9 5 3 2 R O M C A R D

I N S T R U C T I O N
M A N U A L

Preface

Thank you for buying Hioki's 9532 ROM card. Used properly, this product should serve you well for a long time. To ensure that it does so, and that you get the full benefit of the functions provided by this product, please carefully read and follow the instructions given in this manual.

Contents

1. Introduction

The 9532 ROM card makes it possible for the 8850 Memory HI-Corder to perform the following types of functions.
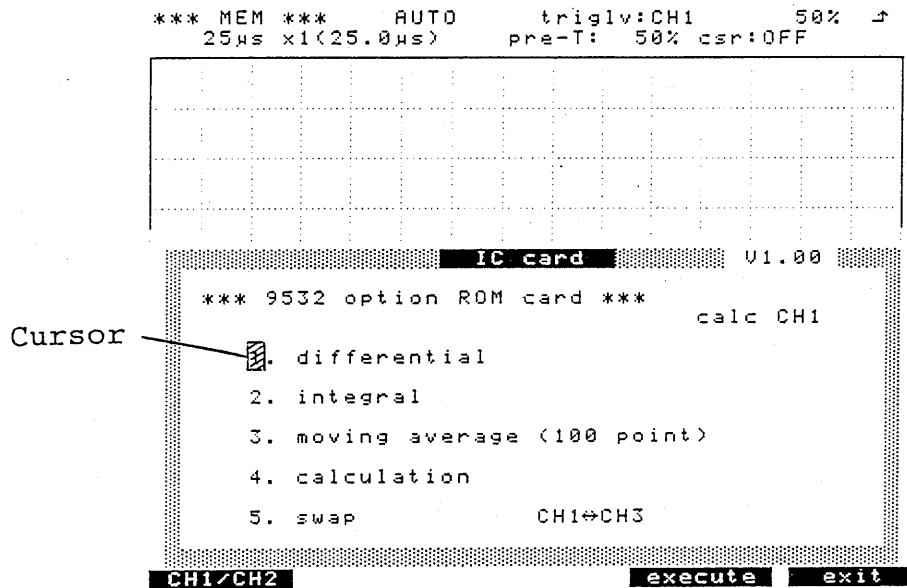
    (1) First order differentiation
    (2) First order integration
    (3) Calculation of moving averages (2-100 points)
    (4) Addition, subtraction, multiplication, and division
    (5) Inter-channel transfer of waveform data
    (6) Max-min calculation
    (7) Peak calculation
    (8) RMS calculation
    (9) Area calculation
    (10) Period calculation
    (11) Frequency calculation
    (12) Rise time calculation (10-90%)
    (13) Fall time calculation (90-10%)
    (14) Averaging

Notes: . Calculations other than Memory HI-Corder functions are
          not possible.
        . Except for inter-channel data transfer, calculations are
          not possible for channels that do not have an input unit
          or which are connected to the 8943 logic unit.

2. Operating Instructions

(1) Set the ROM card into the 8850 Memory HI-Corder.

(2) After switching to the memory recorder function screen, press
the IC Card key. A screen like the following then appears.

Note: Select either [NORMAL] or [DUAL] as display format for the
status screen. Calculation is not possible when [X-Y] is
selected.

```
*** MEM ***       AUTO       triglv:CH1        50%   ⌁
    25µs  x1(25.0µs)        pre-T:   50% csr:OFF
┌─────────────────────────────────────────────────────┐
│                                                       │
│                                                       │
│                                                       │
│                                                       │
│                                                       │
│                                                       │
└─────────────────────────────────────────────────────┘
▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓ IC card ▓▓▓▓▓▓▓▓▓▓ V1.00 ▓▓▓
  *** 9532 option ROM card ***
                                    calc CH1
      ▓. differential

      2. integral

      3. moving average (100 point)

      4. calculation

      5. swap            CH1⟷CH3

 ▓CH1/CH2▓                     ▓execute▓  ▓exit▓
```

Cursor ───────→ (points to item 1. differential)

(3) Move the cursor to the number corresponding to the type of
calculation desired, then press the [execute] key to run the
function.
To exit the menu without running any function, press the
[exit] key.
To move the cursor, either use the cursor keys or turn the
rotary knob.

(4) After selecting and executing setting the ROM card function,
press the START key to read the signal waveform and begin
calculations. Leave the ROM card in the 8850 while
calculations are being performed.

Note: Calculations are not possible during start operation if
either of the following settings are selected.
. When time/div is in the range 100ms/div to 5s/div
. When sequential save is selected.

(5) Calculation during signal input ends upon any of the
following conditions.
(a) When the [exit] key is pressed during display of the
calculation setup screen

(b)   When display is switched to a screen other than the memory function screen.

(c)   When the ROM card is removed from the 8850 Memory HI-Corder.

2-1 Selecting the waveform display function

This function is effective for all data of the input shot length.

(1) differential (first order differentiation), integral (first order integration)

. Select either CH1 or CH2. Results of differentiation or integration are output to CH3.
   The calculated waveform on CH3 can be displayed by pressing the [DARK] key.
. Select the channel for which calculations are to be performed by pressing the [CH1/CH2] key.
. The input waveform offset is used as the zero point for the calculated waveform.
. Calculations are performed upon pressing the [execute] key. When execution is completed, the calculation state (displayed in the status screen) is automatically set to ON.
. Calculations are performed according to the following expressions.

Differentiation
$$b_i = (d_{i+5} - d_{i-5}) + d_{ofs} \qquad\qquad (i = 0, 1, \cdots n)$$

   b_i : i_{th} data item for calculated result

   d_i : i_{th} data item from source channel

   d_{ofs}: Source channel offset data

Integration
$$b_i = \left\{ \frac{1}{K} \sum_{t=0}^{i} (d_t - d_{ofs}) \right\} + d_{ofs} \qquad (i = 0, 1, \cdots n)$$
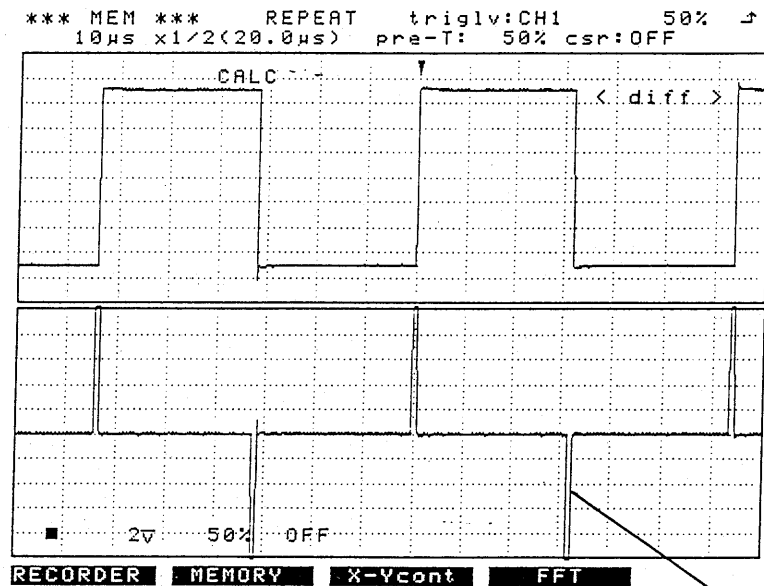
   b_i : i_{th} data item for calculated result

   d_i : i_{th} data item from source channel

   d_{ofs}: Source channel offset data

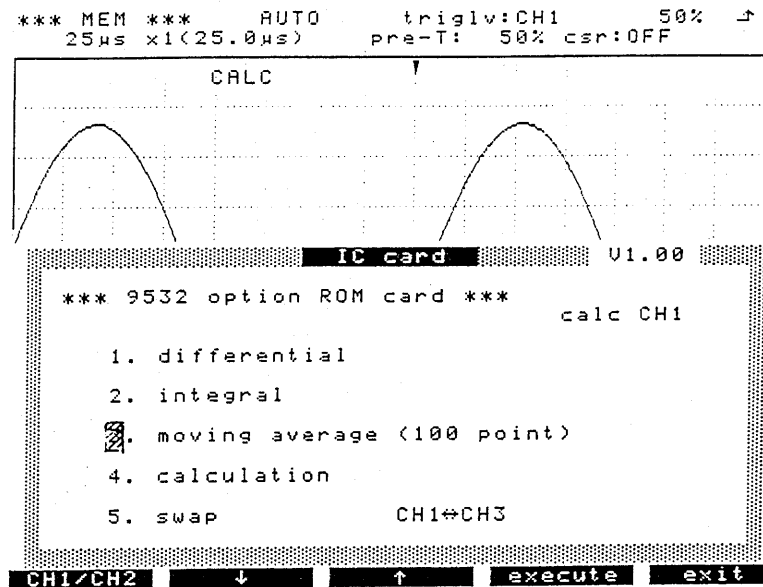 K : Integrated waveform amplitude/source waveform amplitude (set automatically)

Note: Calculation is not possible for logic waveforms or channels that do not have an input unit.

```
*** MEM ***      REPEAT    triglv:CH1        50%  ⌐
    10µs  x1/2(20.0µs)   pre-T:   50% csr:OFF
```

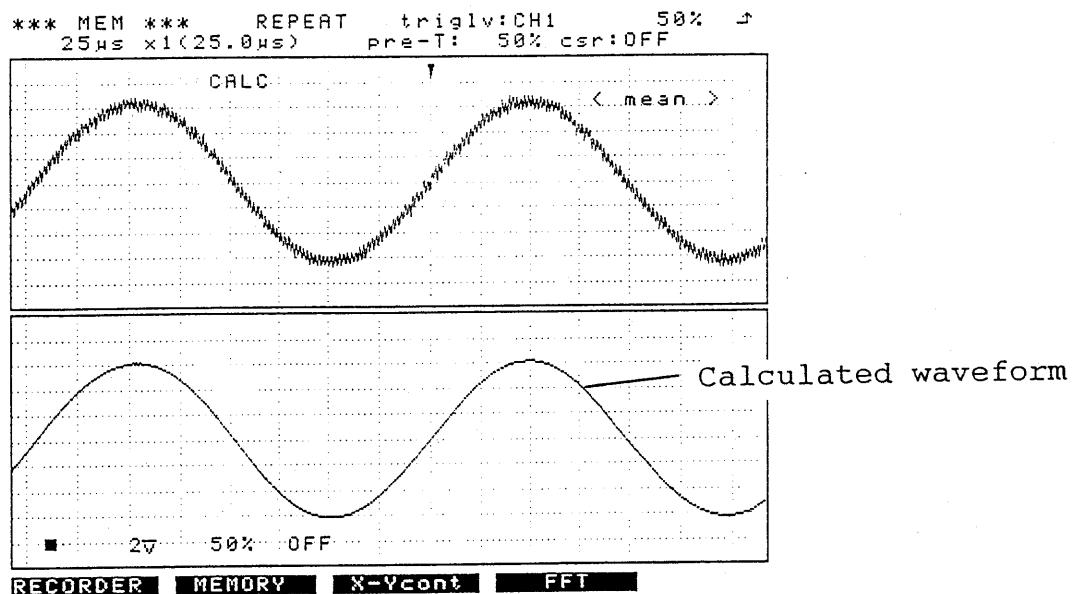Calculated waveform
(first order integral)

(2) Moving averages

. This function calculates a moving average from waveform
  data input to CH1 or CH2, and outputs the results of
  calculation to CH3. The CH3 calculation results are
  displayed by pressing the [DARK] key.
. Select the source channel for calculation by pressing the
  [CH1/CH2] key.
. Set the number of points to be included in each average by
  pressing the [↓] or [↑] key. The number of points can be
  set to anywhere in the range from 2 to 100.
. Calculations are performed upon pressing the [execute] key.
  When calculation is completed, the calculation state
  (displayed in the status screen) is automatically set to
  ON.
. Calculations are performed according to the following
  expressions.

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```
*** MEM ***      AUTO        triglv:CH1        50%   ⌐
   25µs  x1(25.0µs)      pre-T:   50% csr:OFF
┌──────────────────────────────────────────────────┐
│           CALC              ▼                      │
│                                                    │
│        ╱‾╲                        ╱‾╲              │
│       ╱   ╲                      ╱   ╲             │
│      ╱     ╲                    ╱     ╲            │
│     ╱       ╲                  ╱       ╲           │
│  ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓ IC card ▓▓▓▓▓▓▓▓ V1.00 ▓▓▓        │
│                                                    │
│   *** 9532 option ROM card ***                     │
│                                     calc CH1       │
│                                                    │
│      1.  differential                              │
│                                                    │
│      2.  integral                                  │
│                                                    │
│      ▓.  moving average (100 point)                │
│                                                    │
│      4.  calculation                               │
│                                                    │
│      5.  swap              CH1⇔CH3                  │
│                                                    │
└──────────────────────────────────────────────────┘
 ▐CH1/CH2▌    ▐ ↓ ▌      ▐ ↑ ▌    ▐execute▌  ▐exit▌
```

$$b_i = \frac{1}{K} \sum_{t=i-K/2}^{i+K/2} d_t \qquad\qquad (i = 0, 1, \cdots n)$$

b_i : i_{th} data item for calculated result

d_i : i_{th} data item from source channel

K : Number of moving points

Note: Calculation is not possible for logic waveforms or channels
       that do not have an input unit.

```
*** MEM ***      REPEAT       triglv:CH1        50%   ⌐
   25µs  x1(25.0µs)      pre-T:   50% csr:OFF
┌──────────────────────────────────────────────────┐
│           CALC              ▼                      │
│      ╱╲╱╲                        ╱╲╱╲   <.mean.>   │
│    ╱      ╲                    ╱      ╲            │
│   ╱         ╲                ╱          ╲          │
│  ╱            ╲            ╱              ╲         │
│                ╲        ╱                  ╲      ╱│
│                  ╲╱╲╱╲╱                     ╲╱╲╱╲╱ │
├──────────────────────────────────────────────────┤
│                                                    │
│        ╱‾╲                        ╱‾╲              │
│       ╱   ╲                      ╱   ╲             │
│      ╱     ╲                    ╱     ╲            │
│     ╱       ╲                  ╱       ╲           │
│    ╱         ╲                ╱         ╲          │
│  ■    2V    50%  OFF                               │
└──────────────────────────────────────────────────┘
 ▐RECORDER▌  ▐MEMORY▌   ▐X-Ycont▌   ▐FFT▌
```
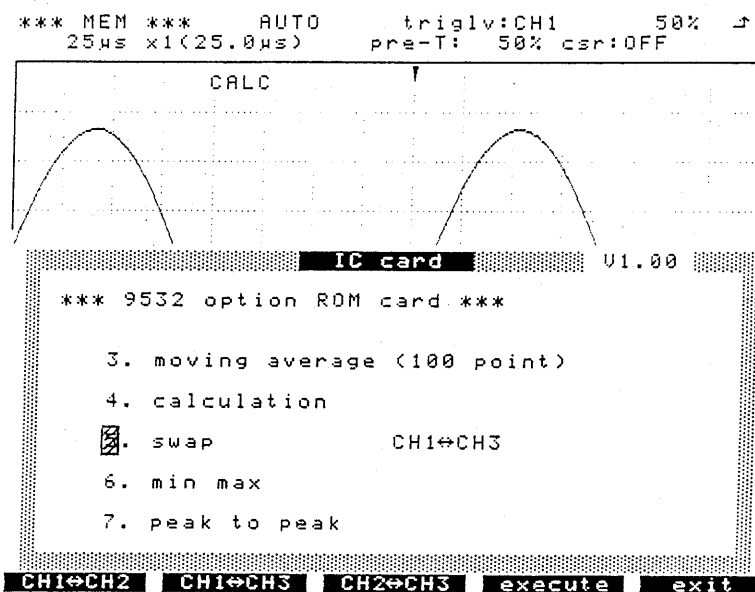
Calculated waveform

(3) calculation (addition, subtraction, multiplication, division)

. This function provides the same 4-function arithmetic as is
  provided by the calculation function of the 8850 itself.
  Set up the calculation by entering operators and factors in
  the status screen.
. Calculations are performed upon pressing the [execute] key.
. When execution is completed, the calculation state
  (displayed in the status screen) is automatically set to
  ON.

Calculated waveform
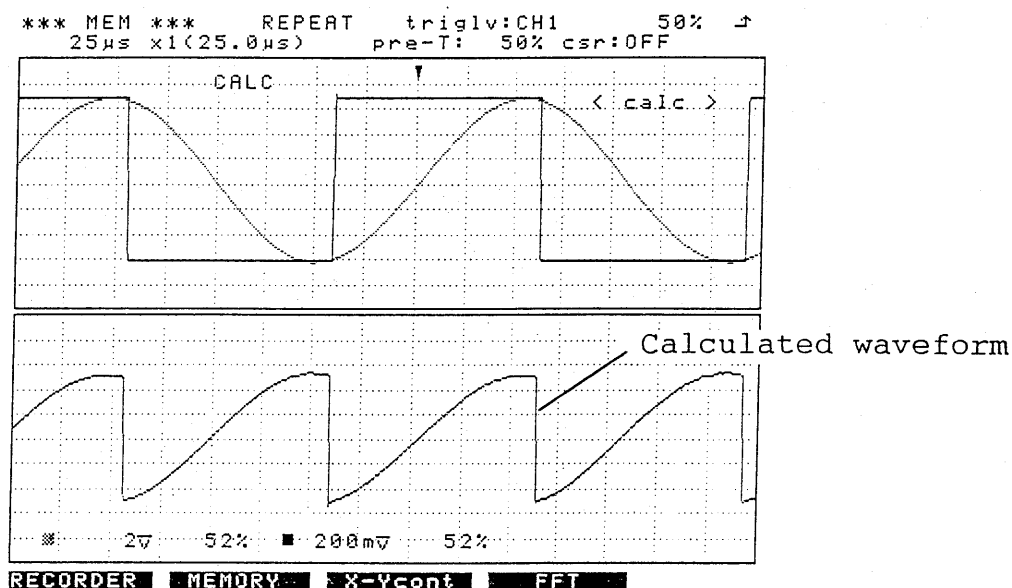
(4) swap (inter-channel transfer of waveform data)

. This function exchanges waveform data between selected
  channels.

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. Select either [CH1⟷CH2], [CH1⟷CH3], or [CH2⟷CH3] as the transfer path.
. Press the [execute] key to transfer data between the channels.
. Calculations are performed according to the following expressions.

$$d_{1i} \rightleftarrows d_{2i} \quad (i = 0, 1, \cdots n)$$

d_{1i} : i_{th} data item from channel 1
d_{2i} : i_{th} data item from channel 2

Notes: . When using divided memory, waveform data is only transferred for the memory block currently being used.
. Data is transferred between the selected channels regardless of the type of input units connected (or not connected) to those channels. However, no waveform data is displayed for channels without an input unit.

2-2 Setting calculations that display values

- The calculation functions described in this section perform calculations on waveform data displayed on the screen for all channels.
- If the A·B cursors appear on the screen, calculations are performed on data in the area specified by those cursors. If only the A cursor appears, calculations are performed on all waveform data following the A cursor.
- Whether or not calculated values are printed is determined during start-up operation with the [prt ON/OFF] key.

No.	[CH1]	[CH2]	[CH3]
12. MAX: MIN:	399 µV -199 µV	69.5 mV -62.3 mV	
11. MAX: MIN:	399 µV -199 µV	65.5 mV -63.1 mV	
10. MAX: MIN:	399 µV -199 µV	65.5 mV -62.3 mV	
9. MAX: MIN:	199 µV -199 µV	65.5 mV -62.3 mV	
8. MAX: MIN:	199 µV -199 µV	66.3 mV -62.3 mV	
7. MAX: MIN:	199 µV -199 µV	65.5 mV -63.9 mV	
6. MAX: MIN:	399 µV -199 µV	65.5 mV -63.1 mV	
5. MAX: MIN:	199 µV -199 µV	65.5 mV -62.3 mV	
4. MAX: MIN:	199 µV -199 µV	66.3 mV -61.5 mV	
3. MAX: MIN:	399 µV -199 µV	64.7 mV -63.1 mV	
2. MAX: MIN:	399 µV -199 µV	67.1 mV -63.1 mV	
1. MAX: MIN:	199 µV -199 µV	66.3 mV -63.1 mV	

<<< min-max >>>

Example of data printout

(1) min, max

- This function displays the maximum and minimum waveform data values in volts.
- For waveform data that has been manipulated through calculation, a value of 0 corresponds to the bottom of the screen (0%) and a value of 10 corresponds to the top of the screen (100%).

Calculated value

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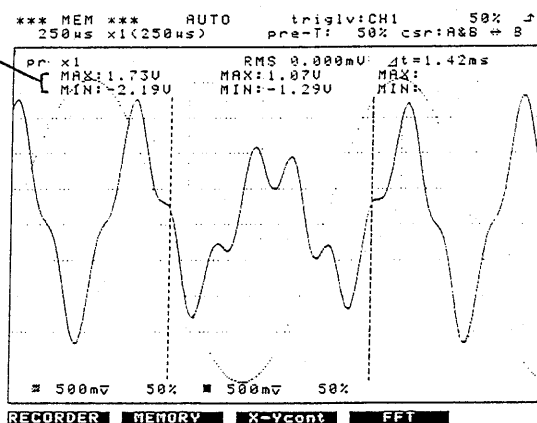
(2) peak to peak

   . This function displays peak values of waveform data
     (maximum value minus minimum value) in volts.
     For waveform data that has been manipulated through
     calculation, a displayed value of 1 corresponds to the
     width of one grid square on the display.
   . Calculations are performed upon pressing the [execute] key.
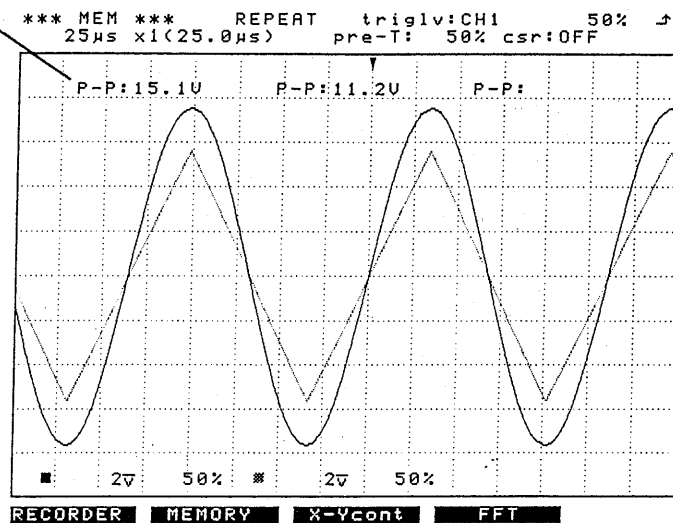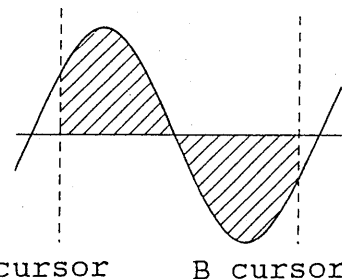

Calculated value

(3) rms (root mean square)

   . This function duplicates the RMS function of the 8850
     itself.
   . For waveform data that has been manipulated by calculation,
     the offset value is automatically set to the 50% position.
     In the results, a displayed value of 1 corresponds to the
     width of one grid square.
   . Calculations are performed upon pressing the [execute] key.

Calculated value

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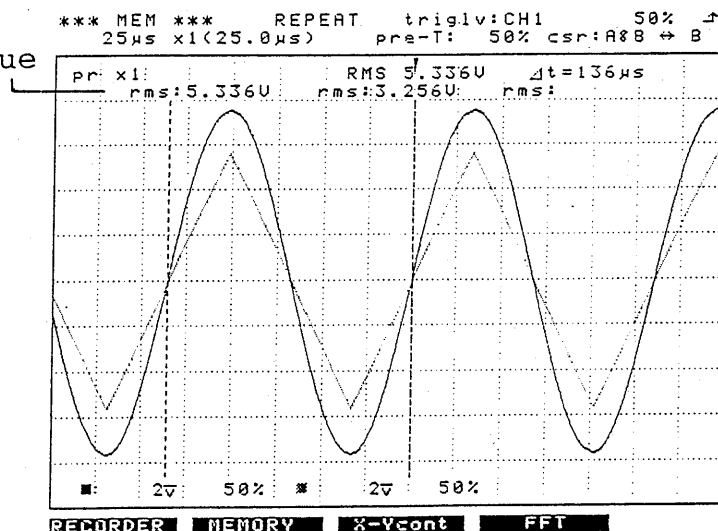
(4) area (area calculation)

. This function displays the area
  enclosed by the input waveform
  and the offset. (Unit: Vs)
. When the A and B cursors are
  displayed, the waveform area for
  the interval between the cursors
  is displayed (the shaded area in
  the figure at right).
. For waveform data that has been
  subjected to calculation, area
  calculation uses the display's 0%
  position as the offset value.
  Results are converted for display
  such that, for a 1:1 display
  ratio, the area of one grid
  square corresponds to 1 Vs.
. Calculations are performed upon pressing the [execute] key.
. Calculations are performed according to the following
  expressions.

$$\text{Area } A = \frac{|d_0 - ofs|}{2} + \sum_{i=1}^{n-1} |d_i - ofs| + \frac{|d_n - ofs|}{2}$$

d_i : i_{th} data item from source channel
ofs : offset value of source channel

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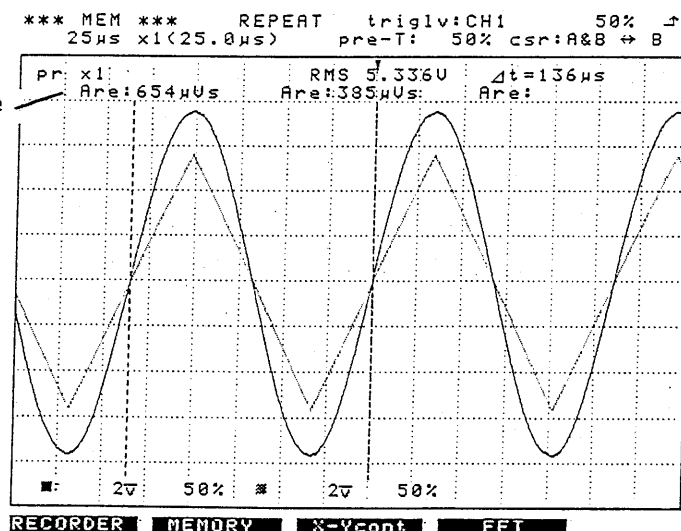
(5) period and frequency

- These functions display the period (in seconds) and the
  frequency (in Hertz) of the signal waveform.
- The median amplitude of the signal is found, then
  calculations are performed over the time between the two
  successive instants at which the rising slope passes
  through that level.
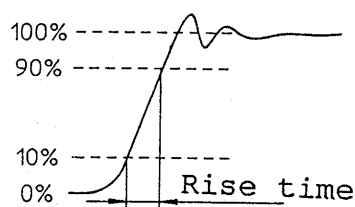- Calculations are performed upon pressing the [execute] key.

Note: Calculations are performed only for input waveforms whose
       period exceeds 1DIV.

Calculated value
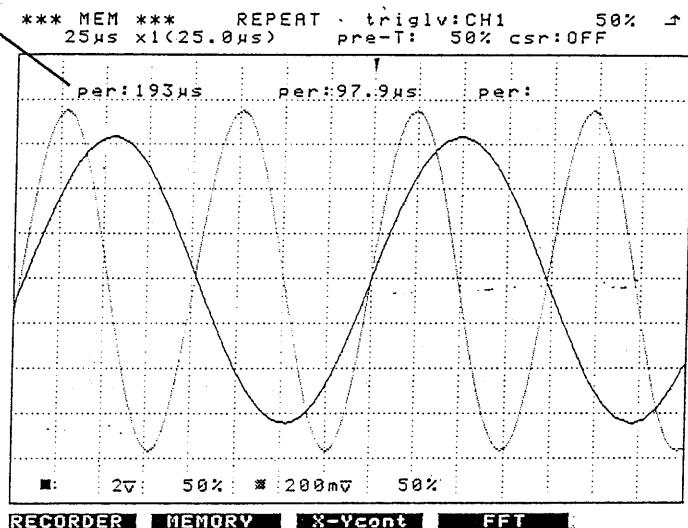
(6) rise time and fall time

- These functions display the time
  required for the signal waveform
  to rise from the 10% level to the
  90% level, or to fall from the
  90% level to the 10% level. Time
  is displayed in seconds.
- Calculations are performed by
  constructing a histogram of the
  input waveform data, then
  calculating the 0% and 100%
  levels based on that histogram.
- Unless the A·B cursors are
  present, the rise (fall) time is
  calculated based on the first
  rising slope included in the
  input waveform data.

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. When part of the waveform is selected with the A·B cursors,
  the rise (fall) time is calculated based on the first
  rising slope included in the interval between the cursors.
. Calculations are performed upon pressing the [execute] key.

Note: Calculated value may not be displayed for some types of
      waveforms.

Calculated value ——

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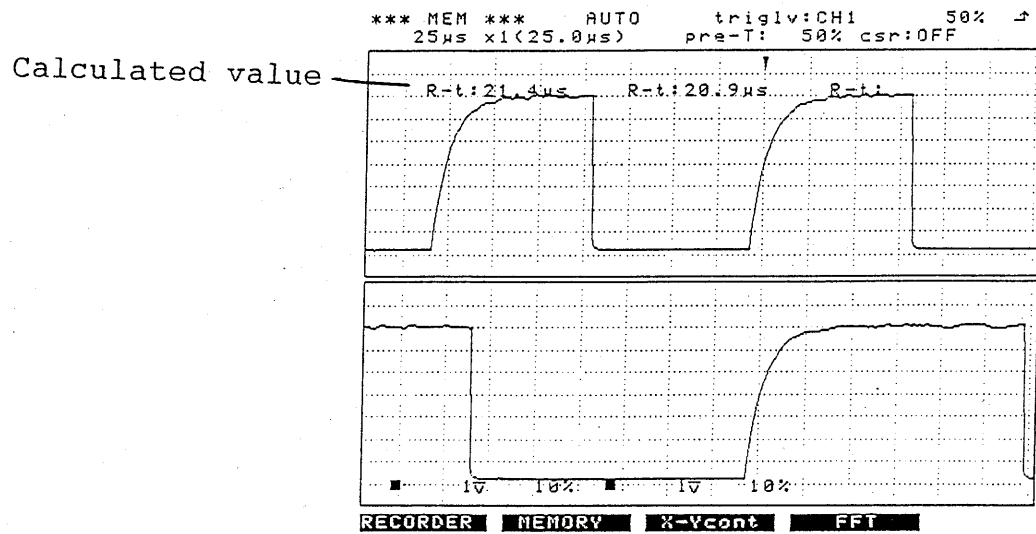
(7) mean

- This function displays the mean (in volts) of the signal
  waveform from the offset.
- When part of the waveform is selected with the A·B cursors,
  the mean is displayed for the interval between the cursors.
- For waveform data that has been subjected to calculation,
  the mean is calculated for an fixed offset of 0%. In
  results displayed, a value of 1 corresponds to the width of
  one grid square.
- Calculations are performed according to the following
  expression.

$$\text{Mean} \quad \overline{d} = \frac{1}{n+1} \sum_{i=0}^{n} d_i$$

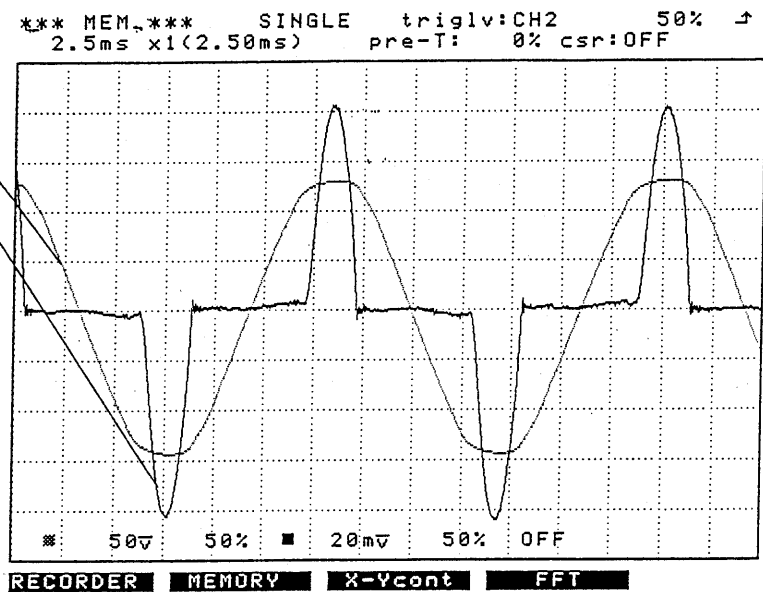d_i : i_{th} data item from source channel

Calculated value

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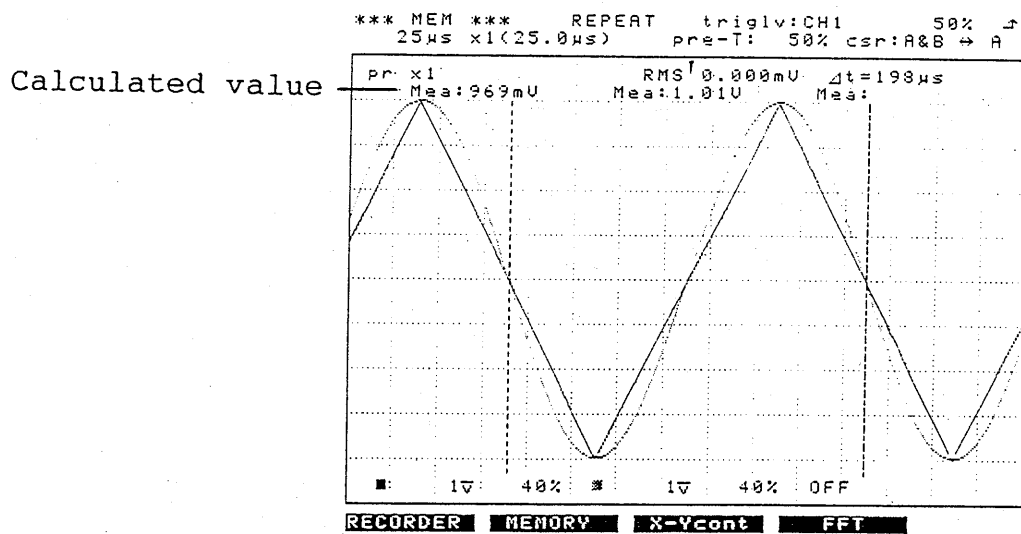
3. Sample Application

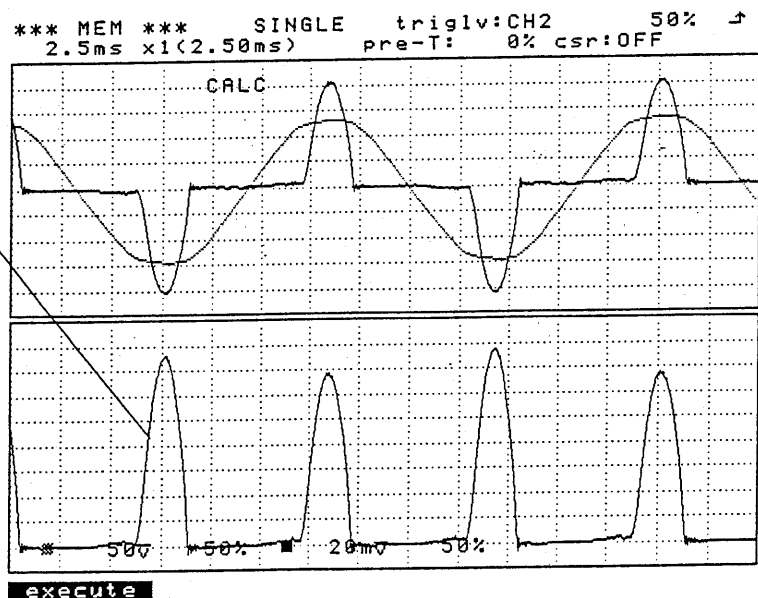The following example uses the ROM card to calculate power.

(1) Input the voltage waveform to CH1 and the current waveform to CH2.
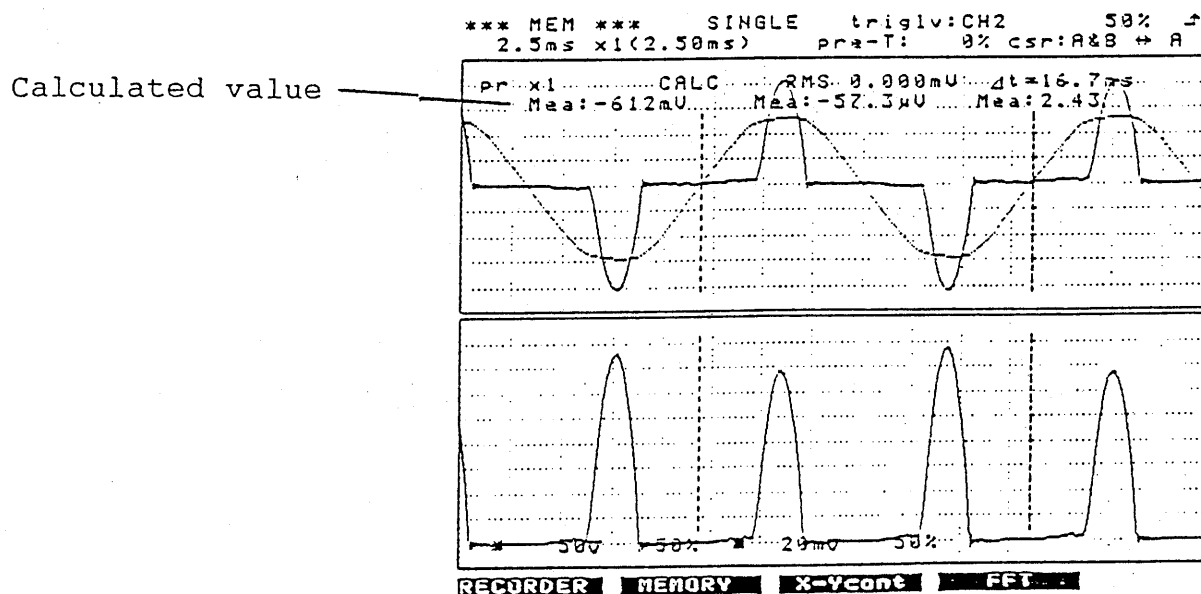
Voltage waveform
Current waveform

(2) Use the arithmetic function to calculate the product of CH1 and CH2.

Power waveform

(3) Use the A·B cursors to select one cycle of the power waveform on CH3, then determine the average power with the mean function.

Calculated value ——————

*** MEM ***   SINGLE   triglv:CH2   50%
   2.5ms x1(2.50ms)   pre-T: 0% csr:A&B ↔ A

pr x1   CALC   RMS 0.000mU   Δt=16.7ms
Mea:-612mU   Mea:-57.3µU   Mea:2.43

RECORDER   MEMORY   X-Ycont   FFT

(4) Determine the power value from the mean according to the following expression.

$$\frac{CH1 \text{ range } [V/DIV] \times CH2 \text{ equivalent current range } [A/DIV]}{a \times b} \times (mean - c) \text{ [W]}$$

Here, a, b, and c are arithmetic coefficients.

Thus, the calculated power for the following conditions is equal to 111.7 (W).

CH1 range = 50 [V/DIV]
CH2 equivalent current range = 1 [A/DIV]
a = 0.80, b = 0.80, c = 1
mean = 2.43

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4. Precautions

· The ROM card is designed for operation with 8850 Memory HI-Corder versions from 1.10. It can not be used with earlier versions of the 8850. In case of doubt, please check with any Hioki dealer.

· If the STOP key is pressed during calculation (for repeated operation, etc.) while waveforms are being input, calculated waveforms displayed can differ from the actual waveforms.
This occurs because the calculations are interrupted. In such cases, please repeat the calculations following the instructions given in section 2 of this manual.

●Never open the shutter of the ROM card and touch the terminals.

●Never drop the card, bend it, or subject it to impact shocks of any kind.

●Never allow the ROM card to become wet.

●Always handle the ROM card with care, especially during insertion.

●Avoid storing the ROM card in direct sunlight or near heating equipment.

●The manufacturer and vendor cannot accept responsibility for direct or indirect damages arising from use of this ROM card.