPEAT, AUTO	Select whether to stop after a single recording or carry out repeated recording.
⑥ Pre-trigger	0, 5, 10, 25, 50, 75, 90, 95, 100, -95 %	Set the proportion in percent of the recording length of the signal that comes before the trigger.
⑦ Timer trigger	OFF, ON	Used when recording at a predetermined time.

6.3 Basic Operational Procedures

6.3.1 Operational Flow

The flowchart below illustrates the sequence of operations involved in using the memory recorder function.



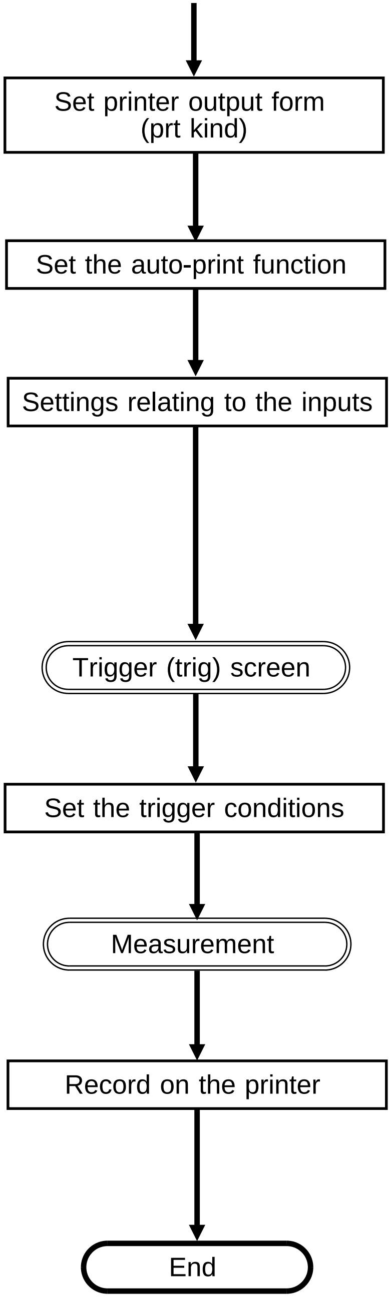
Set to the Memory recorder function mode.

Set the input and storage speed for the input signal waveform.

Set the length of the recording for one measurement.

Like the recorder function, in time axis range less than 20 ms/DIV, the waveform can be scrolled.

Set the format type for the waveform display screen.


Set printer output form (prt kind)
Set the auto-print function
Settings relating to the inputs
Trigger (trig) screen
Set the trigger conditions
Measurement
Record on the printer
End

Set whether measurement data will be sent to the printer as a waveform or as numerical values.

Set whether or not printing will occur simultaneously with screen display.

Set the channels for which display and recording will be performed. Also set voltage axis range, magnification/compression along the voltage axis range, input coupling, and filters.

Set the trigger source, the trigger type and conditions, and the pre-trigger.

Press the **START** key and start measurement.

After measurement has been completed, print the results

6.3.2 Example of Operation

This example illustrates the procedure connecting the 8804 to an oscillator to measure and record a 8 Vp-p 1 kHz sine wave input.

(1) Turn on the power.

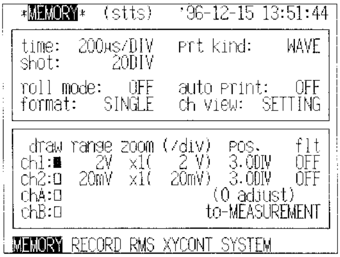
Turn on the power switch on the 8804.

(2) Connect the input.

Connect the oscillator to the input terminal of channel 1 of the 8804.

Set the oscillator so that it outputs a sine wave of frequency 1 kHz and voltage of 8 Vp-p.

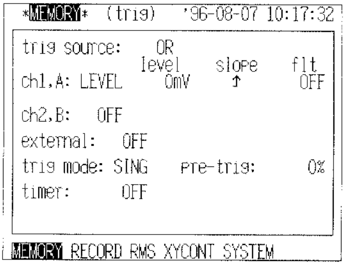
(3) Set the status screen.



```
  *MEMORY*  (stts)   '96-12-15 13:51:44
 time:  200µs/DIV   prt kind:     WAVE
 shot:      20DIV
 roll mode:   OFF   auto print:    OFF
 format:   SINGLE   ch view:   SETTING

  draw range zoom (/div)  pos.    flt
 ch1:■    2V  x1(   2 V)  3.0DIV  OFF
 ch2:□  20mV  x1(  20mV)  3.0DIV  OFF
 chA:□                  (0 adjust)
 chB:□                to-MEASUREMENT
MEMORY RECORD RMS XYCONT SYSTEM
```

1. Using the CURSOR keys and **+**, **−** keys, set as same as the setting on the figure left.

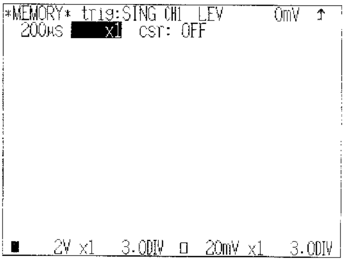
(4) Set the trigger screen.



```
  *MEMORY*  (trig)   '96-08-07 10:17:32
 trig source:    OR
                level    slope    flt
 ch1,A: LEVEL     0mV      ↑       OFF

 ch2,B:   OFF
 external:    OFF
 trig mode: SING    pre-trig:      0%
 timer:       OFF

MEMORY RECORD RMS XYCONT SYSTEM
```

1. Press the **MENU/WAVE** key to display the trigger screen.
2. Using the CURSOR keys and **+**, **−** keys, set as same as the setting on the figure left.

(5) Set the waveform display.



```
*MEMORY* trig:SING CH1 LEV      0mV ↑
 200μs  x1  csr: OFF

■  2V x1  3.0DIV □ 20mV x1  3.0DIV
```

1. Press the **MENU/WAVE** key to display the waveform screen.
2. Using the CURSOR keys and **+**, **−** keys, set time axis magnification/compression to " ×1".

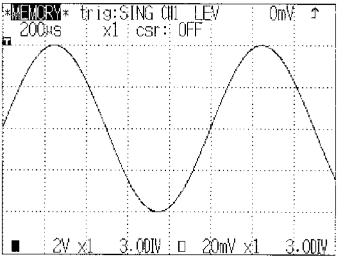
(6) Begin measurement.

Press the **START** key. The LED above the key will light up and then the measurement starts.

(7) End measurement.

When storing in the memory of 20 DIV of data is completed, the LED goes out and the system enters the STOP condition, and the waveform is shown on the screen.

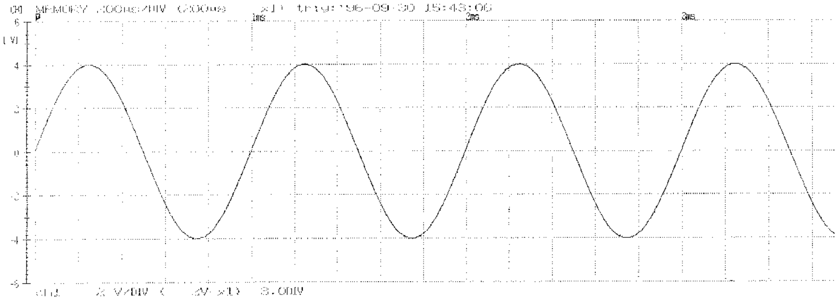
(8) Print out.



```
*MEMORY* trig:SING CH1 LEV      0mV ↑
 200μs  x1  csr: OFF

■  2V x1  3.0DIV □ 20mV x1  3.0DIV
```

1. Press the **COPY** key. The display copy as the figure left is recorded.

2. Press the **PRINT** key. The manual print as the figure below is recorded.



6.4 Auto-Range Function

- The time axis range and the voltage axis range for the input waveform are automatically set and shown on the screen display.
- Taking the lowest numbered channel among the channels for which waveform display is on, 1 to 2.5 cycles are automatically set to be recorded as 8 DIV.

Method (on the waveform screen)

1. Press the left and right CURSOR keys simultaneously and then press the **START** key.
2. After setting the range, the LED above the **START** key will light up and then the measurement is automatically started.

NOTE

- If there is only a small difference between maximum value and the minimum value in the range of highest sensitivity for the channel 1, the setting is made to the time axis for the channel 2.
- If the range cannot be determined, for channels 1 and 2 , a warning message appears, and measurement is stopped.

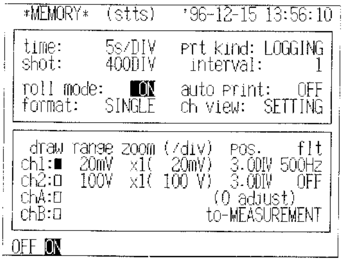
If measurement has started using the auto-range function, only the items on the next page are changed:

Time axis range, input range, zero position value	Set automatically.
Trigger source (channels 1 and 2), trigger level value	Set automatically.
Input filter, and input coupling	Set to OFF, V (DC).
Trigger type, slope, and filter	Set to level, rising (↥), or OFF.
External trigger and timer trigger	Set to OFF.
Trigger mode	Set to AUTO.
Pre-trigger	Set to 10 %.
Magnification/compression ratio along the time and voltage axes	Set to ×1.

6.5 Roll Mode Function

- This function is only available in the time axis range which is less than 20 ms/DIV when the screen is set to SINGLE or DUAL.
- With the roll mode setting OFF, after the start of measurement, because usually auto-print is only performed after one recording length of data has been completely sampled, during low speed sampling it takes a long time to complete the printing.
- If roll mode is enabled (ON), after triggering, it is possible to start waveform display and print by the auto-print simultaneously with the capturing waveform, just as during operation in the Recorder function mode.

Method (on the status (stts) screen)



```
 *MEMORY*  (stts)   '96-12-15 13:56:10
 time:       5s/DIV   prt kind: LOGGING
 shot:      400DIV     interval:       1
 roll mode:     ON    auto print:    OFF
 format:    SINGLE    ch view:   SETTING

  draw range zoom (/div)  pos.     flt
 ch1:■  20mV  x1(  20mV)  3.0DIV 500Hz
 ch2:□  100V  x1( 100 V)  3.0DIV   OFF
 chA:□                 (0 adjust)
 chB:□              to-MEASUREMENT
OFF ON
```

1. Using the CURSOR keys, move the flashing cursor to roll mode.
2. By using the + and − keys, set to ON.

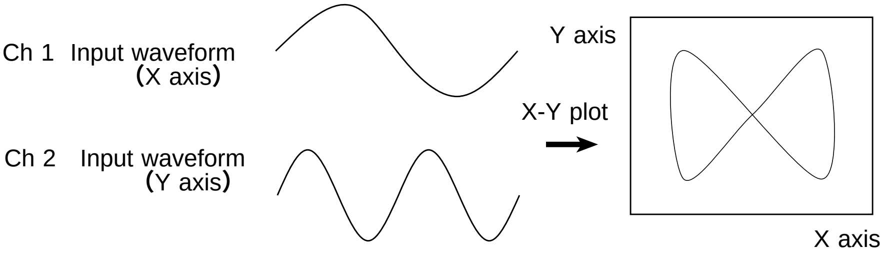
NOTE If the roll mode is enabled, the partial print by using the A and B cursors is not performed with auto-print ON.

6.6 Using X-Y Waveform Plots

- Setting the screen displays to X-Y DOT or X-Y LINE allows for X-Y combination of waveforms.
- The channel 1 is shown as X-axis and the channel 2 is shown as Y-axis.
- Magnification and compression along the voltage axis are also effective for X-Y plots.
- Using the A and B cursors, the X-Y plot can be made for the data between the A and B cursors.

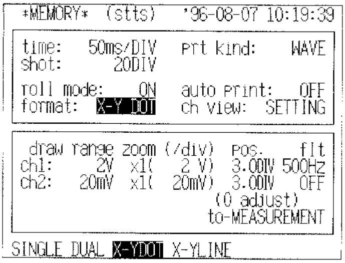
X-Y DOT, X-Y LINE

Display and record as one graph.



NOTE The difference between X-Y DOT and X-Y LINE is whether the linear interpolation is performed or not. (Refer to Section 5.2, "Basic Setting Items of Each Channel- (7) "Line style.")

Method (on the status "stts" screen)

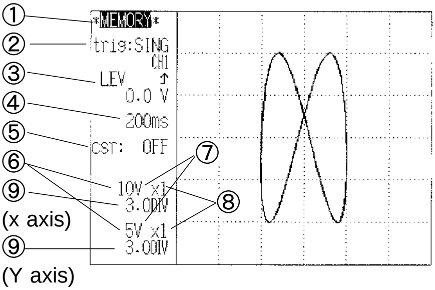


```
 *MEMORY*  (stts)   '96-08-07 10:19:39

 time:    50ms/DIV   prt kind:    WAVE
 shot:       20DIV
 roll mode:     ON   auto print:   OFF
 format:  X-Y DOT    ch view:  SETTING

  draw range zoom (/div)  pos.    flt
 ch1:     2V  x1(  2 V)  3.0DIV 500Hz
 ch2:   20mV  x1( 20mV)  3.0DIV   OFF
                       (0 adjust)
                     to-MEASUREMENT
SINGLE DUAL X-YDOT X-YLINE
```

1. Using the CURSOR keys, move the flashing cursor to format.
2. By using the $\boxed{+}$ and $\boxed{-}$ keys, set to X-Y DOT or X-Y LINE.

NOTE

On the X-Y DOT and X-Y LINE screens, the following items can be set.



① Function
② Trigger mode
③ Internal trigger
④ Time axis range
⑤ A・B cursors
⑥ X and Y axes range
⑦ Input coupling
⑧ Magnification/compression along the X and Y axes range
⑨ Position

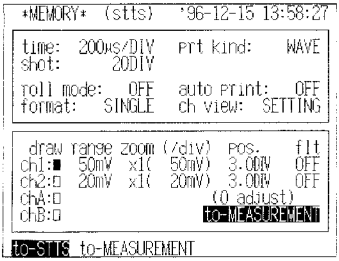
6.7 Numerical Calculation

For sampled waveform data or for waveform data which is the result of waveform calculation processing, the following types of calculation can be performed:

(1) Maximum values and time to maximum values
(2) Minimum values and time to minimum values
(3) Peak-to-peak values
(4) Mean values
(5) Rms values
(6) Area values

- The result of each of these types of calculation appears as a numerical value.
- If the A and B cursors are not being used, the calculation is performed for all of the data. When the cursors are used, the calculation is performed for the data between the A and the B cursors.
- The settings relating to the calculation functions are made on the numerical calculation screen.

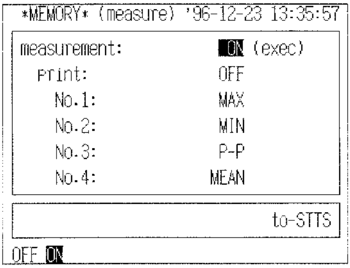
On the status (stts) screen



```
 *MEMORY*  (stts)   '96-12-15 13:58:27

time:  200μs/DIV   prt kind:     WAVE
shot:       20DIV

roll mode:    OFF   auto print:    OFF
format:    SINGLE   ch view:   SETTING

 draw range zoom (/div)  pos.      flt
ch1:■  50mV  x1(  50mV)  3.0DIV    OFF
ch2:□  20mV  x1(  20mV)  3.0DIV    OFF
chA:□                 (0 adjust)
chB:□                 to-MEASUREMENT

to-STTS  to-MEASUREMENT
```

1. Move the flashing cursor to "to-MEASUREMENT", and press the + key, the screen changes to the numerical calculation screen.
2. Move the flashing cursor to "to-STTS" and press the – key, the status screen will be returned.

Method (on the numerical calculation "measure" screen)



```
*MEMORY* (measure) '96-12-23 13:35:57
measurement:          ON (exec)
  print:              OFF
    No.1:             MAX
    No.2:             MIN
    No.3:             P-P
    No.4:             MEAN
                              to-STTS
OFF ON
```

1. Using the CURSOR keys, move the flashing cursor to measurement. Set to "ON" by pressing the $\boxed{+}$ and $\boxed{-}$ keys.
2. Using the CURSOR keys, move the flashing cursor to print. Select ON or OFF (whether the results of calculation is printed out or not) by pressing the $\boxed{+}$ or $\boxed{-}$ keys.
3. Using the CURSOR keys, move the flashing cursor to No.1 to No.4. Select the types of calculation by pressing the $\boxed{+}$ and $\boxed{-}$ keys. Up to four calculations can be set simultaneously.

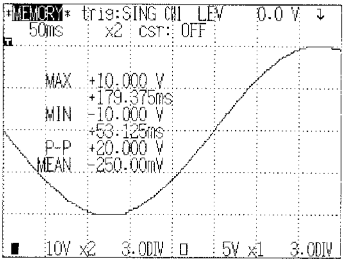
Selection

OFF, MAX, MIN, P-P, MEAN, RMS, AREA

4. Case A When the calculation is performed simultaneously with the waveform reading. Press the **START** key.

   Case B When the calculation is performed on measurement data that have already been read in. Using the CURSOR keys, move the flashing cursor to (exec). Press the **START** key.

5. On the waveform screen, the waveform and results of the calculation are displayed together.



```
*MEMORY* trig:SING CH1  LEV    0.0 V  ↓
  50ms       x2  csr: OFF

     MAX  +10.000 V
          +179.375ms
     MIN  -10.000 V
          +53.125ms
     P-P  +20.000 V
    MEAN  -250.00mV

 ■   10V x2   3.0DIV □   5V x1   3.0DIV
```

NOTE

- The results is automatically recorded on the printer when print setting is ON.
- The calculation can be performed as many times as desired on the reading waveform data.

Details of the various calculations

(1) Maximum value (Max)

- The maximum value of the waveform data is shown (in volts).

Time to maximum value (Max-Time)

- The time period from the moment that triggering occurred till the maximum value is shown (in seconds).
- If the maximum value is attained twice or more in the data, the first point is took as the maximum value.

(2) Minimum value (Min)

- The minimum value of the waveform data is shown (in volts).

Time to minimum value (Min-Time)

- The time period from the moment that triggering occurred till the minimum value is attained is shown (in seconds).
- If the minimum value is attained twice or more in the data, the first point is took as the minimum value.

(3) Peak-to-peak value

The peak-to-peak value (the difference between the maximum value and the minimum value) of the waveform data is shown (in volts).

(4) Mean value

- The average value (in volts) of the waveform data is shown.
- The equation used for the calculation is as follows:

$$\text{The mean value } \overline{d} = \frac{1}{n+1}\sum_{i=0}^{n} d_i$$

n: number of data samples

d_i: the ith data value of the source channel

(5) RMS value

- The rms value (in volts) of the waveform data is shown.
- The equation used for the calculation is as follows:

$$\text{RMS value} = \sqrt{\frac{\sum_{i=0}^{n} d_i^2}{n+1}}$$

n: number of data samples
d_i: the ith data value of the source channel

(6) Area value

- The value of the area from the origin position for the waveform (the point corresponding to 0 V) to the signal waveform is shown in volt-seconds.
- If the A and B cursors are in use, the area between A and B cursors is displayed.
- The equation used for the calculation is as follows:

$$\text{The area value} \quad A = \sum_{i=0}^{n} |d_i| \cdot h$$

n : the number of data samples
d_i : the ith data value of the source channel
h = Δt: sampling period

NOTE If scaling has been set, calculation will be executed after scaling the waveform data. (When scaling, the calculation will be slowed down.) The unit of the waveform value is the unit to be set. (Refer to Section 12.4.1, “ Scaling Function.")

6.8 Memory Recorder Function Possible Recording Time

TIME/DIV	Sampling period	Recording time capability
200 µs/DIV	2.5 µs	0.16 s
400	5	0.32 s
1 ms/DIV	12.5	0.8 s
2	25	1.6 s
5	62.5	4 s
10	125	8 s
20	250	16 s
50	625	40 s
100	1.25 ms	1 min 20 s
200	2.5	2 min 40 s
500	6.25	6 min 40 s
1 s/DIV	12.5	13 min 20 s
2	25	26 min 40 s
5	62.5	1 h 6 min
10	125	2 h 13 min
30	375	6 h 40 min
1 min/DIV	750	13 h 20 min
2	1.5 s	26 h 40 min

NOTE

Calculated with recording length 800 DIV.
(only channel 1 is in use)

Chapter 7
Recorder Function Mode

7.1 What is the Recorder Function?

7.1.1 Introduction

In this function mode, the input signal is displayed and recorded in real time.

(1) Real continuous time recording is possible.

(2) Recording can be performed for all input channels along the same time axis. Allowing the signals to overlap makes it easier to see their relative relationships.

(3) The chart speed (time axis scale) can be set to any of 13 levels, from 200 ms/DIV to 1 h/DIV (200 ms to 1 s/DIV for display only).

(4) High speed sampling.
Because sampling can be done at speeds of 2.5 μs independently of the printing speed, envelope observation is possible.

(5) The waveform can be scrolled.
While continuous real time recording is taking place, the last about 200 DIV of waveform including the screen is held in memory. Accordingly, this previous part of the waveform can be scrolled back to and observed.

(6) There are two display formats to choose from.
SINGLE and DUAL of time axis waveform are available.

(7) Reprinting is available.
The waveform held in memory (the last about 200 DIV including the screen) can be printed as many times as desired.

7.1.2 Finding Reference Material in This Manual

(1) Basic setting items (Refer to Section 5.2, "Basic Setting Items of Each Function")
There are time axis range, compression along the time axis range, recording length, waveform display, voltage axis range, input coupling, magnification/compression along the voltage axis range, position, and filter.

(2) Start/stop measurement operation (Refer to Section 5.3, "Starting and Stopping Measurement.")
Measurement is started by pressing the **START** key, and finished by pressing the **STOP** key.

(3) Printing function (Refer to Section 5.4, "Printer Operations.")
There are two styles of recording; waveform (WAVE) and numerical values (LOGGING).
There are four methods of printing; manual printing, partial printing, auto printing, and screen copy printing.

(4) Zero adjustment function (Refer to Section 5.5, "Zero Adjustment.")
This function provides for accurate adjustment of the waveform to the origin position when a zero voltage is input.

(5) A and B cursors operations (Refer to Section 10.1, "Using the A and B Cursors.")
The time differences, frequencies, and voltage differences getting as digital value can be readout on the waveform screen.

(6) Waveform scrolling function (Refer to Section 10.2, "Waveform Scrolling.")
The waveform can be scrolled vertically and horizontally.

(7) Screen setting (Refer to Section 5.2, "Basic Setting Items of Each Function"- (4).)
There are two types of screens (display format) to select.

(8) Channel information function (Refer to Section 5.2, "Basic Setting Items of Each Function"-(8).)

(9) Trigger function (Refer to Chapter 11, "Trigger Function.")
The suitable trigger can be selected from the many types of trigger available.
Level trigger, window-out trigger, and logic trigger can be used as the internal trigger.

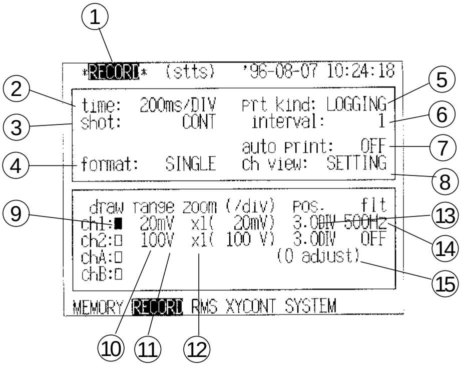
(10) Scaling function (Refer to Section 12.4.1, "Scaling Function.")
The scaling function allows the units and numerical values for the input voltages to be converted, so that they can be directly read out as physical values.

(11) Comment input function (Refer to Section 12.3.9, "Appending Comments.")

(12) List and gauge functions (Refer to Section 12.3.3, "Listing and Gauge Functions.")

7.2 Display Screens

(1) Status screen



```
*RECORD*  (stts)   '96-08-07 10:24:18
 time:  200ms/DIV   prt kind: LOGGING
 shot:       CONT    interval:      1
                    auto print:   OFF
 format:   SINGLE   ch view:  SETTING

  draw range zoom (/div)  pos.   flt
 ch1:■  20mV  x1(  20mV)  3.0DIV 500Hz
 ch2:□  100V  x1( 100 V)  3.0DIV   OFF
 chA:□                  (0 adjust)
 chB:□
MEMORY RECORD RMS XYCONT SYSTEM
```

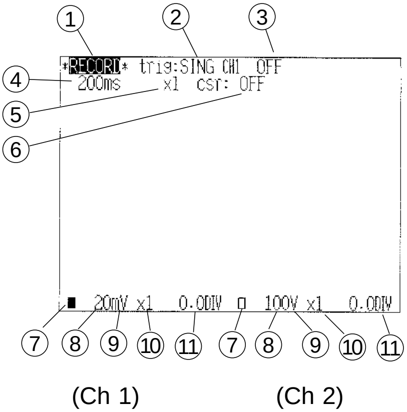
① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Time axis range	200, 500 ms/DIV, 1 s/DIV (display only) 2, 5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV	Set the chart speed. Set the time for 1 scale (1 DIV).
③ Recording length	20, 50, 100, 200, 400, CONT	The length of recording for one measurement operation (the number of DIV) can be set.
④ Screen setting	SINGLE, DUAL	Set the style for displaying waveforms on the waveform screen and recording them on the printer.
⑤ Types of print	WAVE, LOGGING	Select the style for recording on the printer.
⑥ Print interval	1, 8, 16, 40, 80, 160, 400, 800, 1600	When recording as numerical value, set the printing interval.
⑦ Auto-print	OFF, ON	Print out simultaneously with the waveform display.

⑧ Channel information	SETTING, UP & LOW	Display information for the input setting or upper and lower limit value on the waveform screen.
⑨ Waveform display	OFF, ON	Select whether display waveforms or not.
⑩ Voltage axis range	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50, 100 V/DIV	Set the voltage axis range for each channel.
⑪ Input coupling	V (DC), ⏚ (GND)	Select the connection for the input.
⑫ Magnification/ compression along the voltage axis	×4, ×2, ×1, ×1/2	Set the magnification/ compression ratio along the voltage axis for each channel.
⑬ Position	-0.4 to 6.4 DIV (magnification ratio: ×1)	Set the position for each channel.
⑭ Filter	OFF, 500 Hz, 5 Hz	Set the low-pass filters to restrict the frequency bands.
⑮ Zero adjustment	0 adjust	Performs the zero adjustment.

NOTE

If the printing interval is set to less than 80 at the start of auto-printing (auto print ON), the following warning message appears and the interval is forcibly set to 80. "WARNING 23: Can’t set interval to 1-40".

(2) Waveform screen



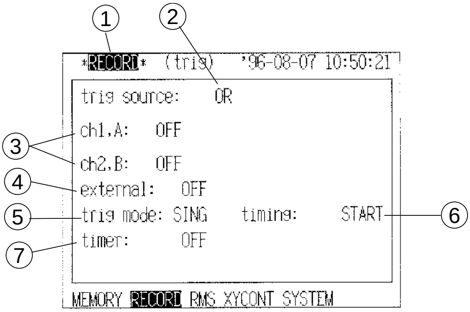
① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Trigger mode	SINGLE, REPEAT	Select whether to stop after a single recording, or carry out repeated recording.
③ Internal trigger	OFF, LEV, OUT, LOG	Set the internal trigger.
④ Time axis range	200, 500 ms/DIV, 1 s/DIV (display only) 2, 5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV	Set the chart speed. Set the time for 1 scale (1 DIV).
⑤ Compression along time axis	×1, ×1/2 ×1/5, ×1/10, ×1/20, ×1/50	Set the compression ratio along the time axis for each channel.
⑥ A and B cursors	OFF, ↔, ↕, +	The A and B cursors can be used.
⑦ Waveform display	OFF, ON	Select whether display waveforms or not.
⑧ Voltage axis range	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50, 100 V/DIV	Set the voltage axis range for each channel.
⑨ Input coupling	V (DC), ⏚ (GND)	Select the connection for the input.

⑩ Magnification/ compression ratio along the voltage axis	×4, ×2, ×1, ×1/2	Set the magnification ratio along the voltage axis for each channel.
⑪ Position	-0.4 to 6.4 DIV (magnification ratio: ×1)	Set the position for each channel.

NOTE

With the level meter function, the level of the analog input signal is displayed on the waveform screen during waiting for the trigger.
(Refer to Section 11.10, "Level Meter Function.")

(3) Trigger screen



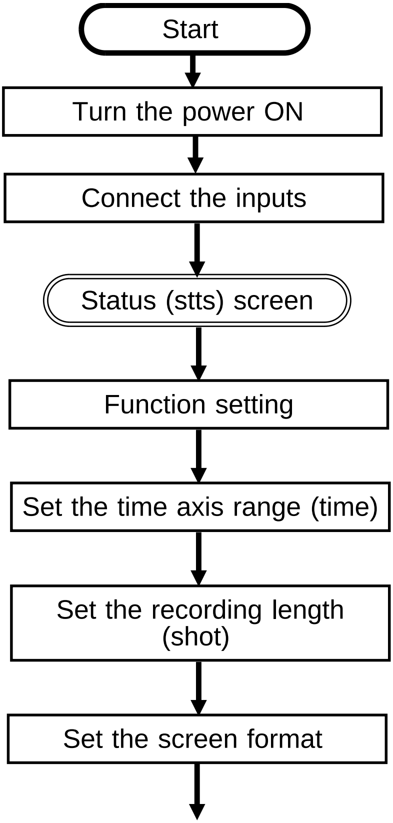
```
*RECORD* (trig)   '96-08-07 10:50:21
trig source:    OR
ch1,A:   OFF
ch2,B:   OFF
external:   OFF
trig mode: SING    timing:     START
timer:      OFF
MEMORY RECORD RMS XYCONT SYSTEM
```

① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Trigger source AND/OR	AND, OR	Set whether the triggers are AND or OR.
③ Internal trigger	OFF, LEVEL, OUT, LOGIC	Set the internal trigger.
④ External trigger	OFF, ON	Using of the external input as a trigger source is possible.
⑤ Trigger mode	SINGLE, REPEAT	Select whether to stop after a single recording, or carry out repeated recording.
⑥ Trigger timing	START, STOP	Set whether start or stop recording after the trigger occur.
⑦ Timer trigger	OFF, ON	Use when recording at a predetermined time is required.

7.3 Basic Operational Procedures

7.3.1 Operational Flow

The flowchart below illustrates the sequence of operations involved in using the recorder function.

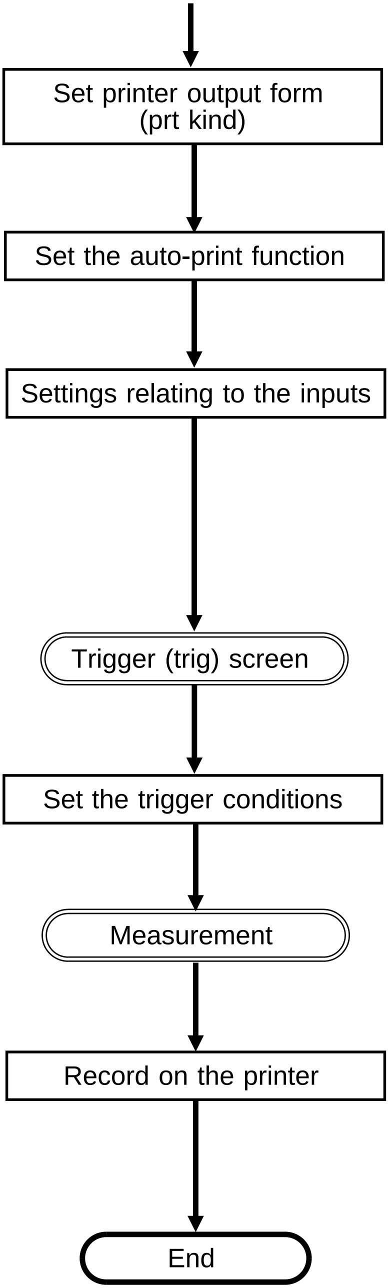


Set to the Recorder function mode.

Set the chart speed.

Set the length of the recording for one measurement.

Set the format type for the waveform display screen.



Set whether measurement data will be sent to the printer as a waveform or as numerical values.

Set whether printing will occur simultaneously with screen display or not .

Set the channels for which display and recording will be performed. Also set voltage axis range, magnification/compression along voltage axis range, input coupling and filters.

Set the trigger source, trigger type and conditions, and trigger timing.

Press the **START** key and start measurement.

Print out the result of measurement simultaneously with the measurement start.

7.3.2 Example of Operation

This example illustrates the procedure connecting the 8804 to an oscillator to measure and record a 8 Vp-p 1 Hz sine wave input.

(1) Turn on the power.

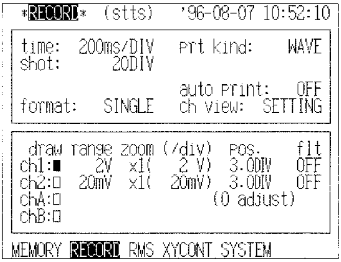
Turn on the power switch of the 8804.

(2) Connect the input.

Connect the oscillator to the input terminal of channel 1 of the 8804.

Set the oscillator so that it outputs a sine wave of frequency 1 Hz and voltage of 8 Vp-p.

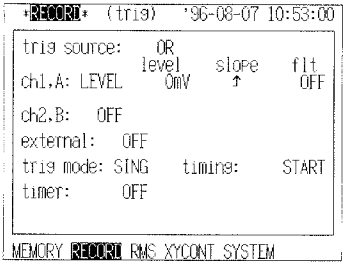
(3) Set the status screen.



```
  *RECORD*  (stts)   '96-08-07 10:52:10
 time:  200ms/DIV   prt kind:    WAVE
 shot:       20DIV
                    auto print:   OFF
 format:   SINGLE   ch view:  SETTING

  draw range zoom (/div)  pos.    flt
 ch1:■    2V  x1(   2 V)  3.0DIV  OFF
 ch2:□  20mV  x1(  20mV)  3.0DIV  OFF
 chA:□                 (0 adjust)
 chB:□
MEMORY RECORD RMS XYCONT SYSTEM
```

1. Using the CURSOR keys and + , − keys, set as same as the setting on the figure left.

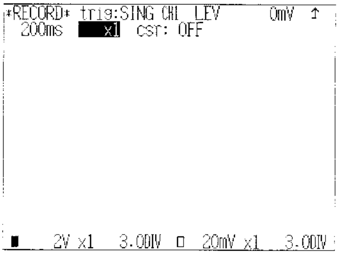
(4) Set the trigger screen.



```
  *RECORD*  (trig)   '96-08-07 10:53:00
 trig source:    OR
                level    slope    flt
 ch1,A: LEVEL    0mV       ↑      OFF

 ch2,B:   OFF

 external:   OFF

 trig mode: SING    timing:     START

 timer:      OFF

MEMORY RECORD RMS XYCONT SYSTEM
```

1. Press the **MENU/WAVE** key to display the trigger screen.
2. Using the CURSOR keys and + , − keys, set as same as the setting on the figure left.

(5) Set the time axis range.



```
*RECORD* trig:SING CH1 LEV      0mV ↑
 200ms  x1  csr: OFF

■  2V x1  3.00DIV  □  20mV x1  3.00DIV
```

1. Press the **MENU/WAVE** key to display the waveform screen.
2. Using the CURSOR keys and **+** , **−** keys, set the time axis magnification/compression to "×1".

(6) Begin measurement.

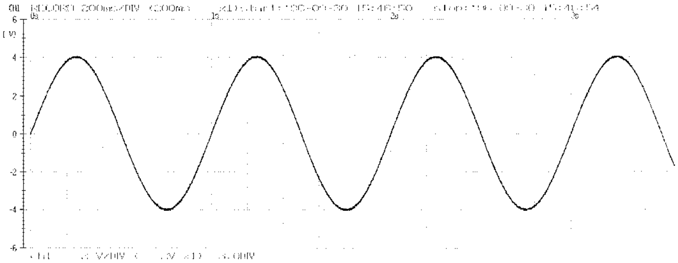
Press the **START** key. The LED above the key will light up and then the measurement starts. The waveform will be displayed on the screen simultaneously with triggering occurs.

(7) End measurement.

When storage in the memory of 20 DIV of data is completed, the LED goes out and the system enters to the STOP condition, and the waveform is shown on the screen.

(8) Print out.

Press the **PRINT** key. The manual print as the figure below is recorded.



Chapter 8
RMS Recorder Function Mode

8.1 What is the RMS Recorder Function?

8.1.1 Introduction

In this function mode, the voltage value and DC signal for the commercial power supplies are displayed and recorded as the rms value.

(1) Real time continuous recording is possible.

(2) The 8804 is designed to measure commercial power supplies (50/60 Hz) and DC signal.
The chart speed (time axis scale) can be set to any of 9 levels, from 5 s/DIV to 1 h/DIV.

(3) There are two display formats to choose from.
SINGLE and DUAL of time axis waveforms are available.

(4) Recording can be performed for all input channels along the same time axis. Allowing the signals to overlap makes it easier to see their relative relationships.

(5) Magnified and compressed display and recording are available, both along the time axis and along the voltage axis.

Along the time axis	×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50
Along the voltage axis	×4, ×2, ×1, ×1/2

(6) Partial printing is available.
From a recorded waveform, it is possible to extract and print only the section desired.

(7) Reprinting is available.
The waveform held in memory (200 DIV including the display screen) can be printed as many times as desired.

(8) With the pre-trigger function, the signal before triggering can be seen.

8.1.2 Finding Reference Material in This Manual

(1) Basic setting items (Refer to Section 5.2, "Basic Setting Items of Each Function.")
There are time axis range, magnification/compression along the time axis range, recording length, frequencies, waveform display, voltage axis range, input coupling, magnification/compression along the voltage axis range, position, and filter.

(2) START/STOP measurement operation (Refer to Section 5.3, "Starting and Stopping Measurement.")
Measurement is started by pressing the **START** key, and is finished by pressing the **STOP** key.

(3) Printing function (Refer to Section 5.4, "Printer Operations.")
There are two styles for recording; waveform (WAVE) and numerical values (LOGGING).
There are four methods of printing; manual printing, partial printing, auto-printing, and screen copy printing.

(4) Zero adjustment function (Refer to Section 5.5, "Zero Adjustment.")
This function provides for accurate adjustment of the waveform to the origin position when a zero voltage is input.

(5) A and B cursors operations (Refer to Section 10.1, "Using the A and B Cursors.")
The time differences, frequencies, and voltage differences getting as digital value can be readout on the waveform screen.

(6) Waveform scrolling function (Refer to Section 10.2, "Waveform Scrolling.")
The waveform can be scrolled vertically and horizontally.

(7) Screen setting (Refer to Section 5.2, "Basic Setting Items of Each Function"- (4).)
There are two types of screens (display format) to select.

(8) Channel information function (Refer to Section 5.2, "Basic Setting Items of Each Function" -(8).)

(9) Trigger function (Refer to Chapter 11, "Trigger Function.")
A suitable trigger from the many types of triggers available can be selected.
Logic trigger and rms level trigger can be used as the internal trigger.

(10) Scaling function (Refer to Section 12.4.1, "Scaling Function.")

The scaling function allows the units and numerical values for the input voltages to be converted, so that they can be directly read out as physical values.

(11) Comment input function (Refer to Section 12.3.9, "Appending Comments.")

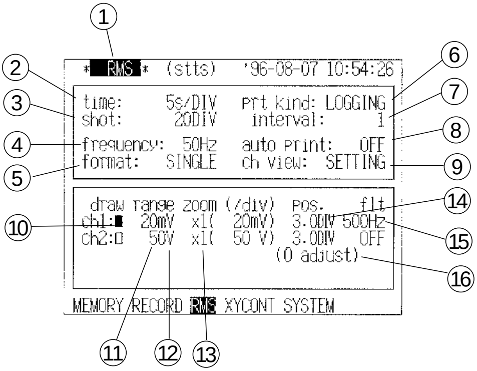
Instead of making handwritten memos on recordings, comments can be input and printed on.

(12) List and gauge functions (Refer to Section 12.3.3, "Listing and Gauge Functions.")

These functions provide voltage axis scales and listings of settings on printed recordings.

8.2 Display Screens

(1) Status screen



```
*  RMS * (stts)   '96-08-07 10:54:26

time:      5s/DIV   prt kind: LOGGING
shot:      20DIV     interval:      1
frequency:  50Hz    auto print:   OFF
format:   SINGLE    ch view:  SETTING

 draw range zoom  (/div)  pos.    flt
ch1:■  20mV  x1(  20mV)  3.0DIV 500Hz
ch2:□   50V  x1(  50 V)  3.0DIV   OFF
                     (0 adjust)

MEMORY RECORD RMS XYCONT SYSTEM
```

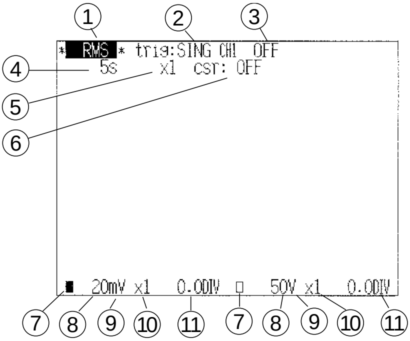
① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Time axis range	5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV	Set the chart speed. Set the time for 1 scale. (1 DIV)
③ Recording length	20, 50, 100, 200, 400, CONT	The length of recording for one measurement operation (the number of DIV) can be set.
④ Frequency	50 Hz, 60 Hz	Select the frequency of the commercial power supplies to be measured.
⑤ Screen setting	SINGLE, DUAL	Set the style for displaying waveforms on the waveform screen and recording them on the printer.
⑥ Types of print	WAVE, LOGGING	Select the style for recording on the printer.
⑦ Print interval	1, 8, 16, 40, 80, 160, 400, 800, 1600	Set the printing interval for recording as numerical value.

⑧ Auto print	OFF, ON	Printouts simultaneously with the waveform display.
⑨ Channel information	SETTING, UP & LOW	Display information of the input setting or upper and lower limit value on the waveform screen.
⑩ Waveform display	OFF, ON	Select whether display waveforms or not.
⑪ Voltage axis range	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50 V/DIV	Set the voltage axis range for each channel.
⑫ Input coupling	V(DC), ⏚ (GND)	Select the connection for the input.
⑬ Magnification/ compression ratio along the voltage axis	×4, ×2, ×1, ×1/2	Set the magnification/ compression ratio along the voltage axis for each channel.
⑭ Position	-0.4 to 6.4 DIV (magnification ratio; ×1)	Set the position for each channel.
⑮ Filter	OFF, 500 Hz, 5 Hz	Set the low-pass filters to restrict the frequency bands.
⑯ Zero adjustment	0 adjust	Perform the zero adjustment.

NOTE

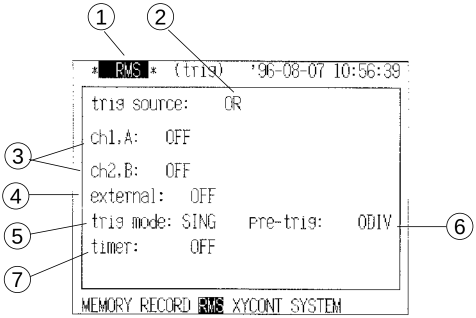
If the printing interval is set to less than 80 at the start of auto-printing (auto print ON), the following warning message appears and the interval is forcibly set to 80.
"WARNING 23: Can’t set interval to 1-40."

(2) Waveform screen



① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Trigger mode	SINGLE, REPEAT	Select whether to stop after a single recording, or carry out repeated recording.
③ Internal trigger	OFF, LOG, RMS	Set the internal trigger.
④ Time axis range	5, 10, 30 s/DIV 1, 2, 5, 10, 30 min/DIV 1 h/DIV	Set the chart speed. Set the time for 1 scale (1 DIV).
⑤ Compression ratio along the time axis range	×1, ×1/2, ×1/5, ×1/10, ×1/20, ×1/50	Set the compression ratio along the time axis for each channel.
⑥ A and B cursors	OFF, ↔, ↕, +	The A and B cursors can be used.
⑦ Waveform display	OFF, ON	Select whether display waveforms or not.
⑧ Voltage axis range	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50 V/DIV	Set the voltage axis range for each channel.
⑨ Input coupling	V(DC), ⏚ (GND)	Select the connection for the input.
⑩ Magnification/ compression ratio along the voltage axis	×4, ×2, ×1, ×1/2	Set the magnification/ compression ratio along the voltage axis for each channel.
⑪ Position	-0.4 to 6.4 DIV (magnification ratio; ×1)	Set the position for each channel.

(3) Trigger screen



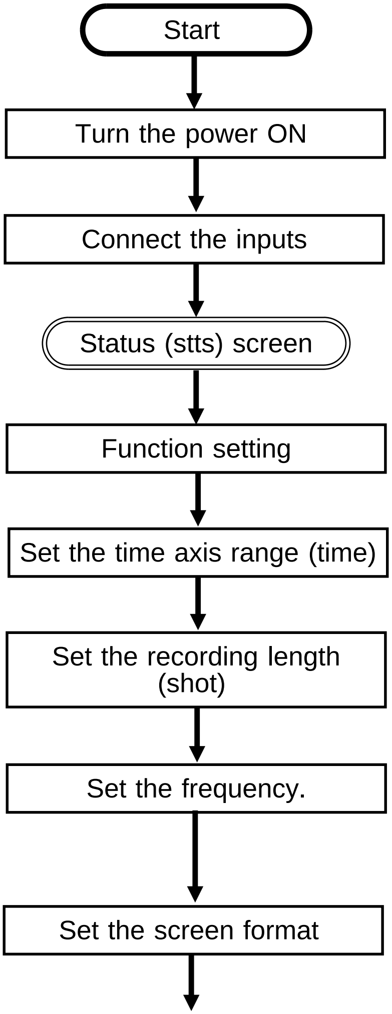
```
* RMS *  (trig)   '96-08-07 10:56:39
trig source:    OR
ch1,A:   OFF
ch2,B:   OFF
external:   OFF
trig mode: SING    pre-trig:    0DIV
timer:      OFF
MEMORY RECORD RMS XYCONT SYSTEM
```

① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Trigger source AND/OR	AND, OR	Set whether the triggers are AND or OR.
③ Internal trigger	OFF, LOGIC, RMS	Set the internal trigger.
④ External trigger	OFF, ON	Using of the external input as a trigger source is possible.
⑤ Trigger mode	SINGLE, REPEAT	Select whether to stop after a single recording, or carry out repeated recording.
⑥ Pre-trigger	0, 5, 10 DIV	Set the number of divisions to record the signal that comes before the trigger.
⑦ Timer trigger	OFF, ON	Used when recording at a predetermined time is required.

8.3 Basic Operational Procedures

8.3.1 Operational Flow

The flowchart below illustrates the sequence of operations involved in using the recorder function.



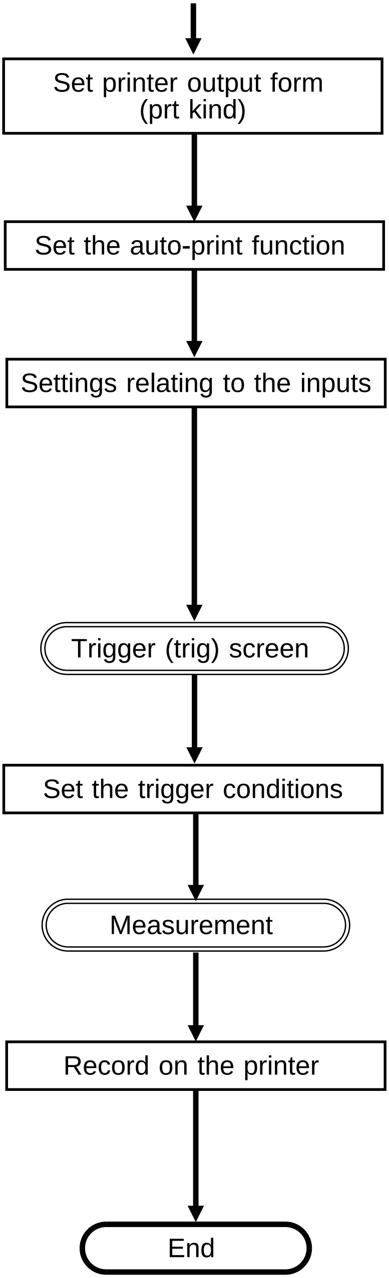
Set to the RMS recorder function mode.

Set the chart speed.

Set the length of the recording for one measurement.

Set the frequency, 50 Hz or 60 Hz, of the commercial power supplies to measure.

Set the format type for the waveform display screen.


Set printer output form (prt kind)
Set the auto-print function
Settings relating to the inputs
Trigger (trig) screen
Set the trigger conditions
Measurement
Record on the printer
End

Set whether measurement data will be sent to the printer as a waveform or as numerical values.

Set whether printing will occur simultaneously with screen display or not.

Set the channels for which display and recording will be performed. Also set voltage axis range, magnification/compression of the voltage axis range, input coupling, and filters.

Set the trigger source, the trigger type and conditions, and pre-trigger.

Press the **START** key and start measurement.

Print out the result of measurement simultaneously with the measurement ends.

8.3.2 Example of Operation

This example illustrates the procedure connecting the 8804 to an oscillator to measure and record a 8 Vp-p 60 Hz sine wave input.

(1) Turn on the power

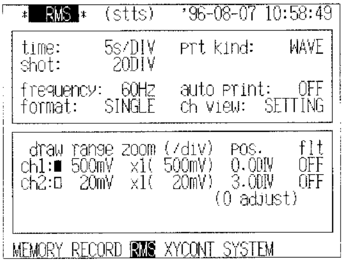
Turn on the power switch on the 8804.

(2) Connect the input

Connect the oscillator to the input terminal of channel 1 of the 8804.

Set the oscillator so that it outputs a sine wave of frequency 60 Hz and voltage of 8 Vp-p.

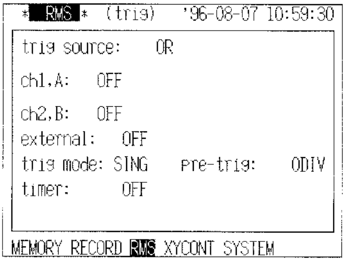
(3) Set the status screen



```
* RMS *  (stts)   '96-08-07 10:58:49

time:       5s/DIV   prt kind:     WAVE
shot:        20DIV

frequency:   60Hz    auto print:    OFF
format:     SINGLE   ch view:   SETTING

 draw range zoom (/div)  pos.      flt
ch1:■ 500mV  x1( 500mV)  0.0DIV    OFF
ch2:□  20mV  x1(  20mV)  3.0DIV    OFF
                        (0 adjust)

MEMORY RECORD RMS XYCONT SYSTEM
```

Using the CURSOR keys and $\boxed{+}$, $\boxed{-}$ keys, set as same as the setting on the figure left.

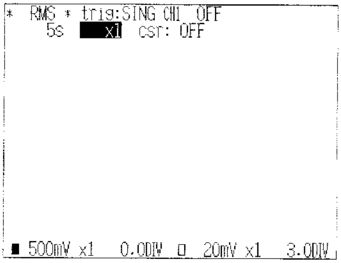
(4) Set the trigger screen



```
* RMS *  (trig)   '96-08-07 10:59:30

trig source:    OR

ch1,A:   OFF

ch2,B:   OFF
external:   OFF
trig mode: SING    pre-trig:    0DIV
timer:      OFF

MEMORY RECORD RMS XYCONT SYSTEM
```

1. Press the **MENU/WAVE** key to display the trigger screen.
2. Using the CURSOR keys and $\boxed{+}$, $\boxed{-}$ keys, set as same as the setting on the figure left.

(5) Set the time axis range.



```
*  RMS * trig:SING CH1  OFF
    5s     x1  csr: OFF

■ 500mV x1   0.0DIV □  20mV x1   3.0DIV
```

1. Press the **MENU/WAVE** key to display the waveform screen.
2. Using the CURSOR keys and **+** , **−** keys, set to "×1".

(6) Begin measurement

Press the **START** key. The LED above the key will light up and then the measurement starts.

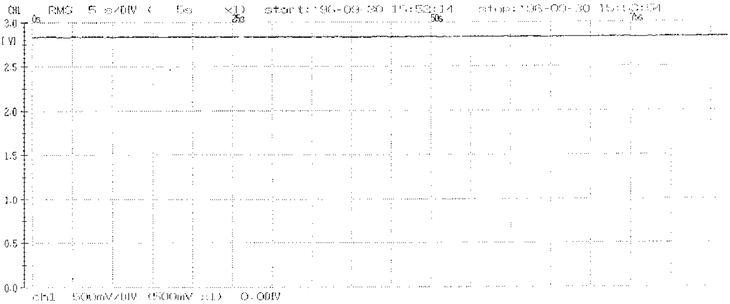
The waveform will be displayed on the screen simultaneously with triggering occurs.

(7) End measurement

When storage in the memory of 20 DIV of data is completed, the LED goes out and the system enters to the STOP condition, and the waveform is shown on the screen.

(8) Print out

Press the PRINT key. The manual print as the figure below is recorded.

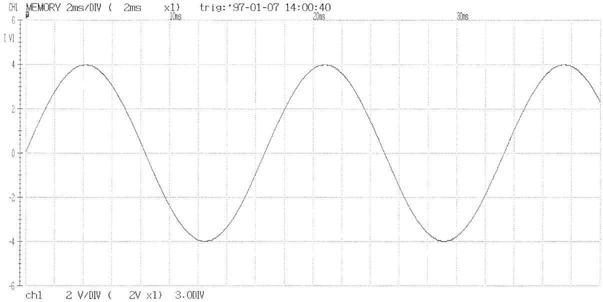


The rms value of the 8 Vp-p sine wave is:

8 Vp-p/2$\sqrt{2}$ 2.83 V

The above diagram was actually recorded at 2.83 V.

Input signal 60 Hz sine wave (recording in the Memory recorder function)



Chapter 9
X-Y CONT Recorder Function

9.1 What is the X-Y CONT Recorder Function?

9.1.1 Introduction

This function allows a X-Y plot between channels 1 and 2 in real time.

(1) The same operation as a normal recorder is available to plot between channels 1 and 2 (real time X-Y recording).

(2) Unlike an X-Y plot produced in the memory recorder function mode, the time axis information for each channel is not being recorded.

(3) The X-Y plot is retained in memory.

(4) The channel 1 is set to X-axis, and the channel 2 is set to Y-axis.

(5) High speed sampling.
For dot display the sampling period is fixed at 200 µs, while for line display the fastest sampling period is 400µs (unfixed)

(6) Unlimited recording time
There is no limit on the length of a recording because basically the operation is the same as that of a conventional recorder.

(7) Superimposition function
When the waveform clear is OFF, waveforms can be superimposed.

9.1.2 Finding Reference Material in This Manual

(1) Setting basic setting items. (Refer to Section 5.2, "Basic Setting Items of Each Function.")
There are waveform clear, line style, waveform display, voltage axis range, input coupling, magnification/compression along the voltage axis range, position, and filter.

(2) Start/stop measurement operation. (Refer to Section 5.3, "Starting and Stopping Measurement.")
Measurement is started by pressing the **START** key and finished by pressing the **STOP** key.

(3) Printing function. (Refer to Section 5.4, "Printer Operations.")
There are two methods of printing; manual printing and screen copy printing.

(4) Zero adjustment function. (Refer to Section 5.5, "Zero Adjustment.")
This function provides for accurate adjustment of the waveform to the origin position when a zero voltage is input.

(5) A and B cursors operations. (Refer to Section 10.1, "Using the A and B Cursors.")
The voltage differences getting a direct digital can be readout on the waveform screen.

(6) Channel information function. (Refer to Section 5.2, "Basic Setting Items of Each Function"-(8).)

(7) Trigger function. (Refer to Chapter 11, "Trigger Function.")
Level trigger, window-out trigger, and logic trigger can be used as the internal trigger.

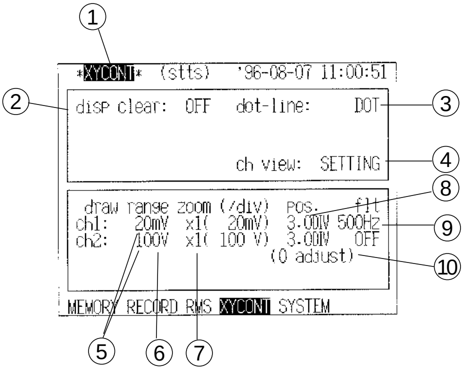
(8) Scaling function. (Refer to Section 12.4.1, "Scaling Function.")
The scaling function allows the numerical values and units for the input voltages to be converted, so that they can be directly read out as physical values.

(9) Comment input function. (Refer to Section 12.3.9, "Appending Comments.")
Instead of making handwritten memos on recordings, comments can be input and printed out.

(10) List and gauge functions. (Refer to Section 12.3.3, "Listing and Gauge Functions.")
These functions print out voltage axis scales and listings of settings

9.2 Display Screens

(1) Status screen

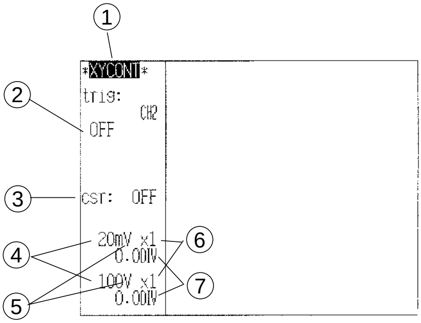


```
*XYCONT* (stts)   '96-08-07 11:00:51
disp clear:  OFF   dot-line:      DOT

                   ch view:   SETTING

 draw range zoom (/div)  pos.    flt
ch1:   20mV  x1(  20mV)  3.0DIV 500Hz
ch2:   100V  x1( 100 V)  3.0DIV   OFF
                      (0 adjust)
MEMORY RECORD RMS XYCONT SYSTEM
```

① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Waveform clear	OFF, ON	The waveforms are superimposed on the existing one with setting OFF.
③ Line style	DOT, LINE	Set whether or not linear interpolation is performed.
④ Channel information	SETTING, UP & LOW	Display information of the input setting or upper and lower limit value on the waveform screen.
⑤ X and Y axes range	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50, 100 V/DIV	Set the X and Y axis ranges.
⑥ Input coupling	V(DC), ⏚ (GND)	Select the connection for the input.
⑦ Magnification/ compression along the X and Y axes range	×4, ×2, ×1, ×1/2	Set the magnification/ compression ratio along the X and Y axes for each channel.

⑧ Position	-0.4 to 6.4 DIV (magnification ratio; ×1)	Set the position for each channel.
⑨ Filter	OFF, 500 Hz, 5 Hz	Set the low-pass filters to restrict the frequency bands.
⑩ Zero adjustment	0 adjust	Performs the zero adjustment.

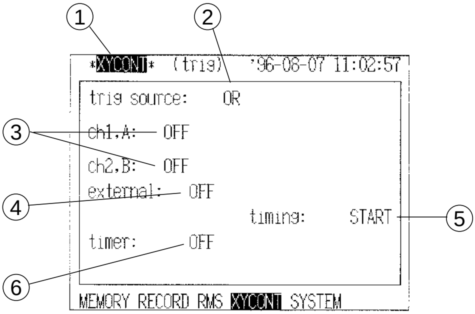
(2) Waveform screen



① Function	Memory, Record, RMS, XY CONT, System	Selects function.
② Internal trigger	OFF, LEVEL, OUT, LOG	Set the internal trigger.
③ A and B cursors	OFF, ↔, ↕	The A and B cursors can be used.
④ X and Y axes range	20, 50, 100, 200, 500 mV/DIV 1, 2, 5, 10, 20, 50, 100 V/DIV	Set the X and Y axes range for each channel.
⑤ Input coupling	V(DC), ⏚ (GND)	Select the connection for the input.
⑥ Magnification/ compression along the X and Y axes	×4, ×2, ×1, ×1/2	Set the magnification and compression ratio along the X and Y axes for each channel.
⑦ Position	-0.4 to 6.4 DIV (magnification ratio; ×1)	Set the position for each channel.

NOTE Unlike the Memory recorder function, even if the setting is changed after the measurement completes, the waveform display is not changed.

(3) Trigger screen



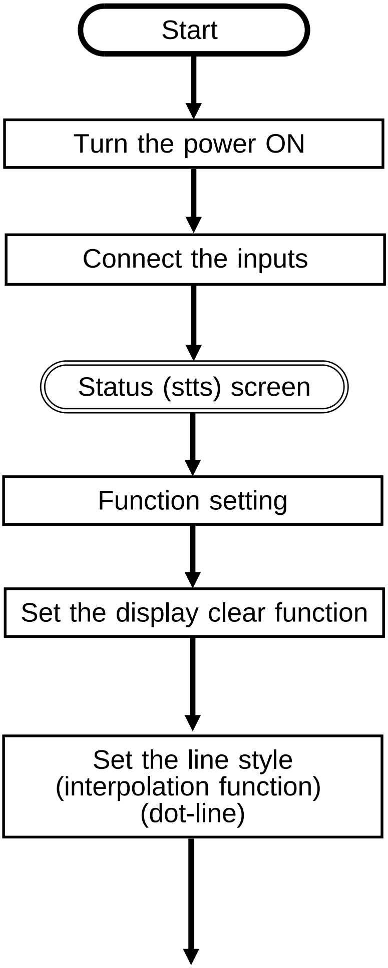
XYCONT (trig) '96-08-07 11:02:57
trig source: OR
ch1,A: OFF
ch2,B: OFF
external: OFF
timing: START
timer: OFF

① Function	Memory, Record, RMS, XY CONT, System	Select function.
② Trigger source AND/OR	AND, OR	Set whether the triggers are AND or OR.
③ Internal trigger	OFF, LEVEL, OUT, LOGIC	Set the internal trigger.
④ External trigger	OFF, ON	Using the external input as a trigger source is possible.
⑤ Trigger timing	START, STOP	Set whether start or stop recording after the trigger occur.
⑥ Timer trigger	OFF, ON	Used when recording at a predetermined time is required. The time intervals can be set.

9.3 Basic Operational Procedures

9.3.1 Operational Flow

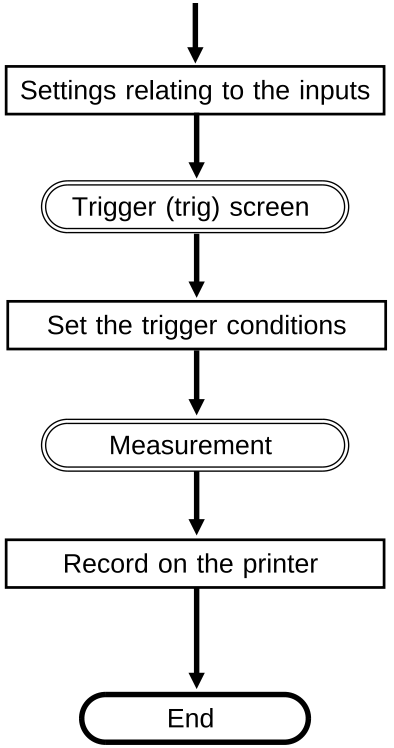
The flowchart below illustrates the sequence of operations involved in using the X-Y CONT recorder function.


Start
Turn the power ON
Connect the inputs
Status (stts) screen
Function setting
Set the display clear function
Set the line style (interpolation function) (dot-line)

Set to the X-Y CONT recorder function mode.

Set whether clear the waveforms remained or not when the measurement starts.

Set to the dot display or line display.



Make the settings such as the voltage axis range and filters.

Set the trigger source, the trigger type and conditions.

Press the **START** key and start measurement.

Press the **STOP** key to terminate the measurement and then press the **PRINT** key to print out the measurement result.

9.3.2 Example of Operation

This example illustrates the procedure connecting two oscillators to the inputs and displaying the Lissajous figure produced by plotting a 8 Vp-p, 1 Hz sine wave against a 8 Vp-p, 2 Hz sine wave.

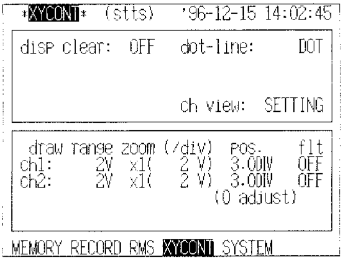
(1) Turn on the power.

Turn on the power switch on the 8804.

(2) Connect the input.

Channel 1 (X axis): Output voltage 8 Vp-p
A sine wave of frequency 1 Hz
Channel 2 (Y axis): Output voltage 8 Vp-p
A sine wave of frequency 2 Hz

(3) Set the status screen.

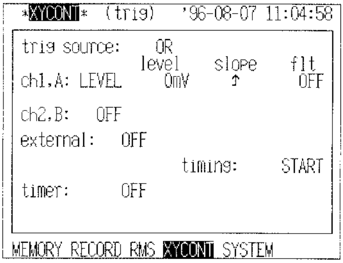


```
 *XYCONT*  (stts)   '96-12-15 14:02:45
 disp clear:  OFF   dot-line:      DOT

                    ch view:   SETTING

  draw range zoom (/div)  pos.     flt
 ch1:      2V  x1(   2 V)  3.0DIV  OFF
 ch2:      2V  x1(   2 V)  3.0DIV  OFF
                        (0 adjust)

MEMORY RECORD RMS XYCONT SYSTEM
```

Status Screen

Using the CURSOR keys and $\boxed{+}$, $\boxed{-}$ keys, set as same as the setting on the figure left.

(4) Set the trigger screen.



```
*XYCONT* (trig)   '96-08-07 11:04:58
trig source:   OR
               level    slope    flt
ch1,A: LEVEL    0mV       ↑      OFF
ch2,B:   OFF
external:   OFF
                     timing:    START
timer:      OFF
```

Trigger Screen

1. Press the **MENU/WAVE** key to display the trigger screen.
2. Using the CURSOR keys and **+** , **−** keys, set as same as the setting on the figure left.

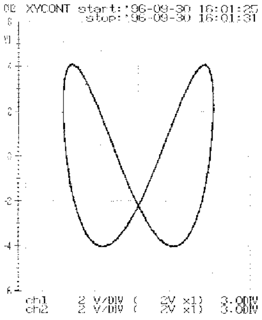
(5) Begin measurement.

Press the **START** key. The LED above the key will light up and then the measurement starts.

(6) End measurement.

Recording continues until the **STOP** key is pressed. By pressing the **STOP** key, the LED will go out, and measurement will end.

(7) Print out.



Press the **PRINT** key. The manual print as the figure left is recorded.

Chapter 10
Applications

10.1 Using the A and B Cursors (All Functions)

The A and B cursors can be used to measure time differences, frequencies, or voltage differences getting a direct digital readout on the waveform screen.
When the partial printing, partial X-Y plot, or numerical calculation is performed, using the vertical or cross cursors, the range can be set.

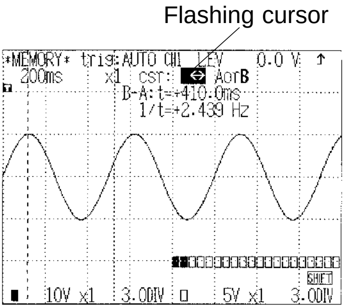
10.1.1 The types of the cursors

	Memory recorder	Recorder	RMS recorder	X-Y CONT recorder
Line cursor (Vertical cursor)	●	●	●	●
Line cursor (Horizontal cursor)	●	●	●	●
Cross cursor	●	●	●	—

NOTE The cross cursor (+) traces the waveform of the specified channel.

	A value	B-A value
Line cursor (Vertical cursor)	Time axis waveform t: time from the trigger point 1/t: the frequency, taking t as the period X-Y plot waveforms v: voltage difference from 0 V	Time axis waveform t: time difference between the A and B cursors 1/t: the frequency, taking t as the period X-Y plot waveforms v: voltage difference between the A and B cursors
Line cursor (Horizontal cursor)	v: voltage difference from 0 V	v: voltage difference between the A and B cursors
Cross cursor	t: time from the trigger point v: voltage difference from 0 V	t: time difference between the trace points v: voltage difference between the trace points

Method (on the waveform screen)



Waveform Screen

1. Using the CURSOR keys, move the flashing cursor to csr.
2. Using the $\boxed{+}$ and $\boxed{-}$ keys, select Vertical cursor, Horizontal cursor, or Cross cursor.

Selection

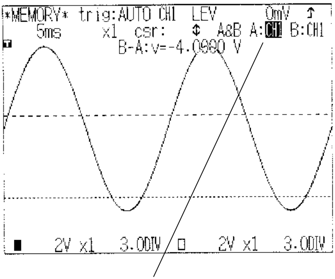
↔	Vertical cursor (displays t, 1/t)
↕	Horizontal cursor (displays v)
+	Cross cursor (displays t, v) (in the Memory, Recorder, RMS recorder function modes)

3. Using the CURSOR keys, move the flashing cursor to the right. Then using the + and – keys, select the cursor to be moved.

   Selection

A	Display A cursor only and move.
A or B	Display A and B cursors and move the A cursor.
A or **B**	Display A and B cursors and move the B cursor.
A & B	Display A and B cursors and move together.

4. If the Horizontal cursor or Cross cursor was selected in step 2., now select the waveform channel for reading voltage values.

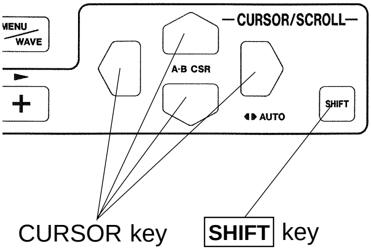


```
*MEMORY* trig:AUTO CH1  LEV         0mV  ↥
   5ms        x1  csr:    ⇕  A&B A:CH1 B:CH1
                B-A:v=-4.0990 V
 ▮     2V x1   3.0DIV □     2V x1   3.0DIV
```

Flashing cursor

Using the CURSOR keys, move the flashing cursor to the right and select the channels for each of the A and B cursors with + and – keys.

NOTE Even if the A and B cursors have different channels specified, the voltage difference between A and B cursors is derived from the absolute values of the voltages relating to their respective channels.



5. Press the **SHIFT** key. The **SHIFT** indication appears on the waveform screen.
6. By pressing the CURSOR keys, the line cursors and cross cursor will move.
   t and 1/t, and v, are derived according to the position of the cursor.

   In the case of Vertical cursors or Cross cursors, it is quite valid for the A or the B cursor to go off the screen.

NOTE

- For waveform scrolling and movement of the cursors, while scrolling the waveform, the case of the vertical cursors or the cross cursors differs from the case of the Horizontal cursors, in the movement of the A and B cursors. However, the position of the cursors on the screen does not change.

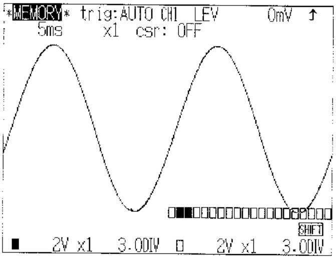
  Vertical cursors and Cross cursor move with the waveform.
  Horizontal cursors do not move with the waveform.
- When the cross cursor is selected in the Recorder or RMS recorder function, the cursor moves on the maximum and minimum sampling data in order.

10.2 Waveform Scrolling

In Memory recorder, Recorder, and RMS recorder function, the waveform can be scrolled vertically and horizontally on the screen display.

Method (on the waveform screen)

(1) Horizontal scrolling



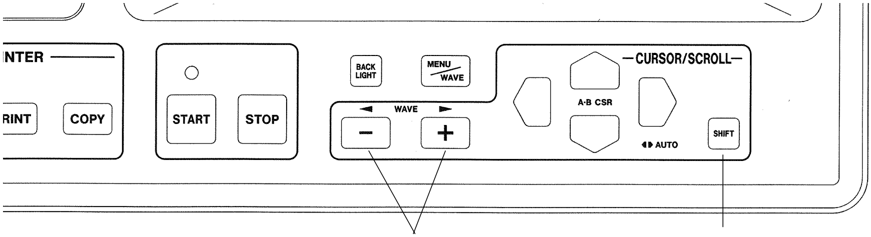
MEMORY trig:AUTO CH1 LEV 0mV ↑
5ms x1 csr: OFF
SHIFT
2V x1 3.0DIV 2V x1 3.0DIV

Waveform Screen

1. Press the SHIFT key. The SHIFT indication appears on the waveform screen.
2. If the + key is pressed, the waveform will be scrolled to the right direction. If the − key is pressed, the waveform will be scrolled to the left direction.

NOTE

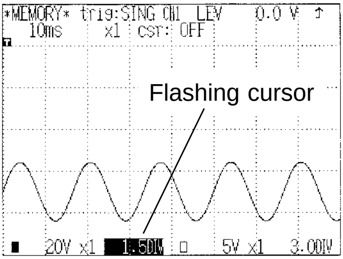
- If the waveform is displayed at 8 DIV or less after the result of the compression along the time axis, the scrolling can not be performed.
- For position display of the waveform scrolling, pressing the SHIFT key, the position of the waveform display for the whole recording length is displayed above the SHIFT key.



+ , − key

SHIFT key

(2) Vertical scrolling



Waveform Screen

1. Move the flashing cursor to pos.
2. If the $\boxed{+}$ key is pressed, the waveform will be scrolled to the upper direction. If the $\boxed{-}$ key is pressed, the waveform will be scrolled to the lower direction.

(Refer to Section 5.2, "Basic Setting Items of Each Function- (13) "Position.")

Chapter 11
Trigger Function

11.1 Overview

(1) The term "trigger" refers to a signal which determines the timing to start or stop recording or internal data capture.

(2) There are three types of signal which can be used for triggering (trigger sources):

① Internal trigger [channel 1 (A), channel 2 (B)]
The trigger is derived from the analog input signals to channels 1 and 2 or the logic inputs to channel groups A and B. The trigger function monitors the state of the signals, and is activated when a predetermined signal state occurs.

② External trigger
Triggering occurs when the EXT TRIG terminals are shorted, or when the input voltage drops below about 2.5 V. This is used for synchronization to other apparatus. This is also used for operation of several 8804 units synchronized in parallel.

③ Timer trigger [timer]
The timer trigger occurs between predetermined times for starting and stopping operation. Use the timer trigger for fixed time recording.

(3) The trigger can be selected to be either the logical AND or the logical OR combination of these trigger sources described in ① to ③.

AND: Triggering occurs only if all of the trigger conditions hold.

OR: Triggering occurs if any one of the trigger conditions holds.

NOTE When the all trigger source is set to OFF, the triggering occurs simultaneously with the start.

(4) Setting the trigger mode (except for the X-Y CONT recorder function mode)

This determines whether or not the trigger is repeatedly accepted after the measurement operation has terminated.

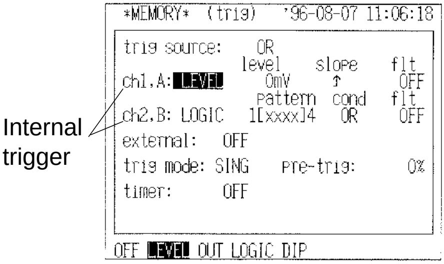
(5) Pre-trigger and trigger timing settings

The trigger timing setting refers to which of the start and stop events are controlled by the trigger.

The pre-trigger setting determines how much of the captured data is actually before the trigger event.

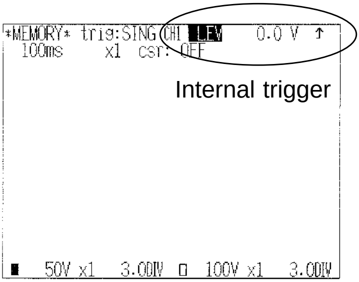
11.2 Internal Trigger

- Using the analog input and logic inputs as the basis of trigger signals, set the trigger.
- The analog channel 1 and the logic channel A, or the analog channel 2 and the logic channel B can not be used simultaneously as the trigger source.



```
  *MEMORY*  (trig)    '96-08-07 11:06:18
 trig source:     OR
                level    slope    flt
 ch1.A: LEVEL      0mV     ↑       OFF
                 pattern  cond    flt
 ch2.B: LOGIC   1[xxxx]4   OR      OFF
 external:    OFF
 trig mode: SING    pre-trig:       0%
 timer:       OFF

OFF LEVEL OUT LOGIC DIP
```

Trigger Screen

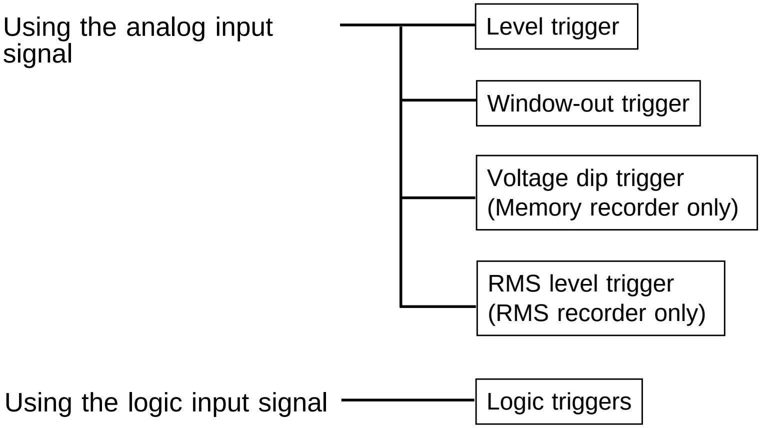


```
*MEMORY* trig:SING CH1 LEV    0.0 V  ↑
  100ms     x1  csr: OFF

■   50V x1   3.0DIV □  100V x1   3.0DIV
```

Waveform Screen

11.3 Setting the Trigger Types

The following trigger types are available:


Using the analog input signal
Level trigger
Window-out trigger
Voltage dip trigger (Memory recorder only)
RMS level trigger (RMS recorder only)
Using the logic input signal
Logic triggers

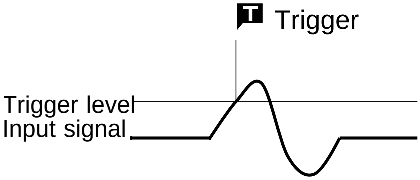
The function and the trigger to be set:

	Memory recorder	Recorder	RMS recorder	X-Y CONT recorder
Level trigger	●	●	—	●
Window-out trigger	●	●	—	●
Logic trigger	●	●	●	●
Voltage dip trigger	●	—	—	—
RMS level trigger	—	—	●	—

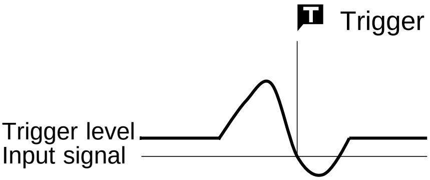
●: can be set, —: can not be set

11.3.1 Level Trigger

This trigger occurs when the input signal crosses a predetermined voltage level in a particular direction ("slope": ↥ or ↧).



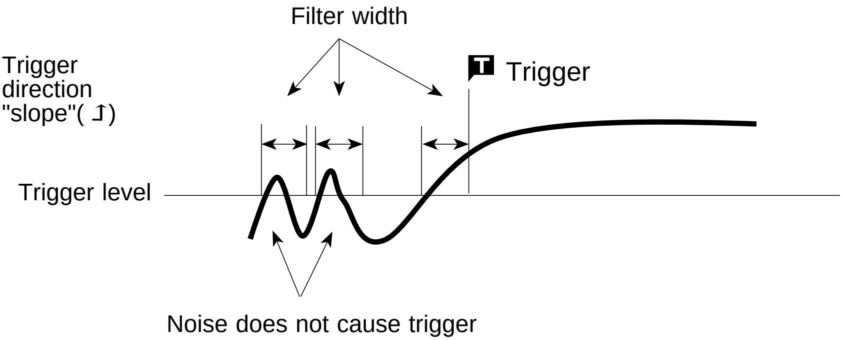
Upward trigger direction (↥)



Downward trigger direction（↧）

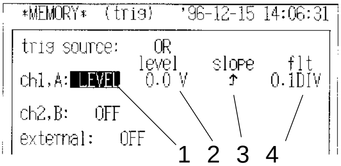
The trigger filter

- When using the trigger filter, trigger only occurs when the trigger conditions have been satisfied over an interval equal to the filter width.
- This provides a mechanism for avoiding mistriggers caused by noise.



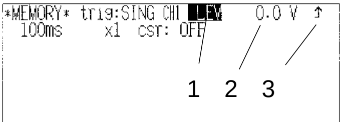
Method (on the trigger screen and waveform screen)

This example illustrates settings for channel 1 (A).
The channel 2 (B) is also set in the same manner.
Using the CURSOR keys, move the flashing cursor to the items designated by the numbers in the figure and make the settings.



```
*MEMORY*  (trig)   '96-12-15 14:06:31
trig source:    OR
                level    slope    flt
ch1,A: LEVEL    0.0 V     ↑      0.1DIV
ch2,B:   OFF
external:   OFF
```

Trigger Screen



```
*MEMORY* trig:SING CH1 LEV    0.0 V  ↑
  100ms     x1  csr: OFF
```

Waveform Screen

1. Set the type of trigger: Select "LEVEL".
2. Set the trigger level: Using the [+] and [−] keys, set the threshold value (voltage value).
3. Select the trigger direction (slope): Set by using the [+] and [−] keys.

Selection

↑	Triggering will occur when the input signal crosses the threshold value (the trigger level) from below going upwards.
↓	Triggering will occur when the input signal crosses the threshold value (the trigger level) from above going downwards.

4. Set the trigger filter (the trigger screen only):
   Set by using the [+] and [−] keys.
   This setting cannot be made on the waveform screen.
   Depending on the function, the contents which can be set vary.

Selection

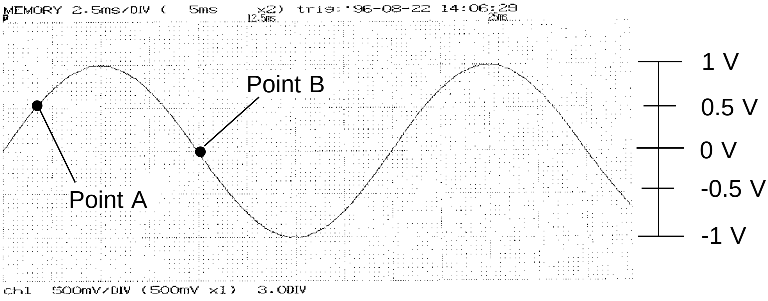
Memory recorder	OFF, 0.1, 0.2, 0.5, 1.0, 2.0 DIV (When the magnification ratio: ×1)
Recorder X-Y CONT recorder	OFF, ON

Example：

In order to cause trigger at point A or B of 2 Vp-p sine wave as shown in the figure below, the following settings are made:

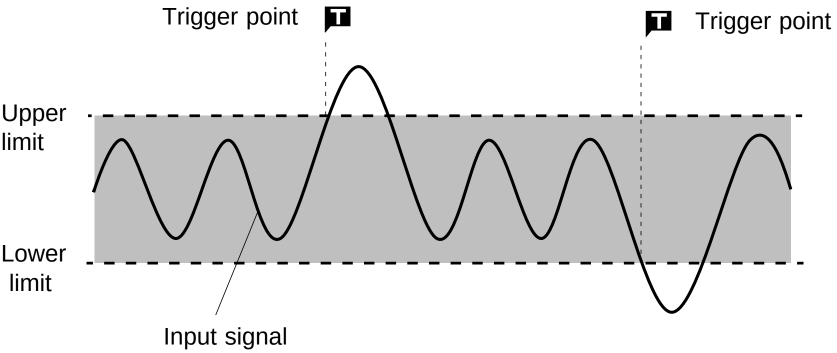
Point A .... Trigger level 0.5 V, trigger direction (slope) rising. (↥)

Point B .... Trigger level 0 V, trigger direction (slope) falling. (↧)



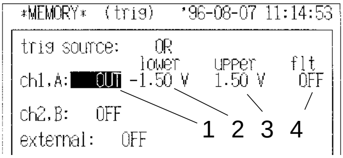
11.3.2 Window-out Trigger

Set upper limit level and lower limit level and activated when the input signal leaves this range.



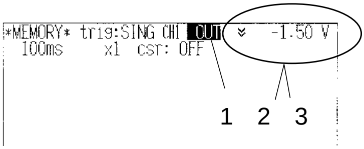
Method (on the trigger screen and waveform screen)

This example illustrates settings for channel 1 (A).
The channel 2 (B) can be set in the same manner.
Using the CURSOR keys, move the flashing cursor in the order indicated by the numbers in the figure, and make the settings.



```
 *MEMORY*  (trig)   '96-08-07 11:14:53
 trig source:    OR
                lower    upper    flt
 ch1.A:    OUT -1.50 V   1.50 V   OFF
 ch2.B:   OFF
 external:   OFF
```

Trigger Screen



```
*MEMORY* trig:SING CH1 OUT  ︾  -1.50 V
 100ms      x1  csr: OFF
```

Waveform Screen

1. Set the trigger type: Select "OUT".
2. Set the lower trigger level (︾):
   Using the [+] and [−] keys, set the threshold value (voltage value).
   The lower trigger level cannot be set more than the value of the upper trigger level.
3. Set the upper trigger level(︽):
   This is done in the same manner as step 2. The upper trigger level cannot be set less than the value of the lower trigger level.
4. Set the trigger filter (trigger screen only):
   Select by using the [+] and [−] keys.
   This setting cannot be made on the waveform screen.
   Depending on the functions, the contents which can be set vary.

Selection

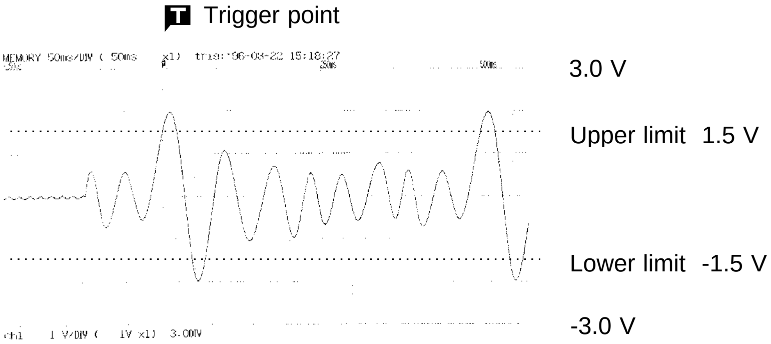
Memory recorder	OFF, 0.1, 0.2, 0.5, 1.0, 2.0 DIV (magnification ratio: ×1 is standard)
Recorder X-Y CONT recorder	OFF, ON

Example:

In order to cause trigger when the signal as shown in the figure below leaves the hatched area, the following settings are made:

[Window-out trigger]

Upper limit value	1.5 V
Lower limit value	-1.5 V

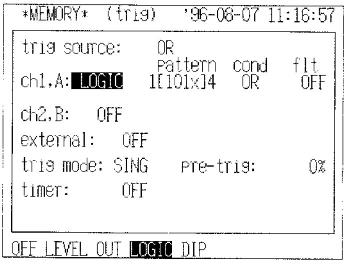


11.3.3 Logic Trigger

- Logic triggers are derived from the logic inputs.
- When a trigger pattern and logical operator (AND or OR) are specified, and the conditions are satisfied, trigger occurs.
- However, if a trigger filter is being used, trigger only occurs when the trigger conditions have been satisfied over an interval equal to the filter width.

Method (on the trigger screen and waveform screen)

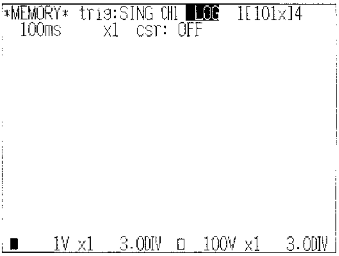
This example illustrates settings for channel A.
The channel 2 B is set in the same manner.
Using the CURSOR keys, move the flashing cursor, and make the settings.



```
*MEMORY*  (trig)    '96-08-07 11:16:57
 trig source:    OR
                  pattern   cond   flt
 ch1,A: LOGIC    1[101x]4    OR    OFF
 ch2,B:    OFF
 external:   OFF
 trig mode: SING     pre-trig:       0%
 timer:       OFF
OFF LEVEL OUT LOGIC DIP
```

Trigger Screen

1. Set the trigger type:
   Select "LOGIC" by using the [+] and [−] keys.
2. Set the trigger pattern: Sets the logic pattern for when trigger should take place. In case of channel A, the settings are made for logic inputs channel A 1 to 4 in order from the left. Select by using the [+] and [−] keys.

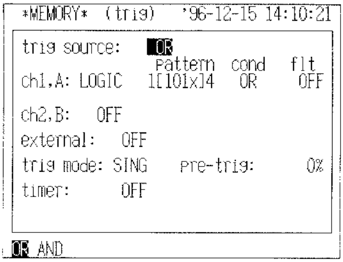


```
*MEMORY* trig:SING CH1 LOG  1[101x]4
  100ms      x1   csr: OFF

■     1V x1    3.0DIV  □  100V x1    3.0DIV
```

Waveform Screen

Selection

×	The signal ignored
0	Low level signal
1	High level signal



```
*MEMORY*  (trig)    '96-12-15 14:10:21
 trig source:    OR
                  pattern   cond   flt
 ch1,A: LOGIC    1[101x]4    OR    OFF
 ch2,B:    OFF
 external:   OFF
 trig mode: SING     pre-trig:       0%
 timer:       OFF
OR AND
```

Trigger Screen

3. Set the AND/OR logical operator for the trigger pattern (trigger screen only):
   Select by using the [+] and [−] keys.
   This setting cannot be set on the waveform screen.

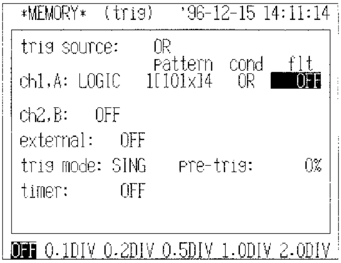
Selection

OR	Trigger occurs if any one of the logic input signals conforms to the trigger pattern.
AND	Trigger only occurs if all of the logic input signals conforms to the trigger pattern.

NOTE In the following cases, if setting to the OR logical operator for the trigger pattern, trigger will not occur, even if any one of the logic input signals conforms to the trigger pattern.

① While the input signal is already on the HIGH level from starting, the trigger pattern is set to 1 (high level signal).

② While the input signal is already in the LOW level from starting, the trigger pattern is set to 0 (low level signal).



```
 *MEMORY*  (trig)   '96-12-15 14:11:14
 trig source:    OR
                 pattern  cond   flt
 ch1.A: LOGIC   1[101x]4   OR    OFF

 ch2.B:   OFF
 external:   OFF
 trig mode: SING    pre-trig:      0%
 timer:      OFF

OFF 0.1DIV 0.2DIV 0.5DIV 1.0DIV 2.0DIV
```

Trigger Screen

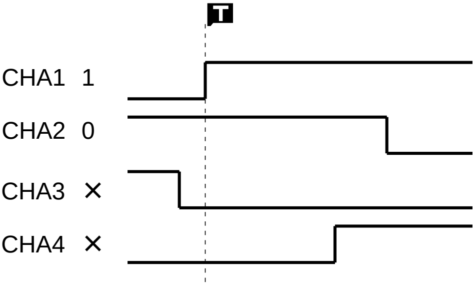
4. Set the trigger filter (on the trigger screen only):
   Select by using the [+] and [−] keys.
   This setting cannot be set on the waveform screen. Depending on the functions, the controls which can be set vary.

Selection

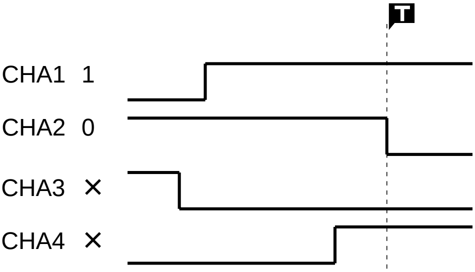
Memory recorder	OFF, 0.1, 0.2, 0.5, 1.0, 2.0 DIV (magnification ratio; ×1 is standard)
Recorder RMS recorder X-Y CONT recorder	ON, OFF

Logic Trigger Example

(1) If the trigger pattern has been set to "10 × ×" with the operator OR, then trigger occurs as shown in the figure right.

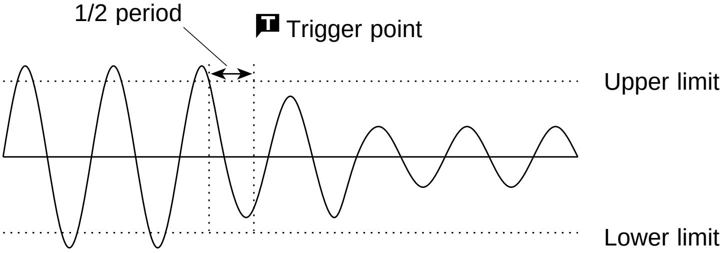


(2) If the trigger pattern has been set to "10 × ×" with the operator AND, then trigger occurs as shown in the figure right.



11.3.4 Voltage Dip Trigger (Memory Recorder Function)

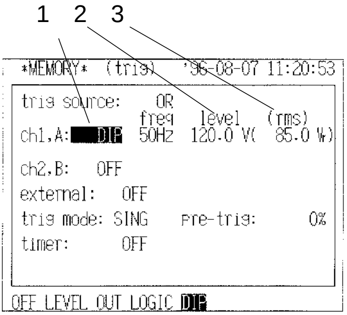
- The 8804 is designed to measure commercial power supplies (50/60 Hz).
- This unit detects momentary voltage drops in commercial power supplies.
- When the peak of the voltage falls lower than the setting level, the trigger will occur.
- The trigger levels of upper and lower limit cannot be set separately.
- On the trigger screen, not only the trigger level but also the rms value is displayed.



Method (on the trigger screen and waveform screen)

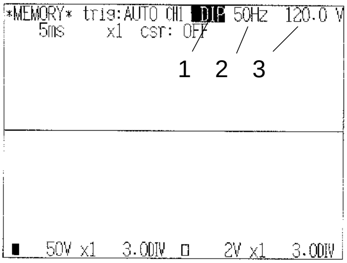
This example illustrates settings for channel 1. The channel 2 is set in the same manner.

Using the CURSOR keys, move the flashing cursor in the order which indicated by the numbers in the figure below, and set.



```
*MEMORY*  (trig)    '96-08-07 11:20:53
 trig source:    OR
                freq   level   (rms)
 ch1,A:    DIP  50Hz  120.0 V(  85.0 %)

 ch2,B:   OFF
 external:   OFF
 trig mode: SING    pre-trig:     0%
 timer:      OFF

OFF LEVEL OUT LOGIC DIP
```

Trigger Screen



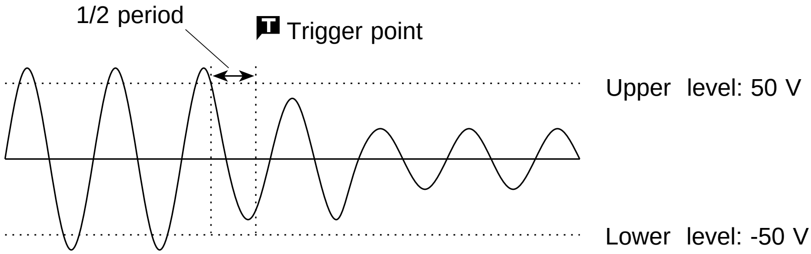
```
*MEMORY* trig:AUTO CH1  DIP 50Hz  120.0 V
   5ms      x1  csr: OFF

▮   50V x1   3.0DIV ▯    2V x1   3.0DIV
```

Waveform Screen

1. Set the trigger type:
   Using the [+] and [−] keys, select "DIP".
2. Set the frequency: Using the [+] and [−] keys, set the frequency to 50 Hz or 60 Hz.
3. Set the trigger level:
   Using the [+] and [−] keys, set the trigger level. The rms value is changed according to the trigger level.

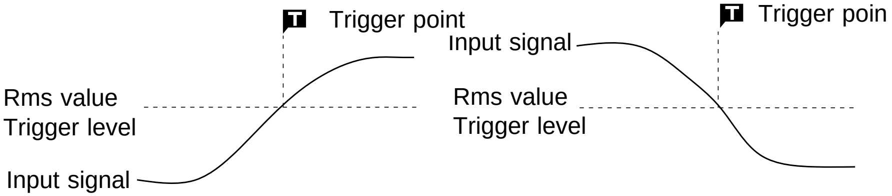
NOTE

- On the waveform screen, the rms value is not displayed.
- If the time axis range is less than 50 ms/DIV, this trigger will not occur.
- The trigger levels of upper and lower limit can not be set separately. For example, if set to 50 V, the upper limit is 50 V, and the lower limit is -50V.



11.3.5 RMS Level Trigger (RMS recorder function)

This trigger occurs when the input signal crosses a predetermined trigger level (rms value) in a particular direction ("slope": ↥ or ↧). The commercial power supplies, 50/60 Hz can be measured.

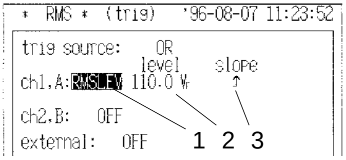


Upward trigger direction (↥)   Downward trigger direction (↧)

Method (on the trigger screen and waveform screen)

This example illustrates settings for channel 1(A). The channel 2 (B) is set in the same manner.

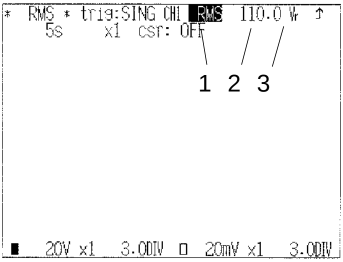
Using the CURSOR keys, move the flashing cursor in the order indicated by the numbers in the figure, and set.



```
 *  RMS *  (trig)   '96-08-07 11:23:52
 trig source:    OR
                level    slope
 ch1.A:RMSLEV 110.0 Vr     ↑
 ch2.B:   OFF
 external:   OFF
```

Trigger Screen

1. Set the trigger type:
   Using the + and − keys, select "RMSREV".
2. Set the trigger level:
   Using the + and − keys, set the threshold value (voltage value).



```
*  RMS * trig:SING CH1 RMS  110.0 Vr  ↑
    5s    x1  csr: OFF

■   20V x1   3.0DIV  □  20mV x1   3.0DIV
```

Waveform Screen

3. Set the trigger direction (slope):
   Make the setting by using the $\boxed{+}$ and $\boxed{-}$ keys.

Selection

↑	Trigger will occur when the input signal crosses the threshold value (the trigger level) from below going upwards.
↓	Trigger will occur when the input signal crosses the threshold value (the trigger level) from above going downwards.

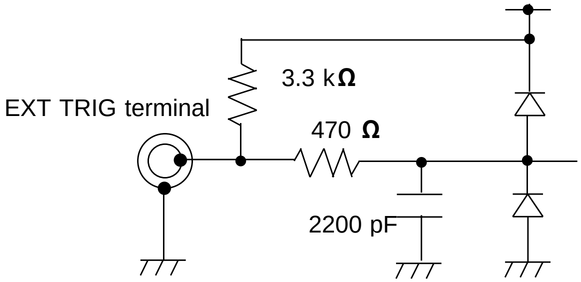
11

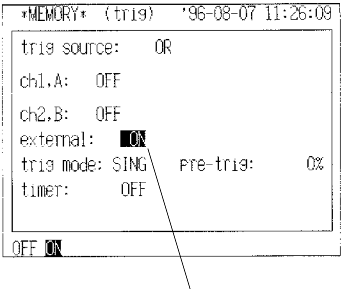
11.4 External Trigger

⚠WARNING **To avoid damage to the unit, do not input a voltage exceeding -5 V to +10 V to the EXT TRIG terminal.**

- It is possible to use an external input as a trigger source.
- External trigger is performed either by shorting out the EXT TRIG terminal, or by the supplied signal falling to less than about 2.5 V.

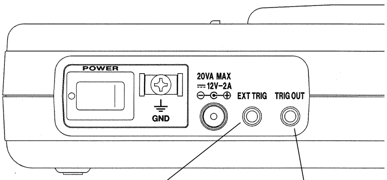
Circuit Diagram of the Input Circuit



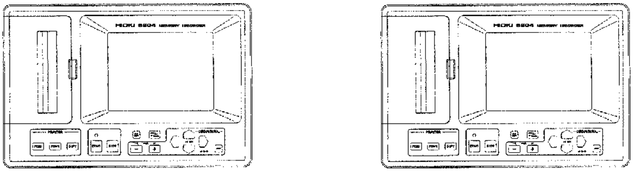


```
*MEMORY*  (trig)   '96-08-07 11:26:09
trig source:    OR
ch1,A:   OFF
ch2,B:   OFF
external:  ON
trig mode: SING    pre-trig:      0%
timer:      OFF
OFF ON
```

Flashing cursor



The external trigger facility can be used to synchronize a number of the 8804 units for parallel operation.

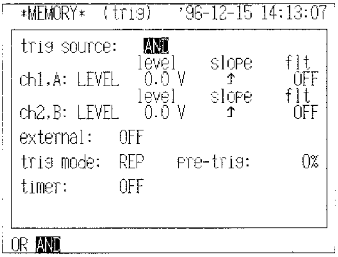


Set the EXT TRIG ON.

11.5 Internal and External Trigger Logical Operator

AND/OR is set according to the conditions of internal and external triggers.

Method (on the trigger screen)



```
 *MEMORY*  (trig)   '96-12-15 14:13:07
 trig source:    AND
                 level    slope    flt
 ch1.A: LEVEL    0.0 V      ↑       OFF
                 level    slope    flt
 ch2.B: LEVEL    0.0 V      ↑       OFF
 external:     OFF
 trig mode:    REP    pre-trig:      0%
 timer:        OFF

OR AND
```

Trigger Screen

1. Using the CURSOR keys, move the flashing cursor to trig source.
2. Select the desired logical operator AND or OR by using the $\boxed{+}$ and $\boxed{-}$ keys.

Selection

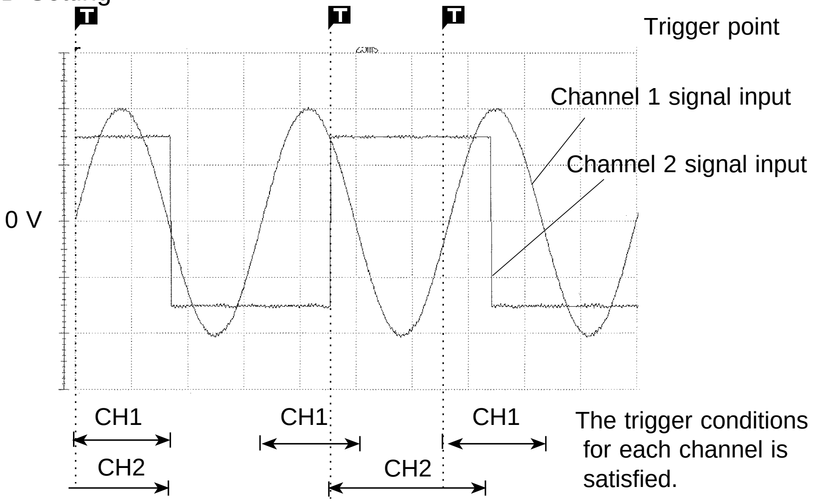
AND	Trigger occurs only if all of the trigger conditions hold.
OR	Trigger occurs if any one of the trigger conditions holds.

Example

If the settings are made as follows, then trigger occurs depending on the AND/OR setting.

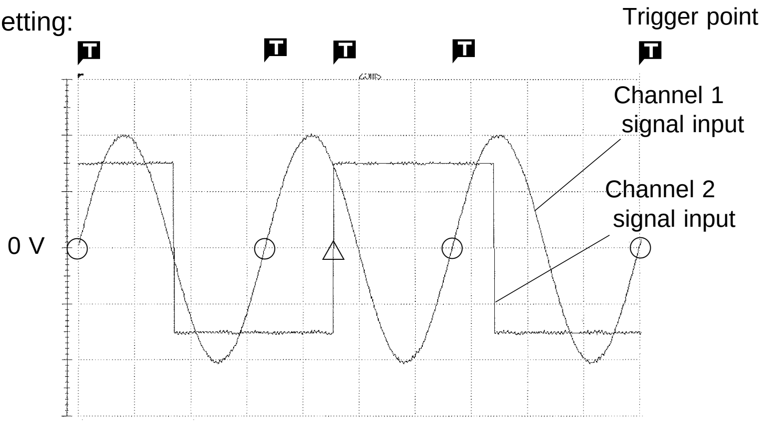
channel 1, A: LEVEL	level	slope	filter (flt)
	0.00 V	↥	OFF
channel 2, B: LEVEL	level	slope	filter (flt)
	0.00 V	↥	OFF

AND Setting



The trigger conditions for each channel is satisfied.

OR Setting:



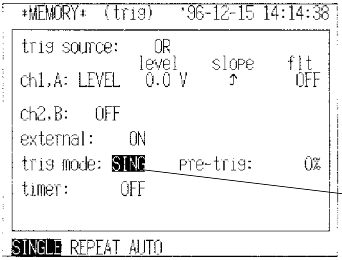
○ : The trigger conditions for channel 1 are satisfied.
△ : The trigger conditions for channel 2 are satisfied.

11.6 Trigger Modes (Memory, Recorder, RMS Recorder Function)

- Except in the X-Y CONT recorder function, the trigger mode setting can be made.
- It determines whether or not the trigger is repeatedly accepted and the recording is continued after the recording operation has terminated.

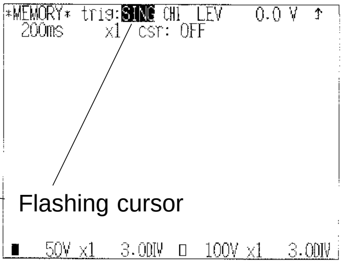
Method (on the trigger screen and waveform screen)

1. Using the CURSOR keys, move the flashing cursor to trig mode.
2. Select the trigger mode by using the + and − keys.



```
*MEMORY*  (trig)   '96-12-15 14:14:38
trig source:   OR
              level    slope    flt
ch1,A: LEVEL   0.0 V     ↑       OFF
ch2,B:   OFF
external:   ON
trig mode: SING     pre-trig:      0%
timer:      OFF
SINGLE REPEAT AUTO
```

Trigger Screen



```
*MEMORY* trig:SING CH1  LEV    0.0 V  ↑
 200ms      x1  csr: OFF
■   50V x1   3.0DIV  □  100V x1   3.0DIV
```

Waveform Screen

Selection

SINGLE	The trigger is activated once after the **START** key is pressed. It does not repeat.
REPEAT	Trigger occurs repeatedly. Measurement takes place each time the trigger event occurs.
AUTO	Trigger occurs repeatedly, but if approximately 1 second elapsed without the trigger applying, recording starts automatically. This is convenient for checking input unit waveform (Memory recorder function only).

11.7 Pre-Trigger (Memory, Rms Recorder Function)

Not only the waveform after the trigger but also before the trigger can be recorded. The moment the trigger occur, the time related to the waveform being recorded can be set. If all the trigger sources are disabled (OFF), pre-trigger setting cannot be performed.

In the memory recorder function

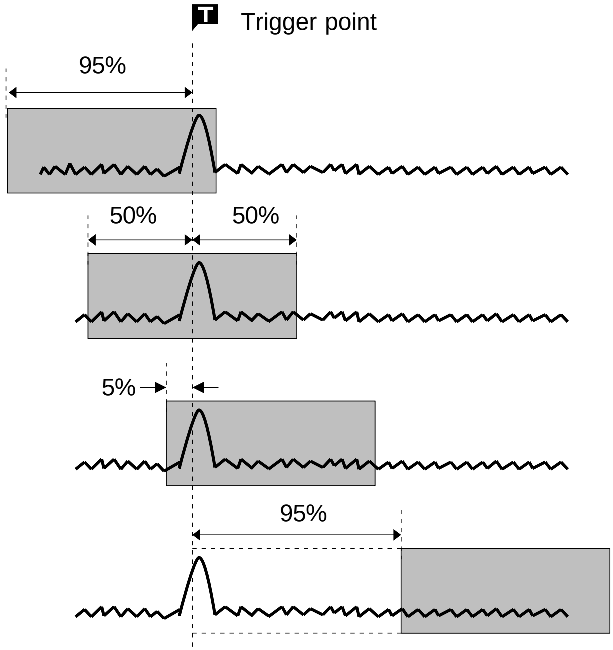
The setting determines the proportion in percent (%) of the recording length of the signal that comes before the trigger.

In the RMS recorder function

The setting determines the number of divisions to be recorded regardless of the recording length of the signal that comes before the trigger.

(1) In the Memory recorder function

Example ▨ ········ recording range (recording length)



[95%] :
95% of the recording in the recording length is before the trigger

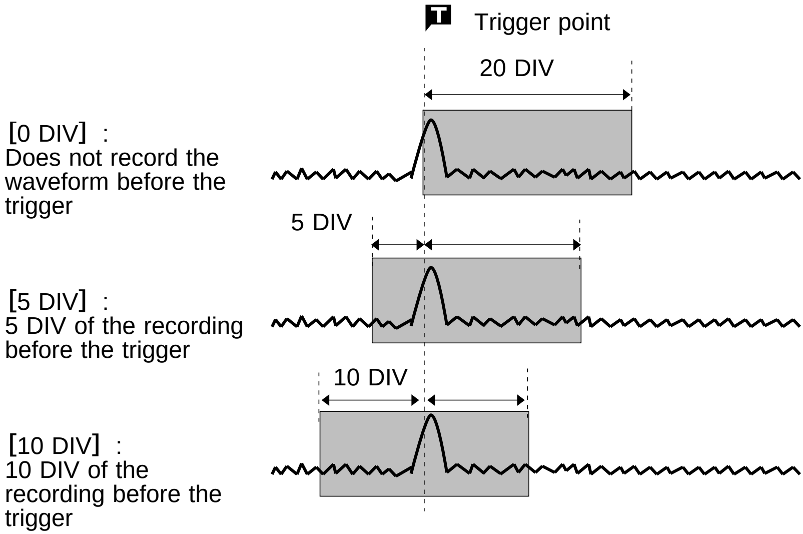
[50%] :
50% before and 50% after the trigger

[5%] :
95% of the recording after the trigger

[-95%] :
Recording is about one recording length after the trigger

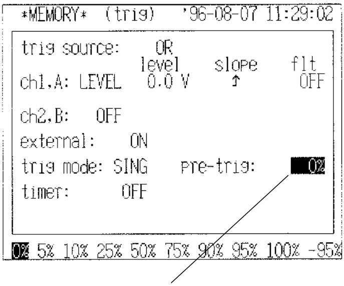
(2) RMS recorder function

Example ▨ ········ recording range (recording length)


Trigger point
20 DIV
[0 DIV] :
Does not record the waveform before the trigger
5 DIV
[5 DIV] :
5 DIV of the recording before the trigger
10 DIV
[10 DIV] :
10 DIV of the recording before the trigger

NOTE In the RMS recorder function, a trigger can be accepted immediately from the start time. In some cases, therefore, the pre-trigger portion of a recording may not be available.

Method (on the trigger screen)



```
 *MEMORY*  (trig)   '96-08-07 11:29:02
 trig source:    OR
                level    slope    flt
 ch1.A: LEVEL   0.0 V      ↑      OFF

 ch2.B:   OFF
 external:    ON
 trig mode: SING    pre-trig:      0%
 timer:       OFF

0% 5% 10% 25% 50% 75% 90% 95% 100% -95%
```

Flashing cursor

1. Using the CURSOR keys, move the flashing cursor to pre-trig.
2. Set by using the $\boxed{+}$ and $\boxed{-}$ keys.

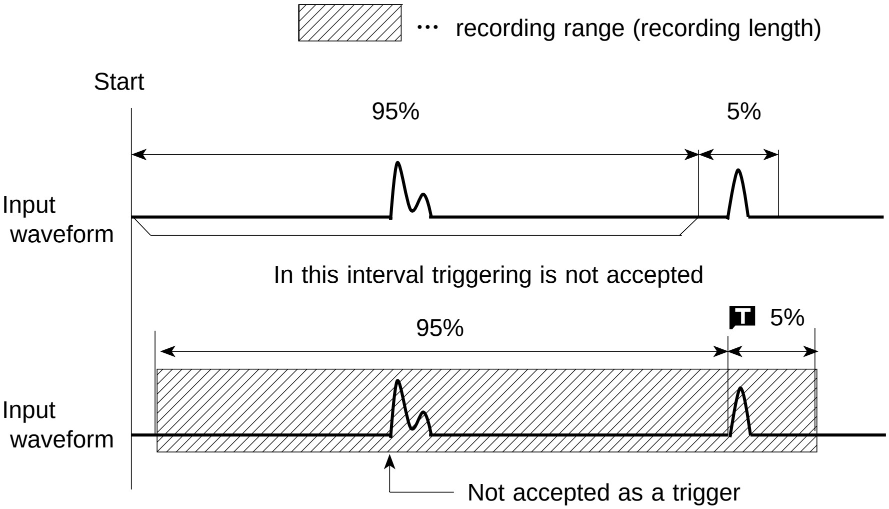
Selection

Memory recorder	0, 5, 10, 25, 50, 75, 90, 95, 100, -95%
RMS recorder	0, 5, 10 DIV

NOTE

- When the pre-trigger is set from 5% to 100%, the trigger is not accepted during some predetermined time interval from the start of measurement. During this interval, the message "Waiting for pre-trigger" is displayed on the screen.
- If the measurement is started with the time axis range less than 5 s/DIV, even if not the pre-trigger setting, the message, "Waiting for pre-trigger" is displayed at first.
- In the trigger accept condition, during the time interval until triggering occurs, the message "Waiting for trigger" is displayed on the screen.

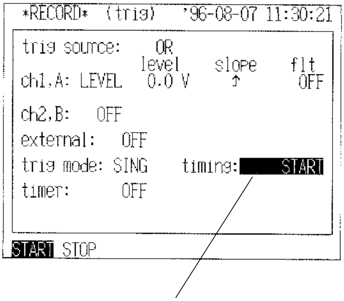
Example: When the pre-trigger is set to 95%


▨ ··· recording range (recording length)
Start
95%
5%
Input waveform
In this interval triggering is not accepted
95%
T 5%
Input waveform
Not accepted as a trigger

11.8 Trigger Timing

- The trigger timing setting refers to which of the start and stop events are controlled by the trigger.
- Not only the waveform after the trigger but also before the trigger can be recorded.
- The trigger timing can be set only in the Recorder and X-Y CONT recorder function.

Method (on the trigger screen)



```
 *RECORD*  (trig)   '96-08-07 11:30:21
 trig source:    OR
                level    slope    flt
 ch1.A: LEVEL   0.0 V      ↑      OFF

 ch2.B:   OFF
 external:   OFF
 trig mode: SING    timing:      START
 timer:      OFF

START STOP
```

Flashing cursor

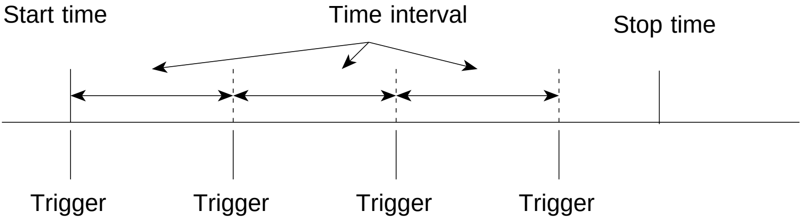
1. Using the CURSOR keys, move the flashing cursor to timing.
2. Select the trigger timing by using the $\boxed{+}$ and $\boxed{-}$ keys.

Selection

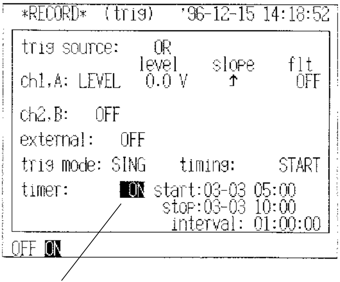
START	Triggering affects the start of recording only. Recording continues until the **STOP** key is pressed.
STOP	Triggering affects the end of recording only. Recording starts from the time instant when the **START** key is pressed.

11.9 Timer Trigger

- This is used when recording at a predetermined time is required.
- Triggering occurs regularly from the set start time instant until the stop time instant at constant time intervals.



Method (on the trigger screen)



```
*RECORD* (trig)   '96-12-15 14:18:52
trig source:    OR
               level    slope    flt
ch1,A: LEVEL   0.0 V     ↑       OFF
ch2,B:   OFF
external:   OFF
trig mode: SING    timing:     START
timer:       ON start:03-03 05:00
                stop:03-03 10:00
                 interval: 01:00:00
OFF ON
```

Flashing cursor

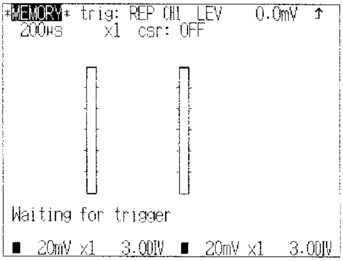
1. Using the CURSOR keys, move the flashing cursor to timer.
2. Select "ON".
3. Move the flashing cursor to start. Then, set the start time instant (month, day, hour, and minute) by using the + and − keys.
4. Move the flashing cursor to stop. Then, set the stop time instant (month, day, hour, and minute) by using the + and − keys.
5. Move the flashing cursor to interval. Then, set the time interval (in hours, minutes, and seconds) by using the + and − keys.

NOTE

- Because triggers are not accepted while capturing data, care must be taken over the time interval setting.
- The start time and the stop time must be after the **START** key is pressed.
- When the trigger mode is SINGLE, regardless of the setting for the time interval, triggering occurs only once at the start time.
- In the OR setting between triggers, if the trigger other than the timer trigger is being set, the trigger occurs before the start time. Further, even though the stop time is past, measurement will not be completed, because of waiting for another trigger.
- When trigger sources are AND, the trigger is applied when all triggers other than the timer trigger are active simultaneously, during the period from the start time to the stop time. At this point, the interval setting is disabled.

11.10 Level Meter Function

- When waiting for the trigger, the level of the analog input signal is displayed on the waveform screen. Use this function for the simple checking of the input signal.
- This function makes it possible to make the settings for the voltage axes, the magnification/compression ratios, and the origin positions while monitoring the levels of the input waveform in real time. (Memory and Recorder function)

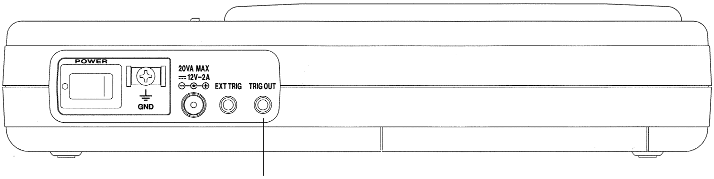


```
*MEMORY* trig: REP CH1  LEV    0.0mV  ↑
 200μs     x1  csr: OFF

Waiting for trigger
■  20mV x1   3.0DIV ■  20mV x1   3.0DIV
```

11.11 Trigger Output Terminal

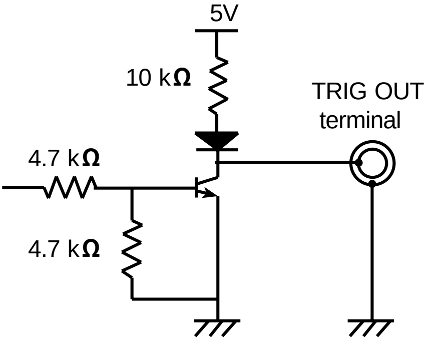
⚠WARNING **To avoid damage to the unit, do not input a voltage exceeding -20 V to + 30 V to the TRIG OUT terminal.**

The trigger output signal is taken from the TRIG OUT terminal on the lower side of the 8804.



TRIG OUT terminal

Output Circuit Diagram



Open collector output,
with 5 V output
Active low
Pulse width: 1.9 ms approx.
Mini-jack: 3.5 mm dia.

Maximum input voltage
range: -20 to +30 V
Maximum input
current: 500 mA
Maximum input
power: 200 mW

NOTE With the auto range function, a trigger signal is output. Care is required if using the auto range function while using the trigger output terminal (Only in the Memory recorder function mode).

Chapter 12
System Screen

12.1 What is the System Screen?

- The various settings, such as time setting, comment input, and scaling function, can be made.
- Move the flashing cursor to the function item. Select SYSTEM by using the [+] and [−] keys, and the SYSTEM screen will appear.
- On the SYSTEM screen, there are three screens; input level monitor, page 1, and page 2. The following functions are available. (To change the screen, press the **MENU/WAVE** key.)

System screen (Input level monitor)
  Input level monitor

System screen (page 1)
(1) Special function setting
  ① Grid setting
  ② Time value display
  ③ Listing and gauge functions
  ④ Intermittent printing
  ⑤ Starting status backup function
  ⑥ Printing intensity setting
  ⑦ Screen contrast setting
  ⑧ Language display setting
(2) Comment setting
(3) Time setting

System screen (page 2)

(1) Scaling setting

(2) Saving, reading and deleting the setting condition

(3) Self check

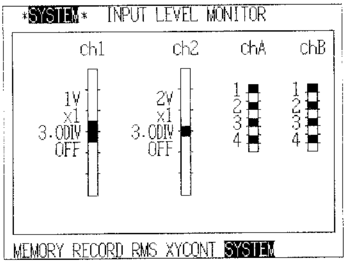
① ROM/RAM check ② PRINTER check

③ KEY/LED check ④ LCD check

12.2 Input Level Monitor Function (Input Level Monitor Screen)

- This function makes it possible to make the settings for the voltage axis, the magnification/compression ratios, and the origin positions while monitoring the levels of the input waveforms in real time.
- The display appears for each of channels 1 and 2, and logic channel groups A and B.

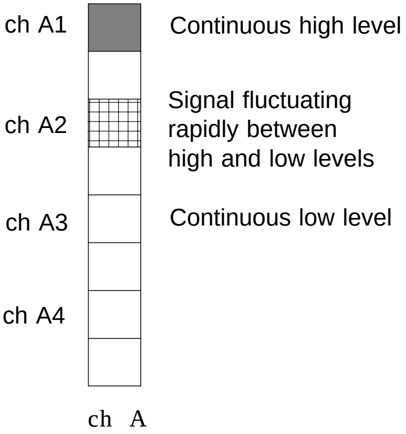
Method



Input Level Monitor

1. Using the CURSOR keys, move the flashing cursor to the item for each channel (voltage axis, input coupling, position, magnification/compression ratio, filter).
2. Using the $\boxed{+}$ and $\boxed{-}$ keys, make the settings.

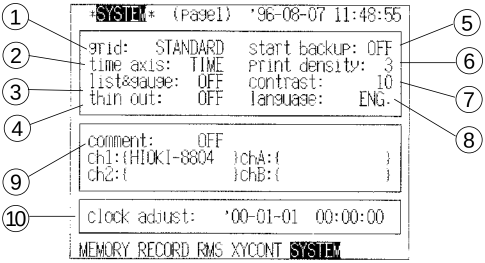
Logic Level Display



High and low logic levels are displayed as shown on the figure left.

12.3 Settings on the System Screen (Page 1)

The following functions are available.



```
 *SYSTEM*  (page1)  '96-08-07 11:48:55
grid:   STANDARD   start backup: OFF
time axis:  TIME   print density:  3
list&gauge:  OFF   contrast:      10
thin out:    OFF   language:    ENG.

comment:      OFF
ch1:{HIOKI-8804  }chA:{           }
ch2:{            }chB:{           }

clock adjust:   '00-01-01  00:00:00
MEMORY RECORD RMS XYCONT SYSTEM
```

① Grid type selection (refer to 12.3.1)
② Time value display (refer to 12.3.2)
③ Listing and gauge functions (refer to 12.3.3)
④ Intermittent printing (refer to 12.3.4)
⑤ Starting status back up function (refer to 12.3.5)
⑥ Printing intensity adjustment (refer to 12.3.6)
⑦ Screen contrast adjustment (refer to 12.3.7)
⑧ Language display setting (refer to 12.3.8)
⑨ Appending comments (refer to 12.3.9)
⑩ Setting the clock (refer to 12.3.10)

12.3.1 Setting the Grid

- The types of grid shown on the display screen or printed recordings can be selected.
- There are three settings: OFF, STANDARD, FINE.

Method (page 1)

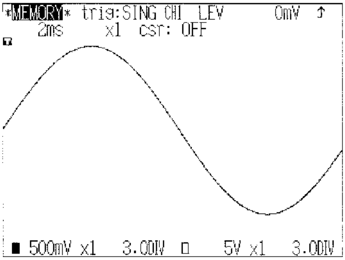
Using the CURSOR keys, move the flashing cursor to grid, then make the setting by using the $\boxed{+}$ and $\boxed{-}$ keys.

Selection

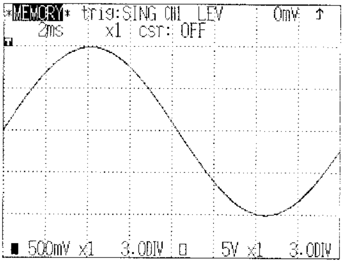
OFF, STANDARD, FINE

NOTE When either of the FINE or STANDARD settings is selected, the display screen still shows the STANDARD grid.

The waveform screen

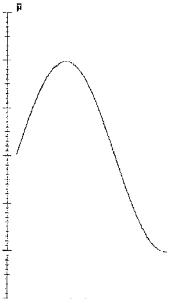

MEMORY trig:SING CH1 LEV 0mV ↑
2ms x1 csr: OFF
■ 500mV x1 3.0DIV □ 5V x1 3.0DIV

Grid: OFF

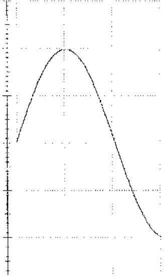

MEMORY trig:SING CH1 LEV 0mV ↑
2ms x1 csr: OFF
■ 500mV x1 3.0DIV □ 5V x1 3.0DIV

Grid: STANDARD or FINE

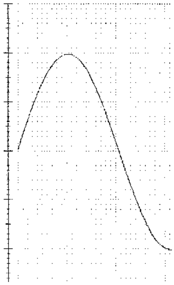
Printed recordings



Grid: OFF



Grid: STANDARD



Grid: FINE

12.3.2 Time Value Display

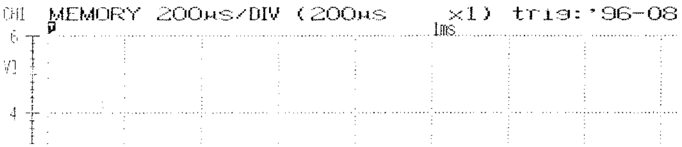
The time from the trigger-point is printed out on the recording paper.

Method (page 1)

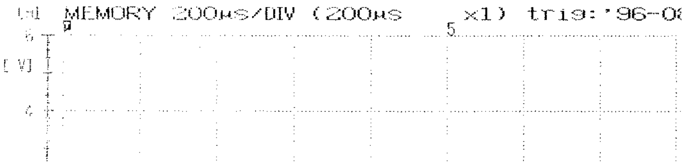
Using the CURSOR keys, move the flashing cursor to time axis, then select by using the $\boxed{+}$ and $\boxed{-}$ keys.

Selection

TIME	Display the time from the trigger point (Memory recorder). Display the time from the beginning of the data (Recorder, RMS recorder).
DIV	Display the number of DIV from the beginning of the data.



TIME display



DIV display

12.3.3 Listing and Gauge Functions

When a waveform is printed out (except for screen copy), gauges showing the voltage axis scales can be printed at the beginning, and a listing of settings and other information can be printed at the end.

Method (page 1)

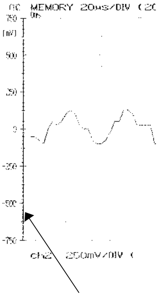
Using the CURSOR keys, move the flashing cursor to list & gauge. Then select by using the + and − keys.

Selection

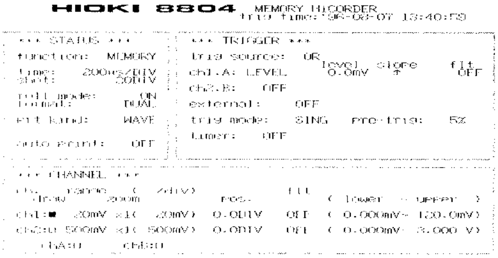
OFF	No gauges or listing.
LIST	Listing only.
GAUGE	Gauges only.
BOTH	Both gauges and listing.

NOTE

- Gauges are printed only for the channels for which the waveform is being drawn.
- After waveform reading, press the **PRINT** key on the status or trigger screen. The listing is printed out.



Gauge



```
HIOKI 8804  MEMORY HiCORDER
            trig time:'96-08-07 13:40:59

*** STATUS ***                *** TRIGGER ***
function:    MEMORY           trig source:  OR
                                                level   slope   filt
time:     200ms/DIV           ch1.A: LEVEL      0.0mV    ↑      OFF
shot:        20DIV            ch2.B:    OFF
roll mode:      ON
format:       DUAL            external:     OFF
Prt kind:     WAVE            trig mode:    SING   pre-trig:   5%
                              timer:    OFF
auto print:    OFF

*** CHANNEL ***
ch.    range    (   /div)              fil
  (draw    zoom           pos.             ( lower  -  upper  )
ch1:■  20mV  x1(  20mV)  0.0DIV   OFF  ( 0.000mV-  120.0mV)
ch2:□ 500mV  x1( 500mV)  0.0DIV   OFF  ( 0.000mV-  3.000 V)
    chA:□      chB:□
```

List

12.3.4 Intermittent Printing

- When the time axis waveform is displayed as black area, this function reduces the printing frequency, by printing intermittently.
- This reduces the likelihood of reduced printing speed or excessive power consumption when operating the unit by using the batteries.
- Also when using the AC adapter, the intermittent printing can be set.
- When the intermittent print function is disabled, the printing speed may fluctuate, depending on the amount of black in the printed image.

Method (page 1)

Using the CURSOR keys, move the flashing cursor to thin out. Then select by using the + and − keys.

Selection

OFF	Intermittent printing is disabled.
ON	Intermittent printing is enabled.

NOTE

- While the Recorder or RMS recorder function (auto print ON), the intermittent printing function is always enabled.
- The sampling rate differs, depending on whether power is being supplied through the AC adapter or from batteries.

12.3.5 Starting Status Backup Function

If the power supply fails during recording operation (while the LED above the START key is illuminated), and then the power supply is restored so that the 8804 goes back to the start condition, recording starts immediately. If the triggering function is being used, the unit enters the trigger stand by state.

Method (page 1)

Using the CURSOR keys, move the flashing cursor to start backup. Then make the selection by using the + and − keys.

Selection

OFF	Starting status backup is not enabled.
ON	Starting status backup is enabled.

12.3.6 Printing Intensity Adjustment

The intensity of printing can be adjusted.

Method (page 1)

Using the CURSOR keys, move the flashing cursor to print intensity. Then select by using the + and − keys.

Selection

1 to 5	The intensity increases at the higher values.

12.3.7 Screen Contrast Adjustment

The screen contrast can be adjusted.

Method (page 1)

Using the CURSOR keys, move the flashing cursor to contrast. Then select by using the + and – keys.

Selection

1 to 16	The intensity increases at the higher values.

NOTE

Pressing the + key simultaneously with the SHIFT key increases the intensity, and pressing the – key simultaneously with the SHIFT key decreases the intensity. (Setting possible on the all screens.)

12.3.8 Language Display Setting

The language to be displayed and recorded on the screen or chart can be selected.

Method (page 1)

Using the CURSOR keys, move the flashing cursor to language. Then select by using the + and – keys.

Selection

JAPAN. (JAPANESE)	Display and record in Japanese.
ENG. (ENGLISH)	Display and record in English.

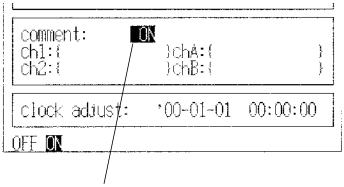
NOTE

The language to be displayed can be changed, when turning on the power supply with pressing the SHIFT key.

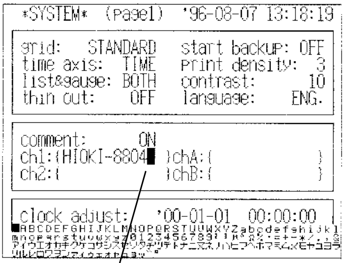
12.3.9 Appending Comments

A comment of up to 12 characters for each channel can be included on the printed recording. If a comment is input, it will be included on the printed recording in all function modes.

Method (page 1)

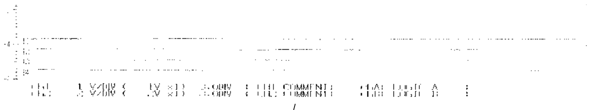


```
comment:      ON
ch1:{            }chA:{            }
ch2:{            }chB:{            }

clock adjust:   '00-01-01  00:00:00
OFF ON
```



```
*SYSTEM*  (page1)  '96-08-07 13:18:19

grid:     STANDARD   start backup: OFF
time axis:    TIME   print density:  3
list&gauge:   BOTH   contrast:      10
thin out:      OFF   language:    ENG.

comment:        ON
ch1:{HIOKI-8804█ }chA:{            }
ch2:{            }chB:{            }

clock adjust:   '00-01-01  00:00:00
█ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijkl
```

1. Using the CURSOR keys, move the flashing cursor to comment. Then set to ON by using the [+] and [−] keys.
2. Enter comments. (Channel 1 is described as an example; the settings are the same on other channels.)
3. Using the CURSOR keys, move the flashing cursor in the area within the bracket as shown in the figure left. The characters to be selected will appear on the lower side of the screen.
4. Select by using the [+] and [−] keys.
5. Using the CURSOR keys, move the flashing cursor to the other position. Repeat the procedure 3. and 4. (12 characters max).



12.3.10 Setting the Clock

- The 8804 real time clock includes a calendar with automatic leap year discrimination, and a twenty-four hour clock.
- The current date and time (year, month, day, hours, minutes, seconds) are shown on the status, trigger, and system screens.
- The clock is used for the timer trigger function.
- The clock is also used for indicating the data capture start time in a printed listing of waveform information.

Method (page 1)

1. Using the CURSOR keys, move the flashing cursor to clock adjust. Then set the date and time by using the $\boxed{+}$ and $\boxed{-}$ keys.

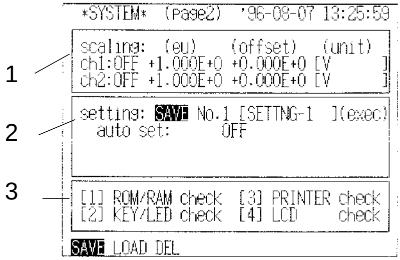
   '00 – 00 – 00   00 : 00 : 00

   (year) (month) (day)   (hour) (minute) (second)

2. Press the $\boxed{\text{START}}$ key, the time which has been set starts.

12.4 Settings on the System Screen (Page 2)

The settings on page 2 of the system screen include scaling function, saving, reading, and deleting the setting condition, and a self check function.



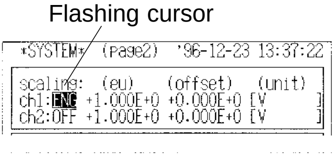
```
 *SYSTEM*  (page2)  '96-08-07 13:25:59
 scaling:  (eu)     (offset)    (unit)
 ch1:OFF +1.000E+0 +0.000E+0 [V      ]
 ch2:OFF +1.000E+0 +0.000E+0 [V      ]
 setting: SAVE No.1 [SETTNG-1  ](exec)
   auto set:       OFF

 [1] ROM/RAM check  [3] PRINTER check
 [2] KEY/LED check  [4] LCD     check
SAVE LOAD DEL
```

① Scaling Function (Refer to 12.4.1.)
② Saving, Reading, and Deleting the Setting Condition (Refer to 12.4.2.)
③ Self Check (Refer to 12.4.3.)

12.4.1 Scaling Function

- By setting an external physical amount to correspond to a one volt input signal (eu/v), the offset, and the name of the units used (eu), a measurement value which has been obtained as a voltage value can be converted into a value in the external units.
- The scaled values appear on the gauge scales, as range values (the upper and lower limit values along the vertical axis), and as the value of V obtained using the A and B cursors.
- For the numerical calculation, scaling will be performed after calculation terminated.
- Scaling can be performed for each channel independently.

Method (on the SYSTEM screen (page 2))

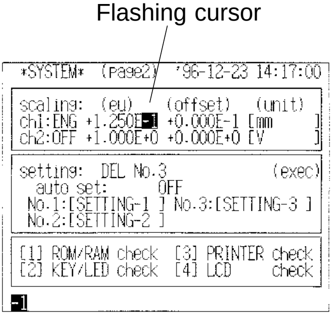

Flashing cursor

```
 *SYSTEM*  (page2)  '96-12-23 13:37:22
scaling:  (eu)    (offset)   (unit)
ch1:ENG +1.000E+0 +0.000E+0 [V      ]
ch2:OFF +1.000E+0 +0.000E+0 [V      ]
```

1. Using the CURSOR keys, move the flashing cursor to scaling. Then select whether or not perform scaling by using the $\boxed{+}$ and $\boxed{-}$ keys.

Selection

OFF	No scaling
SCI	Scaling is performed indicating the exponent in integer. (1.234E +05)
ENG	Scaling is performed indicating the exponent in multiple of 3. (123.4E +03)

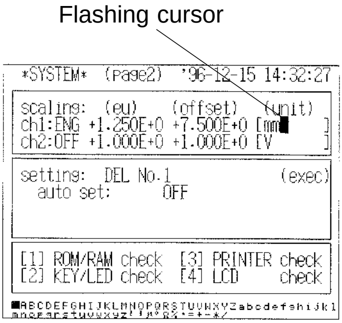

Flashing cursor

```
 *SYSTEM*  (page2)  '96-12-23 14:17:00
scaling:  (eu)    (offset)   (unit)
ch1:ENG +1.250E-1 +0.000E-1 [mm     ]
ch2:OFF +1.000E+0 +0.000E+0 [V      ]
setting:  DEL No.3              (exec)
  auto set:      OFF
 No.1:[SETTING-1 ] No.3:[SETTING-3 ]
 No.2:[SETTING-2 ]
[1] ROM/RAM check  [3] PRINTER check
[2] KEY/LED check  [4] LCD     check
-1
```

2. Set eu/v and offset. They can not be set within the range -9.999E+9 to 9.999E+9. Move the flashing cursor to each digit by using the $\boxed{+}$ and $\boxed{-}$ keys.

Selection

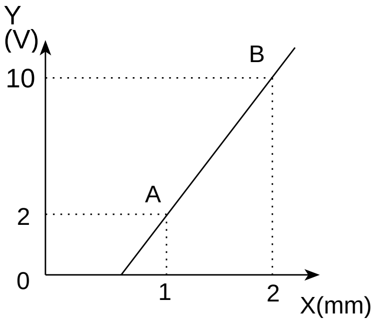
0 to 9	(For the most significant digit and the exponent, from -9 to +9)


Flashing cursor

```
 *SYSTEM*  (page2)  '96-12-15 14:32:27
scaling:  (eu)    (offset)   (unit)
ch1:ENG +1.250E+0 +7.500E+0 [mm     ]
ch2:OFF +1.000E+0 +1.000E+0 [V      ]
setting:  DEL No.1              (exec)
  auto set:      OFF
[1] ROM/RAM check  [3] PRINTER check
[2] KEY/LED check  [4] LCD     check
ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijkl
```

3. Set the external unit name (eu). (The unit name can be up to seven characters long.) Using the CURSOR keys, move the flashing cursor in the bracket. The characters of selection will be displayed on the lower screen. Select the character by using the $\boxed{+}$ and $\boxed{-}$ keys. Using the CURSOR keys, move the flashing cursor to the right and select the next character. Repeat the procedure 1. and 2.

Example:



Setting the scaling for measurement values produced when using a displacement sensor with characteristics as shown by the graph.

Y = 8X - 6 ... (1)
(V) (mm)
↓
X = 0.125Y + 0.75 ... (2)
(mm) (V)

Inverting equation (1) results in equation (2). If scaling is performed as specified, then the results of measurement, which have been obtained as voltage values, are scaled into displacement values in mm.

[eu/v] [offset] [eu]

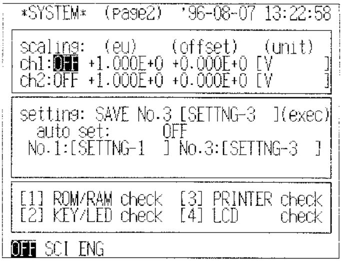
Point A
Y = 2 V,
Displacement X = (+1.250E-1)×2 + (+7.500E-1) = 1 (mm)

Point B
Y = 10 V,
Displacement X = (+1.250E-1)×10 + (+7.500E-1) = 2 (mm)

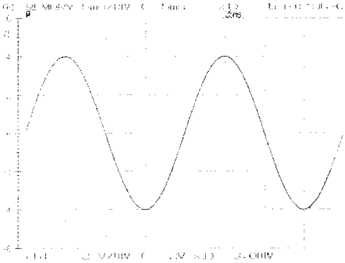
NOTE When the numerical calculation is set, scaling will be performed after the calculation. The rms value and area value is, however, calculated in the value after scaling.

When scaling the channel 1 only

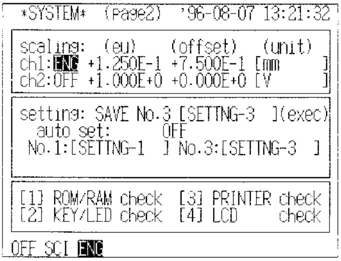
The scaled values appear as shown on the gauge scales, as range values (the upper and lower limit values along the vertical axis), and as the value of V obtained using the A and B cursors.



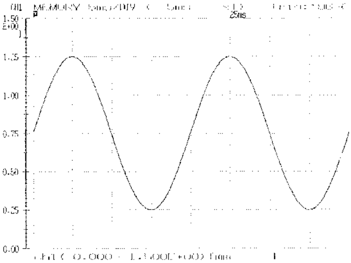
```
*SYSTEM*  (page2)  '96-08-07 13:22:58

scaling:  (eu)     (offset)    (unit)
ch1:OFF +1.000E+0 +0.000E+0 [V        ]
ch2:OFF +1.000E+0 +0.000E+0 [V        ]

setting: SAVE No.3 [SETTNG-3  ](exec)
  auto set:      OFF
 No.1:[SETTNG-1  ] No.3:[SETTNG-3  ]

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

OFF SCI ENG
```



Scaling OFF



```
*SYSTEM*  (page2)  '96-08-07 13:21:32

scaling:  (eu)     (offset)    (unit)
ch1:ENG +1.250E-1 +7.500E-1 [mm       ]
ch2:OFF +1.000E+0 +0.000E+0 [V        ]

setting: SAVE No.3 [SETTNG-3  ](exec)
  auto set:      OFF
 No.1:[SETTNG-1  ] No.3:[SETTNG-3  ]

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

OFF SCI ENG
```



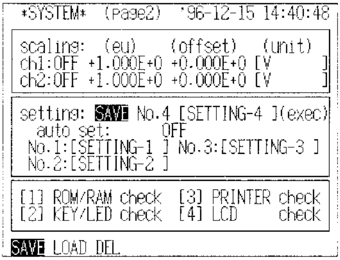
Scaling ON (ENG)

12.4.2 Saving, Reading, and Deleting the Setting Condition

The setting conditions can be saved, and also be read as required.
The setting condition can be saved up to 4.

Method (page 2)

(1) Saving



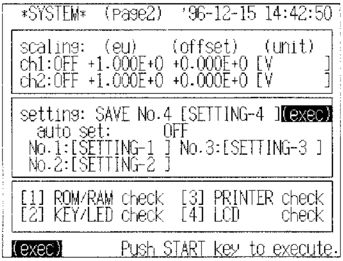
```
 *SYSTEM*  (Page2)  '96-12-15 14:40:48
 scaling:  (eu)    (offset)   (unit)
 ch1:OFF +1.000E+0 +0.000E+0 [V      ]
 ch2:OFF +1.000E+0 +0.000E+0 [V      ]
 setting: SAVE No.4 [SETTING-4 ](exec)
   auto set:      OFF
  No.1:[SETTING-1 ] No.3:[SETTING-3 ]
  No.2:[SETTING-2 ]
 [1] ROM/RAM check  [3] PRINTER check
 [2] KEY/LED check  [4] LCD     check
 SAVE LOAD DEL
```

1. Using the CURSOR keys, move the flashing cursor to setting. Then select "SAVE" by using the + and – keys.
2. Select the saving number by using the + and – keys.

Selection

No. 1 to No. 4

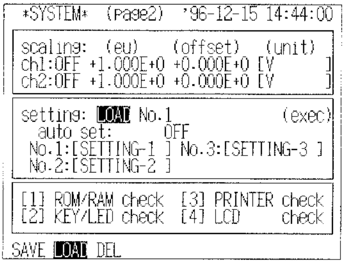
3. Input a comment.
   A comment consists of up to 10 characters can be input.
   Refer to Section 12.3.9, "Appending Comments".



```
 *SYSTEM*  (Page2)  '96-12-15 14:42:50
 scaling:  (eu)    (offset)   (unit)
 ch1:OFF +1.000E+0 +0.000E+0 [V      ]
 ch2:OFF +1.000E+0 +0.000E+0 [V      ]
 setting: SAVE No.4 [SETTING-4 ](exec)
   auto set:      OFF
  No.1:[SETTING-1 ] No.3:[SETTING-3 ]
  No.2:[SETTING-2 ]
 [1] ROM/RAM check  [3] PRINTER check
 [2] KEY/LED check  [4] LCD     check
 (exec)        Push START key to execute.
```

4. Move the flashing cursor to (exec) by using the CURSOR keys and press the START key to complete saving.
   All of the current screen setting are saved in the unit's internal memory.

(2) Reading



```
 *SYSTEM*  (page2)  '96-12-15 14:44:00
scaling:  (eu)     (offset)   (unit)
ch1:OFF +1.000E+0 +0.000E+0 [V       ]
ch2:OFF +1.000E+0 +0.000E+0 [V       ]
setting: LOAD No.1                (exec)
  auto set:      OFF
 No.1:[SETTING-1 ] No.3:[SETTING-3 ]
 No.2:[SETTING-2 ]
[1] ROM/RAM check  [3] PRINTER check
[2] KEY/LED check  [4] LCD     check
SAVE LOAD DEL
```

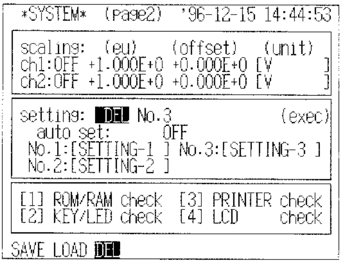
1. Using the CURSOR keys, move the flashing cursor to setting. Then select "LOAD" by using the [+] and [−] keys.
2. Select the loading number by using the [+] and [−] keys.

Selection
No. 1 to No. 4

3. Move the flashing cursor to (exec) by using the CURSOR keys and press the **START** key to complete reading.

NOTE The number without saving the setting condition cannot be loaded. The setting conditions that were saved in previously are read from the unit's internal memory and of the screen settings are changed.

(3) Deleting



```
*SYSTEM*  (page2)  '96-12-15 14:44:53
scaling:  (eu)    (offset)   (unit)
ch1:OFF +1.000E+0 +0.000E+0 [V      ]
ch2:OFF +1.000E+0 +0.000E+0 [V      ]
setting: DEL No.3                (exec)
  auto set:      OFF
 No.1:[SETTING-1 ] No.3:[SETTING-3 ]
 No.2:[SETTING-2 ]
[1] ROM/RAM check  [3] PRINTER check
[2] KEY/LED check  [4] LCD     check
SAVE LOAD DEL
```

1. Using the CURSOR keys, move the flashing cursor to setting. Then select "DEL" by using the + and – keys.
2. Select the deleting number by using the + and – keys.

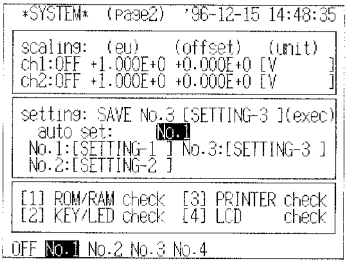
Selection

No. 1 to No. 4

3. Move the flashing cursor to (exec) by using the CURSOR keys and press the **START** key to complete deleting.

NOTE The number without saving the setting condition cannot be deleted.

(4) Auto setting



```
*SYSTEM*  (page2)  '96-12-15 14:48:35
scaling:  (eu)    (offset)   (unit)
ch1:OFF +1.000E+0 +0.000E+0 [V      ]
ch2:OFF +1.000E+0 +0.000E+0 [V      ]
setting: SAVE No.3 [SETTING-3 ](exec)
  auto set:      No.1
 No.1:[SETTING-1 ] No.3:[SETTING-3 ]
 No.2:[SETTING-2 ]
[1] ROM/RAM check  [3] PRINTER check
[2] KEY/LED check  [4] LCD     check
OFF No.1 No.2 No.3 No.4
```

1. Using the CURSOR keys, move the flashing cursor to auto set.
2. Select the saving number by using the + and – keys.

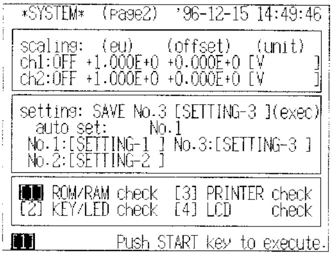
Selection

OFF, No. 1 to No. 4

3. Turn the power OFF, and then turn the power back ON. The setting condition selected in step 2. is automatically loaded.

12.4.3 Self Check

There are four types of self-check:



```
 *SYSTEM*  (Page2)  '96-12-15 14:49:46

 scaling:  (eu)    (offset)   (unit)
 ch1:OFF +1.000E+0 +0.000E+0 [V      ]
 ch2:OFF +1.000E+0 +0.000E+0 [V      ]

 setting: SAVE No.3 [SETTING-3 ](exec)
   auto set:     No.1
  No.1:[SETTING-1 ] No.3:[SETTING-3 ]
  No.2:[SETTING-2 ]

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

[1]           Push START key to execute.
```

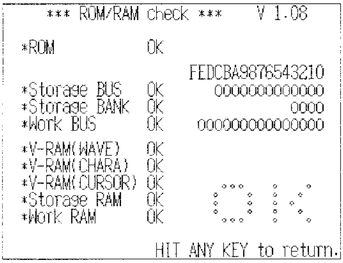
(1) The ROM/RAM check
(2) The PRINTER check
(3) The KEY/LED check
(4) The LCD check

(1) The ROM/RAM check

- This check tests the internal memory (ROM and RAM) of the 8804.
- The ROM/RAM check does not affect the contents of the RAM.
- The result is displayed on the screen (OK means passed and NG means failed.)

Method (page 2)

1. Using the CURSOR keys, move the flashing cursor to [1] ROM/RAM check.
2. Press the START key, and the ROM/RAM check will be performed.
3. When the self check has been completed, press any key. The system will revert to the system (page 2) screen.



```
    *** ROM/RAM check ***    V 1.08

 *ROM             OK
                        FEDCBA9876543210
 *Storage BUS     OK       0000000000000
 *Storage BANK    OK                0000
 *Work BUS        OK     000000000000000

 *V-RAM(WAVE)     OK
 *V-RAM(CHARA)    OK
 *V-RAM(CURSOR)   OK
 *Storage RAM     OK
 *Work RAM        OK

                   HIT ANY KEY to return.
```

RAM/ROM Check End Screen

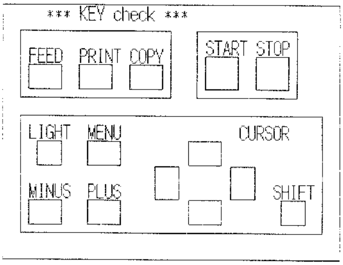
NOTE

- During the self check, all keys are disabled.
- If "OK" appears, the self check was satisfactory.

(2) The KEY/LED check

- This check tests whether the keys are operating normally for input.
- Make sure to check that the LED for the start is lit.

Method (page 2)



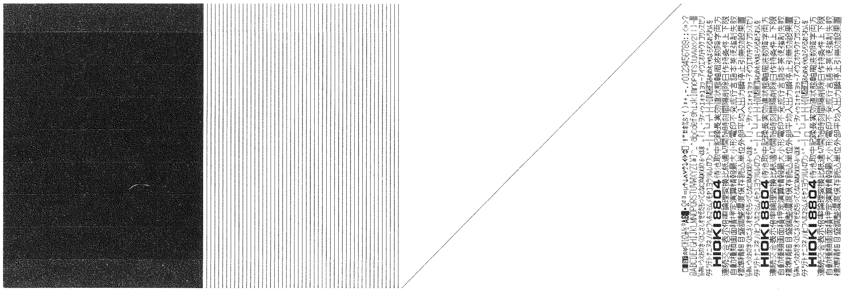
1. Using the CURSOR keys, move the flashing cursor to [2] KEY/LED check.
2. Press the **START** key, and the KEY/LED check screen will appear.
3. Press any key on the front panel of the 8804, and the corresponding key on the "KEY check" screen will be filled in. When pressing the **START** key, and the LED for the start will light.
4. Press each of the keys at least once to finish the keyboard check.
5. When the check has been completed, press any key to return to the system (page 2) screen.

(3) PRINTER check

This check tests printer operation.

Method (page 2)

1. Using the CURSOR keys, move the flashing cursor to [3] PRINTER check.
2. Press the START key, and the printer check will be performed.
   To stop the printer check during execution, press the STOP key.



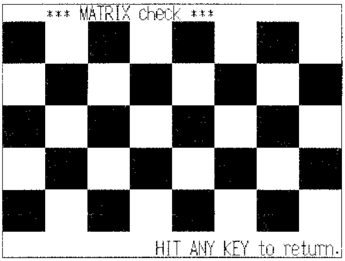
Printer Test Pattern

(4) LCD check

- This checks the display screen.
- There are three test patterns: MATRIX, OVERLAP, and CHARACTER.

Method (page 2)

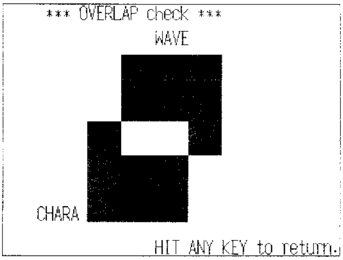
1. Using the CURSOR keys, move the flashing cursor to [4] LCD check.
2. Press the **START** key, and the MATRIX check will be performed.
3. Next, press any key twice more to cycle through the OVERLAP and CHARACTER check.



*** MATRIX check ***

HIT ANY KEY to return.

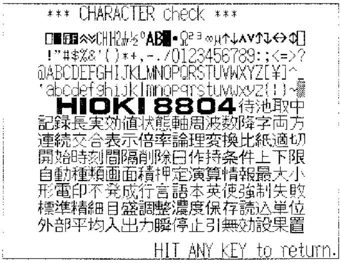
MATRIX Check



*** OVERLAP check ***

HIT ANY KEY to return.

OVERLAP Check



*** CHARACTER check ***

□■▦≈≋CHH2㎐½°AB▮•Ω²³∞μ↑↓▲▼⇑⇓⇔⇕▯
!"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_
'abcdefghijklmnopqrstuvwxyz{¦}~▒
HIOKI 8804 待池取中
記録長実効値状態軸周波数降字両方
連続交合表示倍率論理変換比紙適切
開始時刻間隔削除日作持条件上下限
自動種類画面積押定演算情報最大小
形電印不発成行言語本英使強制失敗
標準精細目盛調整濃度保存読込単位
外部平均入出力瞬停止引無効設果置

HIT ANY KEY to return.

CHARACTER Check

Chapter 13
Input Units

13.1 Analog Inputs

The 8804 has an internal analog input unit, which can record a maximum of 2 channels of analog signals.
This section describes the analog unit and input cables.
Be sure to read the Section 13.3, "Safety Requirements" and follow the instruction.

13.2 Specifications

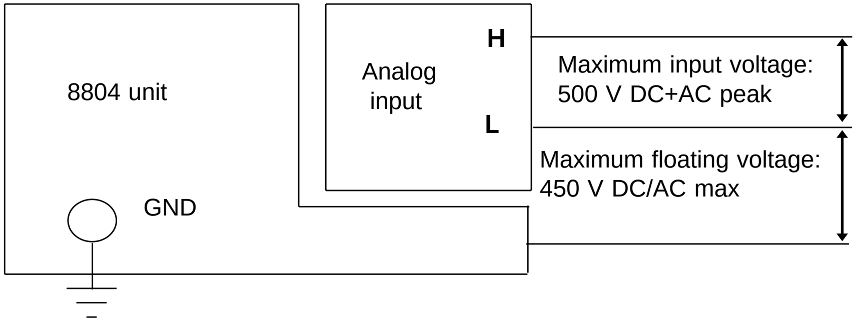
Accuracy at 23°C±5°C, after 30 minutes of warm-up
Accuracy guaranteed for six months.

Measurement ranges	20 mV/DIV to 100 V/DIV 1-2-5 step (120 mV to 600 V f.s.) 20 mV/DIV to 50 V/DIV 1-2-5 step (120 mVrms to 300 Vrms f.s.) RMS recorder only
Maximum input voltage	500 V (DC + AC peak)
Maximum floating voltage	450 V DC, AC
Frequency characteristic	DC to 100 kHz, -3 dB
A/D resolution	9 bits
DC amplitude accuracy	±1% f.s.
Zero position accuracy	±1% f.s.
Input resistance and capacitance	1 MΩ±1%, approx. 5 pF (typ. at 100 kHz)
Common mode exclusion ratio	90 dB or more (at 50 Hz or 60 Hz and with signal source resistance 100 Ω maximum)
Low-pass filter	5 Hz, 500 Hz, OFF

13.3 Safety Requirements

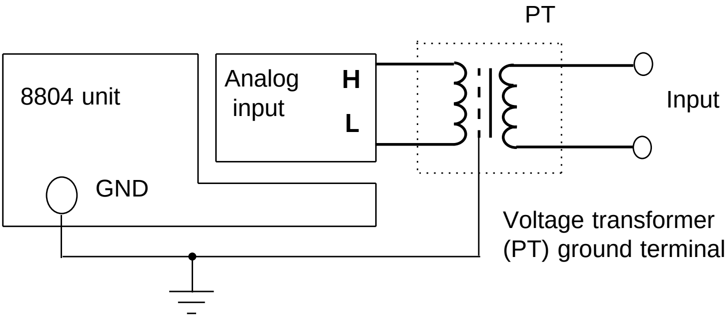
⚠ DANGER

- **If any metallic portions of the input cables are exposed, there is a danger of electric shock.**
  Be sure to use the specified 9574 INPUT CORD.
- **The maximum floating voltage between the analog inputs and the frame of the 8804, or between the analog inputs channels 1 and 2 is 450 V AC/DC.**
  To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds the maximum floating voltage.
- **The maximum floating voltage does not change even when using an attenuator with the input, for example.**
- **The maximum input voltage is 500 V (DC + AC peak). To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds this level.**

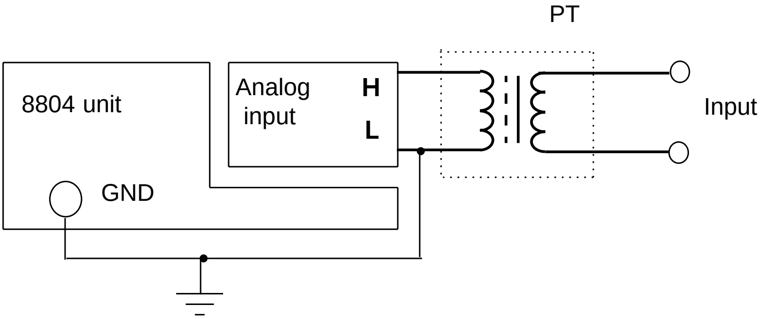

8804 unit
Analog input
H
L
Maximum input voltage: 500 V DC+AC peak
Maximum floating voltage: 450 V DC/AC max
GND

NOTE When making measurements on an AC power line for example, using a voltage transformer, ensure that the transformer is appropriately grounded.

(a) When the voltage transformer has a ground terminal

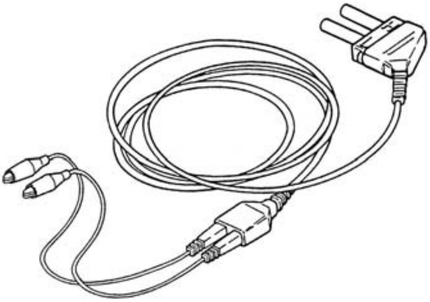


(b) When the voltage transformer has no ground terminal



13.4 Input Cables

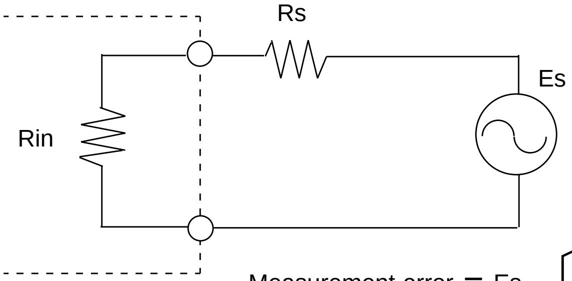
- For safety reasons, only use the 9574 INPUT CORD for connection to the analog input units.
- The cables are approximately 1.7 m long, and the portion which plugs into the unit has a plastic cover for added safety.



9574 INPUT CORD

13.5 Measurement Errors Caused by Signal Source Internal Resistance

This problem only arises if the internal resistance of the signal source is not sufficiently low compared to the internal resistance of the analog input unit. If it is high, it can lead to measurement errors.



Es: Signal voltage

Rs: Signal source resistance

Rin: Input resistance

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

Example:

The internal resistance of the analog input unit is approximately 1 MΩ, and therefore if the signal source resistance is 1 kΩ the error is increased by approximately 0.1%.

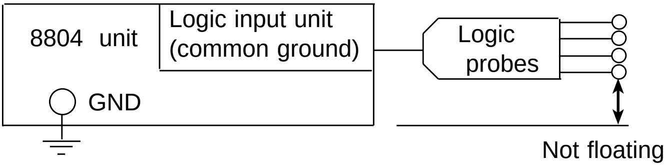
13.6 Logic Inputs

The 8804 has an internal logic input unit, which can record a maximum of 8 channels of logic signals.
For operation details, refer to Section 5.2, "Basic Setting Items of Each Function" and Chapter 11, "Trigger Function."

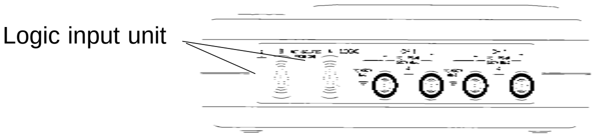
13.6.1 Logic Input Unit

⚠WARNING

- **The logic input unit allows two probes to be connected, but these are not floating, having a common ground with the main unit.**
- **Do not connect logic probes other than those supplied by HIOKI to the logic inputs.**



- The connections to the logic input section are on the right side of the 8804.
- Each logic probe can measure four logic signals (four channels).



NOTE If no logic probe is connected, the corresponding logic waveform is displayed on the waveform screen as high level.

13.6.2 Logic Probe

(1) Using the 9306 LOGIC PROBE

⚠WARNING **The 8804 allows a maximum of two 9306 units to be connected, but in this case the units have a common ground.**

NOTE Read the Instruction Manual for the 9306 carefully.

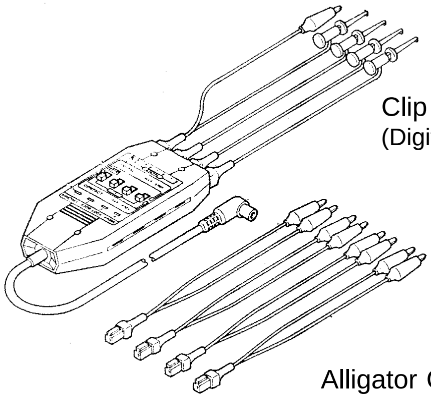
Voltage input and contact input are switchable. It allows a wide range of measurements from electronic circuits to relay timings.

Specification

The number of Channels	4 (common ground)	
Input method	Digital input	Contact input
Input resistance	50 kΩ or more	2 kΩ
Threshold value	+ 1.4 V	
Maximum input voltage	± 50 V	± 30 V
Response time	2 μs or less	

NOTE The input resistance of digital input under 5 V is 100 kΩ. The connector cable length is 1.5 m, and the probe tip cable length is 20 cm.

9306 LOGIC PROBE



(2) Using the 9307 LINE LOGIC PROBE

⚠WARNING **Insulation is provided in the probes between the input and output, and between channels. To avoid the danger of electric shock or damage to the equipment, ensure that the applied voltage never exceeds the maximum floating voltage.**

NOTE Refer to the Instruction Manual for the 9307.

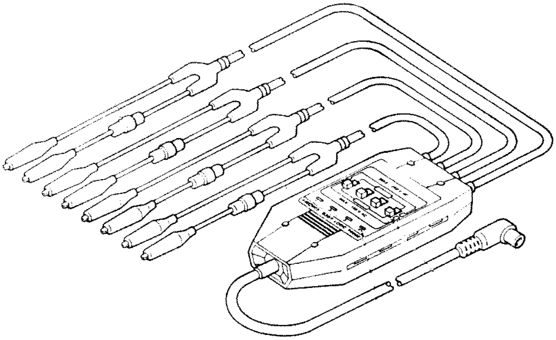
Signals such as 120/200 VAC and 24 VDC, and power failure of power supply line can be detected. This allows timing measurement of relay sequencers and so forth.

Specifications

The number of channels	4 (isolated)	
Input voltage range	LOW	HIGH
Input resistance	Approx. 30 kΩ	Approx. 100 kΩ
Threshold value	60 VAC/20 VDC ≦ H 10 VAC/15 VDC ≧ L	170 VAC/70 VDC ≦ H 30 VAC/43 VDC ≧ L
Maximum input voltage	150 VAC	250 VAC
Response time	(↥) 1 ms or less/(↧) 3 ms or less	

NOTE

- The 9307 detects absolute values, so for DC the input is bipolar.
- The connector cable length is 1.5 m, and the probe tip cable length is 1 m.



9307 LINE LOGIC PROBE

Chapter 14
Maintenance and Service

14.1 Changing the Battery

When using the alkaline batteries and then the following warning message appears, replace the batteries.
"WARNING 10: Change all batteries"

⚠WARNING

- **To avoid electric shock when replacing the batteries, turn the power switch off and disconnect the input cable before beginning. Also, after replacing the batteries, always replace the cover before using the unit.**
- **Do not short-circuit used batteries, disassemble them, or throw them in a fire. Doing so may cause the batteries to explode.**
- **When replacing the batteries, do not install old batteries with new ones, and do not mix different types of batteries. Check the battery polarity carefully when inserting the batteries.**

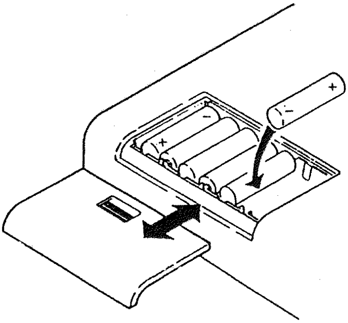
⚠CAUTION

- Use LR6 alkaline batteries or the specified 9420 BATTERY PACK.
- Keep used batteries out of the reach of children. Dispose of used batteries according to their type in the prescribed manner and in the proper location.

NOTE

- When not in use for a long time, to prevent possible corrosion caused by battery leakage, remove the batteries before storage.
- If the 8804 shuts down because the batteries are exhausted, it still continues to consume a very small amount of power. After the shutdown, be sure to turn the power switch off.

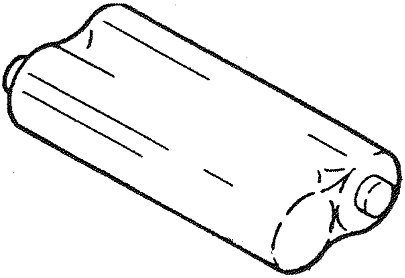
Method



1. Turn the power OFF.
2. Take off the cover of the battery compartment.
3. Remove the old batteries and replace them with six new LR6 alkaline batteries with the correct polarity.
4. Replace the battery cover.

14.2 9420 BATTERY PACK

- The 9420 BATTERY PACK is a Ni-Cd battery which can be recharged while in the unit. The three packages form a set to be used together. When replacing the battery pack, always replace all three packages together.
- Refer to Section 14.1, "Changing the Battery", on replacing the 9420 batteries.



9420 BATTERY PACK

⚠WARNING

- **To avoid electric shock when replacing the battery pack, turn the power switch off and disconnect the input cable before beginning. Also, after replacing the battery pack, always replace the cover before using the unit.**
- **Do not short-circuit used battery pack, disassemble them, or throw them in a fire. Doing so may cause the batteries to explode.**
- **When replacing the battery pack, do not install old battery pack with new ones, and do not mix different types of battery pack. Check the polarity carefully when inserting the battery pack.**

⚠CAUTION

- Do not unwrap the battery pack.
- Keep used batteries out of the reach of children. Dispose of used batteries according to their type in the prescribed manner and in the proper location.
- Only use the specified 9418-10 AC ADAPTER(PSA-30U-120, PHIHONG) for charging.

NOTE

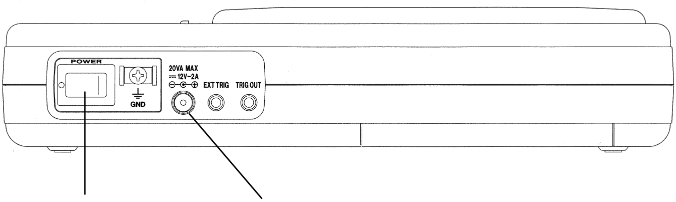
- Always carry out battery charging at an ambient temperature between 10℃ and 40℃. Outside this range, not only is the charging capacity reduced, but also there is a possibility of reduced performance or electrolyte leakage.
- The battery capacity is reduced as a result of self-discharge. Always carry out battery charging before initial use.
- Before storing the unit, remove the battery pack from the unit.
- If the 8804 shuts down becuase the batteries are exhausted, it still continues to consume a very small amount of power. After the shutdown, be sure to turn the power switch off and remove the battery pack from the unit.
- When not in use for a long time, remove the battery packs before storage.
- The 9420 BATTERY PACK has a tendency to self-discharge. When the battery pack is in long-term storage, recharge about once every two months. If stored long-term in the discharged state, the battery pack characteristics will be impaired.
- If the battery capacity remains very low after correct recharging, the useful battery life is at an end.

14.3 Recharging the Battery

- When using the 9420 BATTERY PACK and the following warning message is displayed, recharge the 9420.
  "WARNING 10: Change all batteries"
- If not using the 9418-10 AC ADAPTER(PSA-30U-120, PHIHONG), the recharging is not possible.

Method

1. Connect the 9418-10 AC ADAPTER(PSA-30U-120, PHIHONG).
2. When the power switch is OFF, the LED above the **START** key will light to start the charging.
3. About 2 to 3 hours, the charging is completed and the LED automatically goes off to end.



Power switch AC adapter connecting terminal

NOTE When the power switch is ON, the battery charging is not performed.

14.4 Removing the Battery Before Ultimate Disposal

⚠WARNING **To avoid electric shock when replacing the batteries, turn the power switch off and disconnect the input cable before beginning.**

⚠CAUTION Keep used batteries out of the reach of children. Dispose of used batteries according to their type in the prescribed manner and in the proper location.

- This unit uses a lithium battery for memory backup.
- Before ultimate disposal of this unit, remove the battery.

Removing the battery

① Check that the unit is powered OFF.
② Remove the four screws which is holding on the rear panel with a Phillips screwdriver. (Refer to figure 14.4-1.)
③ Remove the upper case (front).
④ Remove the three screws which is holding on the PCB, with a Phillips screwdriver.
⑤ Remove the connecting cable and the PCB (refer to figure 14.4-2).

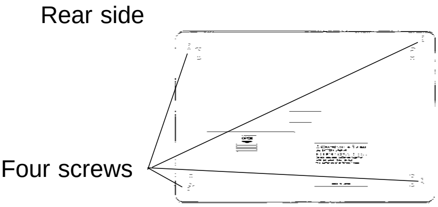


Figure 14.4-1

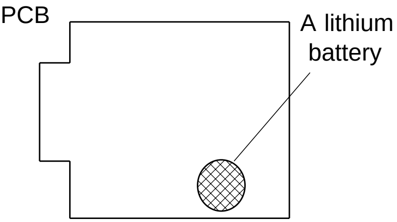
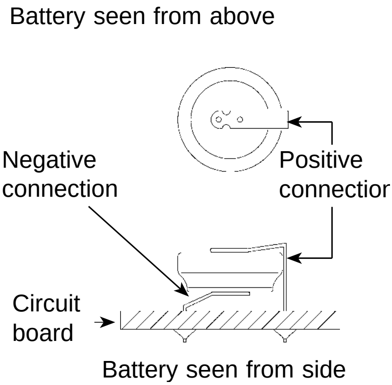


Figure 14.4-2



⑥ Wrench up the battery, and cut the positive (+) connection with nippers.
⑦ Wrench the battery up further.
⑧ Cut the negative (-) connection, which was underneath the battery.

14.5 Cleaning the Printer Head

The maintenance of the printer is not especially required. However, depending upon the conditions of use, and especially if the printer has been used over a long period of time, it is possible for dirt or paper dust to adhere to the printer thermal head, causing the printing to be faint or otherwise indistinct. If this occurs, use one of the following procedures to clean the printer head.

Method 1

1. In the recorder function mode, set the high speed range of 2 s/DIV.
2. On the system screen (page 1), check that the intermittent printing "thin out" is set to OFF. If ON, it has no effect.
3. Increase the input noise, so as to print for at least 5 seconds in solid black (100% black) or repeat solid printing for several times with the PRINTER check (refer to Section 12.4.3, "Self Check").
4. If this does not effect enough improvement, then try method 2.

Method 2

1. Moisten a piece of recording paper with a solvent such as anhydrous alcohol or freon or normal hexane. (Use back of the recording paper.) Then insert it into the printer.
2. After lowering the head up lever, move the recording paper to and fro manually, so as to clean the head.

NOTE

- Do not use thinners, or similar organic solvents.
- After using alcohol, be sure that the printer is completely dry before operating it.
- If the printer has been used over a long period of time, it is possible for paper dust to adhere to the roller. If you mind, clean away with the blower brush for camera.
- Always cut off the recording paper using the paper cutter fixed on the printer cover. If the recording paper is directly cut off on the printer head, lots of paper dust adhere on the roller.

14.6 Troubleshooting

If the unit is not functioning normally, check the following items before sending it for repair.

The screen and indicators do not light when powered on.	• Is the AC Adapter correctly connected? • Are the batteries correctly inserted? • Are the batteries near the end of their useful life? • When the battery capacity is reduced, the power is automatically turned off. Before turning on the power again, turn the power off first and leave the unit for about 30 seconds.
The normal screen is not displayed when turning the power on.	• Are the batteries near the end of their useful life?
No waveform appears on the screen when the **START** key is pressed.	• Is the "Waiting for pre-trigger." message displayed? When recording before the trigger, until the corresponding item interval has elapsed, a trigger is not accepted. • Has the "Waiting for trigger" message appeared? Check the trigger settings. • Are all of the channels switched off on the display? • Has the timer trigger been set?
There is absolutely no variation in the recorded waveform.	• Is the measurement range setting appropriate? • Is the input cord correctly connected? • Has a low pass filter been set?
The printed recording is very faint or non-existent.	• Is the recording paper back to front? • Are you using the correct recording paper?
The setting of the intermittent printing is not made to OFF.	• When using batteries or the 9420 BATTERY PACK, printing is automatically switched to the intermittent setting.

During memory recorder operation, the apparent frequency of the recording is much lower than the expected frequency.	• This is likely to be an aliasing error. • Make the "time" setting (time axis range) faster. For more details see the background information on aliasing distortion in Appendix "Aliasing".
During operation in the recorder function mode, the recording line is very thick.	• A ripple component in the input signal may be the cause.
Before the message: "WARNING 10: Change all batteries" is displayed, the printer is stopped.	• Depending on the battery type and printing ratio, the printer is stopped before the message is displayed. Change all new batteries.

If none of the above conditions apply, and the cause of the problem is not understood, try performing a system reset. All the settings will revert to the factory settings.
Also refer to Appendices (Background, Error Message, Glossary) and Index for more information.

System reset

Method

To perform a system reset, power ON the unit while holding down the STOP key. The settings are initialized, and revert to the factory settings.

14.7 Service

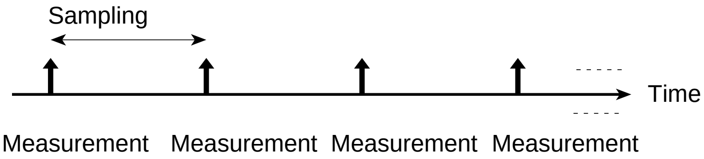
If the unit is not functioning properly, check the "Troubleshooting" list. If a problem is found, contact your dealer or HIOKI representative. Pack the unit carefully so that it will not be damaged during transport, and write a detailed description of the problem. HIOKI cannot bear any responsibility for damage that occurs during shipment.

Appendices

Apendix.1 Background

(1) Sampling

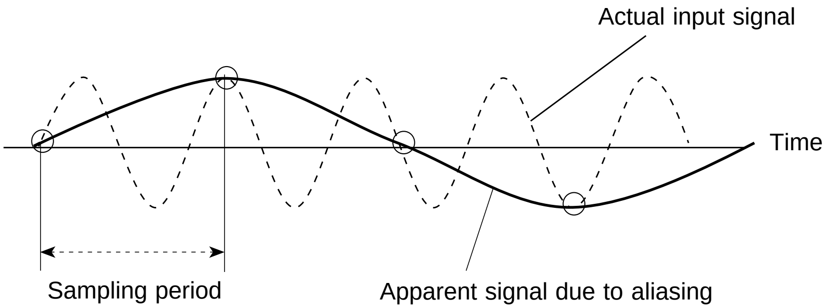
- The 8804 converts the input signal analog value into a digital value, and all internal signal processing thereafter is performed using digital values. This A/D conversion process is called sampling.
- This sampling measures the value of the signal repeatedly at constant intervals.



- The rate of taking these measurements is called the sampling rate.
- The units are S/s, read as samples per second.
- This is the reciprocal of the sampling period.

(2) Aliasing distortion

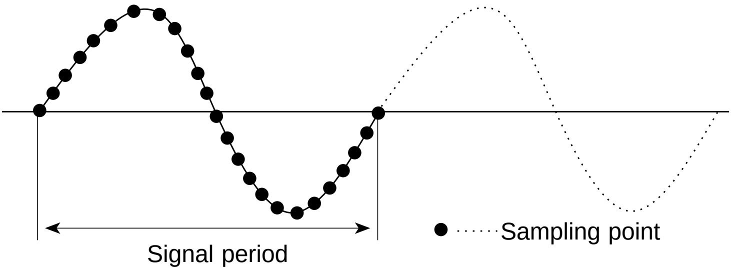
- If the frequency of signal being measured is significantly higher than the sampling rate, it is possible for sampling to produce an apparent signal which is actually non-existent.



- Aliasing distortion cannot be avoided with methods of measurement, like the Memory recorder function mode, in which the sampling period for the time axis range may vary widely.
- Because the measurement limit frequency (refer to next page) is determined by the time axis range used for measurement, try to use as high speed a range as possible for performing measurements.
- When measuring a repeating signal, using the auto ranging function is another useful technique. Refer to Section 6.4, "Auto Range Function".

(3) Measurement limit frequency

- As a general rule, to ensure that sampling catches the peaks of a typical sine wave input, 25 samples are required for each input cycle.



The frequency for each range, when 25 samples per period is taken as the limit.

TIME/DIV	Sampling period	Measurement limit frequency
200 µs/DIV	2.5 µs	16 kHz
400 µs/DIV	5 µs	8 kHz
1 ms/DIV	12.5 µs	3.2 kHz
2 ms/DIV	25 µs	1.6 kHz
5 ms/DIV	62.5 µs	640 Hz
10 ms/DIV	125 µs	320 Hz
20 ms/DIV	250 µs	160 Hz
50 ms/DIV	625 µs	64 Hz
100 ms/DIV	1.25 ms	32 Hz
200 ms/DIV	2.5 ms	16 Hz
500 ms/DIV	6.25 ms	6.4 Hz
1 s/DIV	12.5 ms	3.2 Hz
2 s/DIV	25 ms	1.6 Hz
5 s/DIV	62.5 ms	0.64 Hz
10 s/DIV	125 ms	0.32 Hz
30 s/DIV	375 ms	0.10 Hz
1 min/DIV	750 ms	0.05 Hz
2 min/DIV	1.5 s	0.025 Hz

Apendix.2 Error Messages

The unit produces two levels of message to indicate problems. These are distinguished as follows.

Error messages

ERROR 1	Reload the printer paper.
ERROR 2	Lower the printer lever.

Warning messages

WARNING 10	Change all batteries.
WARNING 11	Invalid key in operation.
WARNING 12	Can’t execute. (no waveform)
WARNING 13	A & B csr incorrect position.
WARNING 14	Auto range setting failed.
WARNING 15	Can’t start on SYSTEM.
WARNING 16	Can’t set. (all trig off)
WARNING 17	Can’t set over up level.
WARNING 18	Can’t set under low level.
WARNING 19	Can’t load. (no data)
WARNING 20	Can’t set. (shot = 800 div)
WARNING 21	Can’t print. (200 ms - 1 s)
WARNING 22	Can’t set to 100 V. (RMS)
WARNING 23	Can’t set interval to 1-40.
WARNING 24	Can’t make XY. (shot = 800 div)
WARNING 25	Can’t set dip. (100 ms - 2 min)

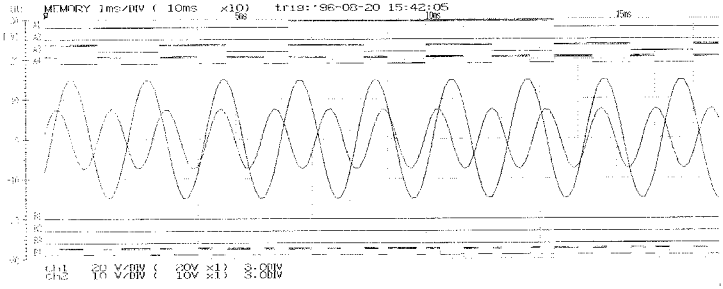
Apendix.3 Glossary

Aliasing error	The phenomenon of not obtaining an accurate signal waveform, due to aliasing distortion. Refer to Appendix 1, "Background".
ch	Used as an abbreviation for channel. "ch 1" means channel 1; "1 ch" means one channel.
Cutoff frequency	The frequency for which the output of a filter falls below $1/\sqrt{2}$(-3 dB) of the input.
DIV	A unit corresponding to one division of the chart scale.
Full span voltage	The voltage difference corresponding to 6 divisions.
Position	When referring to the position of the waveform along the voltage axis on the display, this refers more precisely to the origin, that is the position corresponding to 0 V.
Pre-trigger	Refers to recording the waveform before the trigger. This value is represented as the percentage of the whole recording length coming before the trigger.
PT	Voltage transformer
Scaling	The conversion of an input voltage to some convenient external units.
Shot length	The recording length, which is always expressed in terms of divisions.
Timer trigger	Trigger function using the clock for fixed real time triggering.
Trigger timing	Determines whether the trigger controls starting, stopping, or both.
Unbalanced input	When one of two input terminals is used as the reference for the signal.
Word	The amount of memory representing a single sampled value digitally.

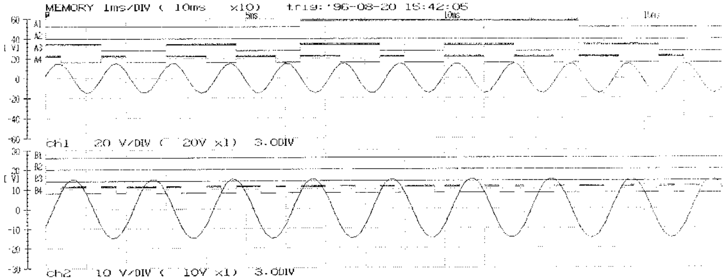
Apendix.4 Example of Waveforms for Each Function

(1) Memory recorder function

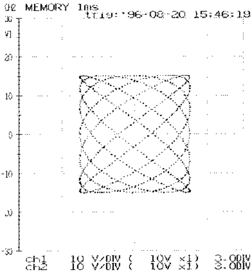
Single



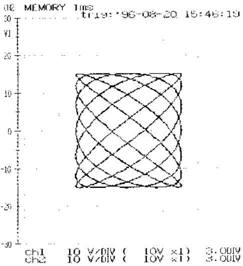
Dual



X-Y DOT

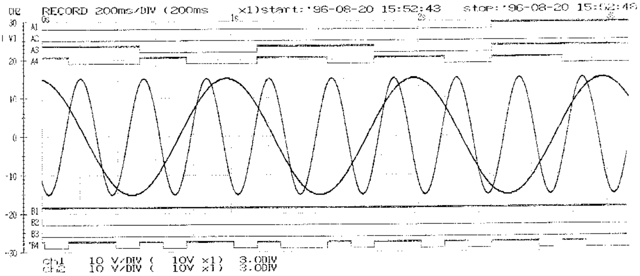


X-Y LINE

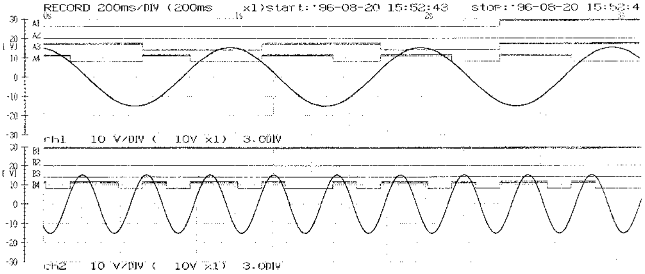


(2) Recorder function

Single

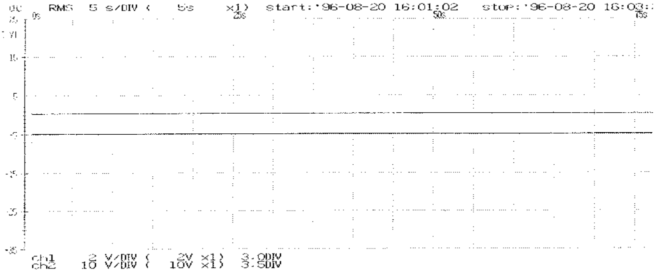


Dual

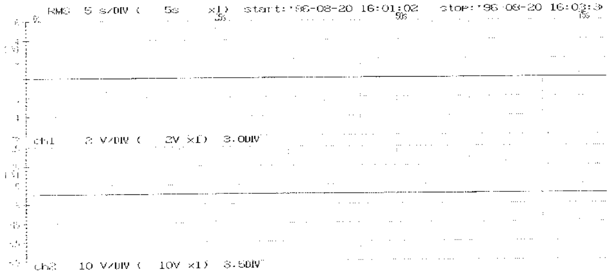


(3) RMS recorder function

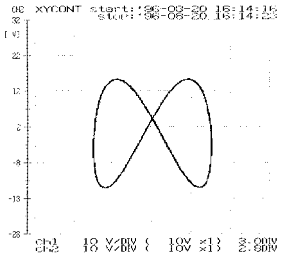
Single



Dual



(4) X-Y CONT recorder function



APP

Index

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HIOKI
HIOKI E. E. CORPORATION

HEADQUARTERS
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 FAX +81-268-28-0568
os-com@hioki.co.jp
(International Sales Department)

www.hioki.com

HIOKI USA CORPORATION
hioki@hiokiusa.com   www.hiokiusa.com

HIOKI (Shanghai) SALES & TRADING CO., LTD.
info@hioki.com.cn   www.hioki.cn

HIOKI INDIA PRIVATE LIMITED
hioki@hioki.in   www.hioki.in

HIOKI SINGAPORE PTE. LTD.
info@hioki.com.sg

1502EN

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