Instruction Manual
Arithmetic operation Unit (RA11-752)
For RA1000 Series

NEC Avio Infrared Technologies Co., Ltd.
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INTRODUCTION

Thank you very much for purchasing the Arithmetic Operation Unit (RA11-752), which is an optional accessory to the thermal dot recorder, Omniace II RA1000 series. The arithmetic operation unit provides an optional functional capabilities to the thermal dot recorder. Prior to as well as while using the unit, please carefully read the Instruction Manual so that you can correctly use the arithmetic operation unit.
This Instruction Manual is to provide information that is necessary for you to safely and correctly operate the arithmetic operation unit (RA11-752) through reading it while using the unit. Please always place this Instruction Manual together with the arithmetic operation unit whenever you use the unit, so that you can access and refer to the manual at any time.

For information on the basic functions of the mainframe, please refer to the mainframe Instruction Manual, RA1000 Series. If you have questions on the descriptions in the Instruction Manual, please contact marketing/sales personnel of NEC San-ei.

Other instruction manuals related to this Manual :

Titles of instruction manuals	Types	Contents
Instruction Manual Mainframe RA1000 Series	95691-2074-0000	The manual involves descriptions of functions and operating instructions of the mainframe, RA1000 series.
Instruction Manual RS-232C and GP-IB RA1000 Series	95691-2075-0000	Please refer to this instruction manual when you use GP-IB or RS-232C interface functions. Explanations of interface commands are involved in the manual for controlling the instrument by a personal computer.
Instruction Manual Amplifier units RA1000 Series	95691-2076-0000	The manual provides operating instructions and setting procedure descriptions for each type of amplifier units.

■ Before Using Arithmetic Operation Unit

－Precautionary notes－

◆If anything unusual happens during use of the instrument, immediately switch off the mainframe RA1000 power and disconnect it from the power supply.
If you cannot find the cause by any means, contact your dealer or one of the service centers listed at the end of this Instruction Manual. (Please use FAX transmission, if possible, clearly describing all details of abnormal symptoms, circumstances and any other information that would help.)

◆Contents of this Instruction Manual are subject to change without prior notice.
◆Reprinting or reproduction of this Manual, in whole or in part, without permission is prohibited.
◆NEC San-ei has made every effort to maintain the completeness in the contents of this Manual. NEC San-ei, however, would appreciate your effort and cooperation to contact us or your dealer regarding any errors, omissions, questions or suggestions for this Manual, if you find one.

■ Safety Considerations and Precautions - Warning and Caution

● Notes for safely using this product

This product conforms to Class I of the IEC Safety Standard.

While this product has been manufactured by placing high priority on safety aspects, errors in handling or operating the instrument on the part of customers could lead to serious accidents. Please read carefully and comprehend thoroughly the Instruction Manual before using this product, so that such accidents can be avoided in the use of this product. The designations described below are used for this product and throughout the Instruction Manual to secure the safe usage and operation of this product; the designations and their respective meanings are explained in the following:

⚠ WARNING

If any instructions in WARNING are ignored in handling the instrument, the ignorance could lead to one or both of the following:

1. possibility of human deaths or serious injuries
2. high rate of occurrence of minor personal injuries or non-personal physical damages

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⚠ CAUTION

If any instructions in CAUTION are ignored in handling the instrument, the ignorance could lead to one or both of the following:

1. risk of human injuries
2. possibility of non-personal physical injuries not involving human injuries

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Please be sure to observe the descriptions hereunder when using the instrument. No warranties or assurances will be provided or implied for any injuries or damages resulting from actions not complying with Warnings, Cautions or alike in handling or operating the instrument.

In addition, please understand that there exist a number of "what you cannot do" and "what you must not do" in handling and operating the instrument and that it is not possible to cover all of such instructions in the Manual. Therefore, your attention is requested to interpret that "you cannot do anything" in any cases unless explicit description of "you can do this" is found in the manual.

■ Warranty Application

NEC San-ei has been making every effort in maintaining a high quality control level for its products throughout the production process from design phase to shipping phase. However, in an unlikely event of finding a symptom of failures during your use of the instrument, you must check the operational procedures and status of the equipment, the status of the electrical power supply voltage and the connection status of various cables, before asking NEC San-ei for repair.

Consult with the nearest service center or dealer for request for repair or for temperature calibration of the instrument. Please do not forget to inform the instrument type (i.e., RA1100, RA1200 or RA1300), the serial number and details of the failure.

The warranty period and the warranty terms are provided in the next section.

■ Warranty Provisions

1. Period of warranties: The period of warranties for the product is one(1) year from the date of delivery.
2. Warranties: Failures that occurred during the period of warranty are repaired free of charge in principle. The following cases, however, as NEC San-ei's policy dictates, are subject to your payment of repair charge:
   - ① damages or failures due to incorrect handling of instrument
   - ② damages or failures due to fires, earthquakes, traffic accidents or any other acts of God.
   - ③ damages or failures caused by repairs or modification of instrument not done by NEC San-ei or any of those who are commissioned by NEC San-ei.
   - ④ failures due to use or storage under the environment exceeding the prescribed conditions for the instrument.
   - ⑤ Regular calibration
   - ⑥ failures or damages that occurred during transport or transfer of instrument after delivery.
3. Coverage of warranties and responsibility: NEC San-ei is not responsible to any instrument not manufactured by NEC San-ei.

■ Designations used in this instruction manual

The following explains the meaning of designations and symbols used in this Instruction Manual:

designations or symbols	meaning
⚠ WARNING	If any instructions in WARNING are ignored in use of the instrument, the ignorance could lead to one or both of the following: 1. possibility of human deaths or serious injuries 2. high rate of occurrence of minor personal injuries or non-personal physical damages
⚠ CAUTION	If any instructions in CAUTION are ignored in use of the instrument, the ignorance could lead to one or both of the following: 1. risk of human injuries 2. possibility of non-personal physical injuries not involving human injuries
NOTE	If any instructions in NOTE are ignored in use of the instrument, the ignorance could lead to one or both of the following: 1. possibility of mal-function of equipment 2. possibility of deletion or loss of measurement data
TIPS	Descriptions under TIPS provide information on restriction or limitation for setting or other supplementary information.
☞	This sign indicates a page or pages to be referred to.
this product	The words indicate the mainframe, RA1100/RA1200.
the memory	The words indicate the internal memories in RA1100/RA1200. Measured data are stored in "the memory" for measurements in the memory mode and the transient mode.
< >	Characters enclosed by the bracket < > indicate a key in the operating panel. example: the <start> key
〈 〉	Characters enclosed by the bracket 〈 〉 indicate a touch panel key displayed in the screen. example: 〈realtime〉
[ ]	Characters enclosed by the bracket [ ] indicate a title of a display screen that appears upon pressing a key in the operating panel.
disk	The following types of media can be used with this product as its storage device: • FD: 3.5-inch type floppy disks, 2HD type (both-side high density double track type) • MO: 3.5-inch type magneto-optical disks (230MB or 640MB) • PD: 12cm phase change optical disks (650MB) The word "disk" or "disks" in this Instruction Manual specifically indicates any of the storage media listed above.
PC card	The following types of PC cards can be used with this product as its storage device: • IC memory card(SRAM card): 64KB - 4MB • flash memory card: 2MB - 640MB The words "PC card" or "PC cards" in this Instruction Manual specifically indicate any of the storage media listed above.
k(small character) K(capital character)	These are units of expressing numerical values as follows: • The small character k indicates 1000; e.g., "10 kg". • The capital character K indicates 1024; e.g., "4 Kbytes of data".

■ Liquid Crystal Display

The display device of this product uses TFT color liquid crystal elements. There could be several dots in the display screen that are always lit on and/or other dots that are never lit on. In addition, depending upon ambient temperatures, there could also be some degree of irregularities in the display due to temperature characteristics inherent in the liquid crystal.
Please note that any of the unusualness described above does not constitute instrument failure or fault.

CONTENTS

1. Zone Statistical Operation

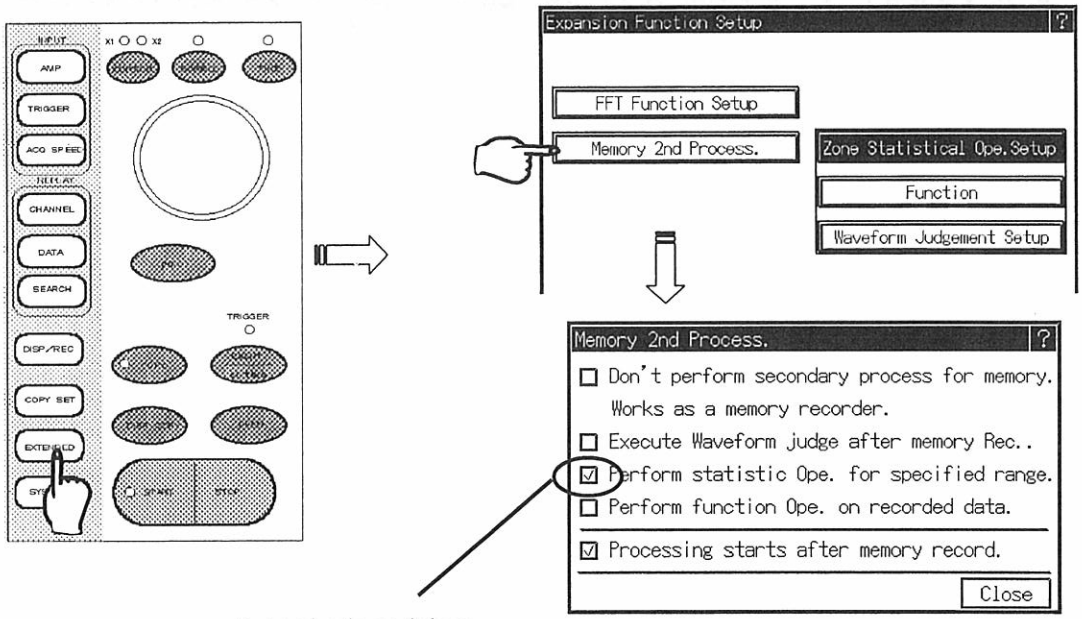
1.1 Zone statistical operation functions

◆ The zone statistical operation functions are used for applying statistical operations and processing for each channel data recorded/compiled in the memory. The zone statistical operation functions involve those of computing the maximum, minimum and average values of data recorded/compiled in the memory for desired zones/ranges as specified. The zone statistical operation can be performed in the memory mode in the measurement.

1. 1. 1. Performing zone statistical operation for playback data

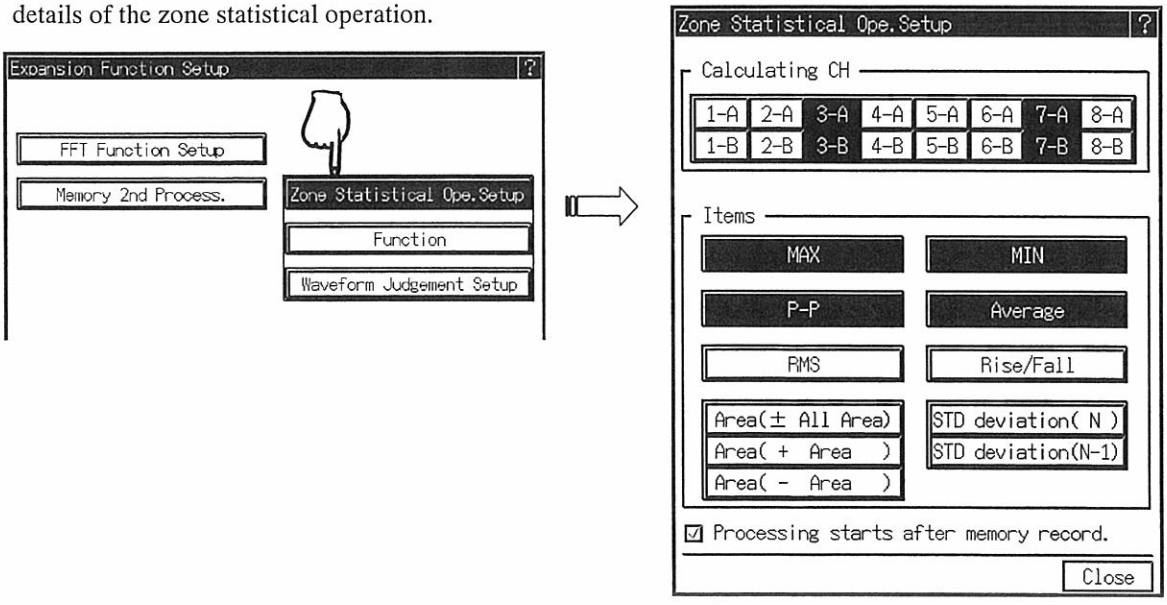
1 Setting zone statistical operation for memory 2nd processing

To perform zone statistical operation, first press the <EXTENDED> key in the operating panel. Then, press the ⟨Memory 2nd Process.⟩ key and select the item of "performing statistical operation for the specified range".



Put a check mark here.

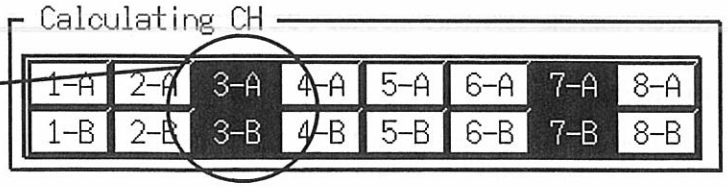
Once you have selected the item of "performing statistical operation for the specified range", you can set more details of the zone statistical operation.



2 Calculating channel setting

Calculating channels for which you can apply arithmetic operations are those having input units other than EV amplifiers. Press desired buttons for individual input units to change the color of the buttons.

Calculations can be done for those channels indicated by inverted (yellow) buttons.

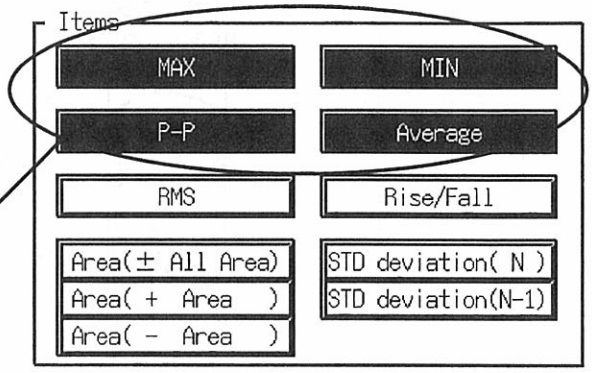


3 Calculation items (contents) setting

The following are calculation items (contents) that are provided for the zone statistical operation:

- Maximum value
- Minimum value
- Peak-to-peak value
- Average
- Area
- Effective value (r.m.s.)
- Standard deviation
- Rising and falling value

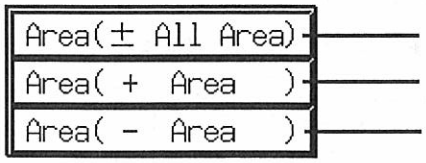
Once you have selected the item of performing statistical operation for the specified range, you can set the content of the zone statistical operation.



☞ For more detailed information on individual calculation items, refer to "1.1.3 Zone statistical operation".

● Setting area calculating method

Select the area calculating method from among the following three methods:



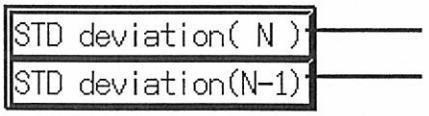
Calculating the area by using absolute values of measurement data

Calculating the area by using positive values of measurement data

Calculating the area by using negative values of measurement data

● Setting standard deviation calculating method

Select the standard deviation calculating method from among the following two methods:



Calculating the standard deviation with N as denominator

Calculating the standard deviation with N-1 as denominator

4 Executing zone statistical operation

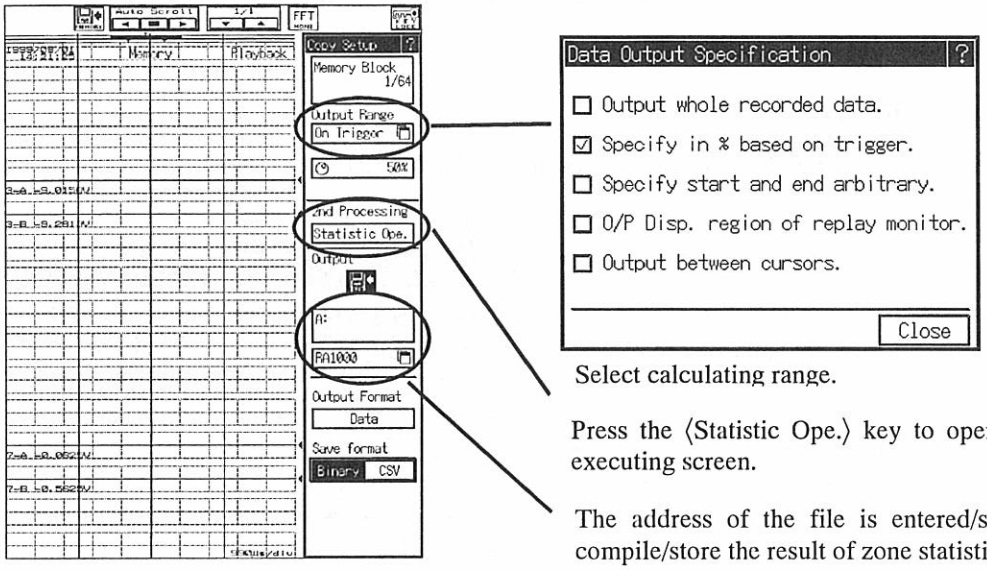
Conduct and execute zone statistical operation upon setting the calculating channel and calculating item.

● Data selection

Select, from the <playback monitor>, the memory block data for which you want to calculate.

● Calculation range setting

Press the ⟨Output Range⟩ key in the <Playback monitor> screen upon data selection, to set the calculating range.



Select calculating range.

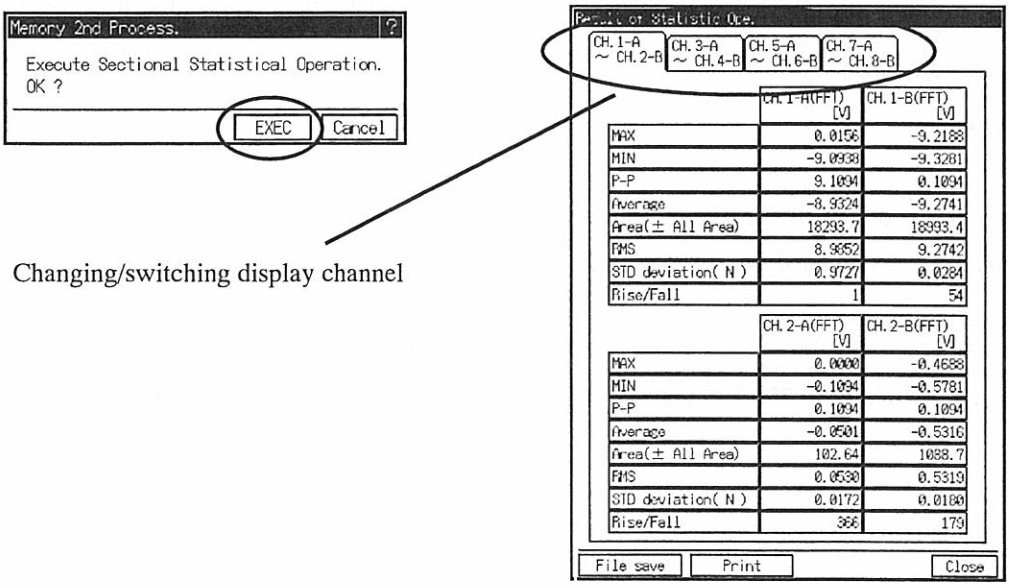
Press the ⟨Statistic Ope.⟩ key to open the calculation executing screen.

The address of the file is entered/specified here to compile/store the result of zone statistical operation.

● Starting calculation

Upon completion of setting the calculation range, press ⟨Statistic Ope.⟩ key to open the calculation executing window. Press the ⟨EXEC⟩ key to start calculation.

Upon completion of calculation operation, the following screen of displaying the result of statistical calculation/operation appears, in which the calculation result can be checked.



Changing/switching display channel

Result of statistical calculation/operation display screen

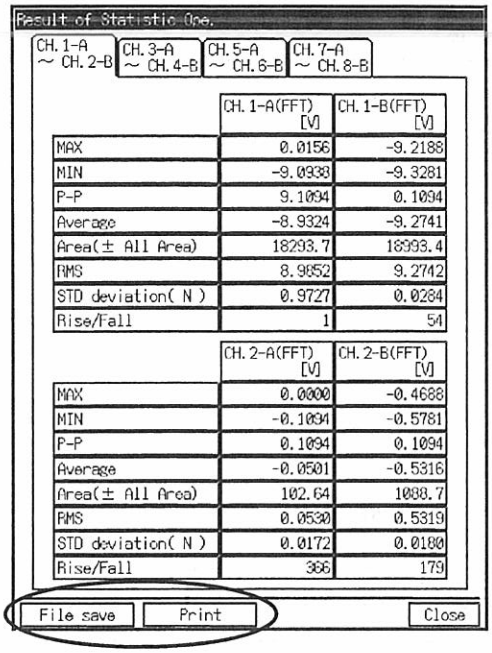
● Changing display channel

The result of statistical operation is displayed for every four-channels.

Use the tabs of ⟨CH.1-A - CH.2-B⟩ to ⟨CH.7-A - CH.8-B⟩ to change the display channel.

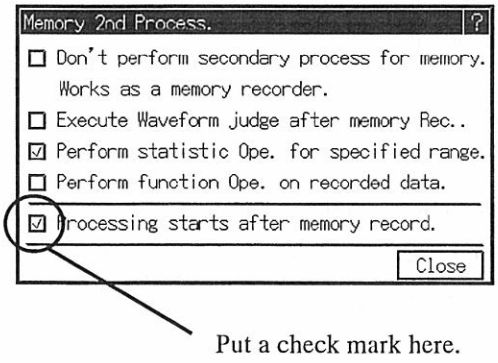
5 Calculation result output

Calculation results can be output on the recording sheet or compiled/recorded in the file. To do so, press the ⟨File save⟩ or ⟨Print⟩ key.



1. 1. 2. Performing automatic zone statistical operation

◆ Put a check mark at ⟨Processing starts after memory record⟩ in the [Memory 2nd Process] check box of the <EXTENDED> screen to perform automatic zone statistical operation.



● **Memory recording/filing**

When the setting is such that processing starts after memory recording, calculation operation starts for the selected calculating items after memory recording is completed.

● **Calculation result output**

Output of calculation results can be copied on recording sheets or compiled in the file, without being displayed in the screen. Use the auto-copy or filing setting to set the output medium.

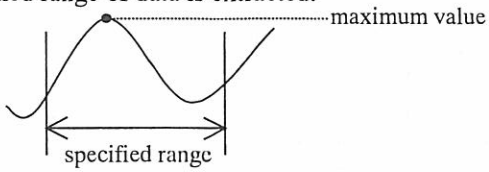
☞ For more detailed information on the auto-copy or filing, refer to "Section 7 Memory mode -Recording high speed phenomena-" in the instruction manual, RA1000 series mainframe.

1. 1. 3. Zone statistical operation

◆ Overviews are given below describing the types of calculations (arithmetic operations) that are provided in the menu of the zone statistical calculation.

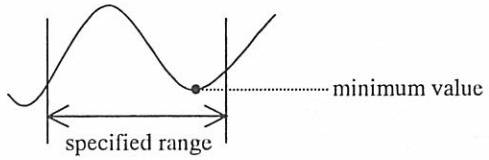
● Maximum value (MAX)

The maximun value within the specified range of data is extracted.



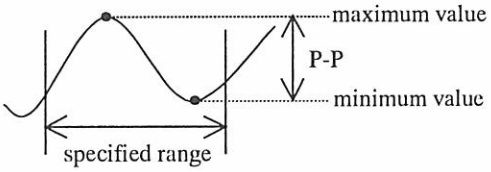
● Minimum value (MIN)

The minimun value within the specified range of data is extracted.



● Peak-to-peak value (P-P)

The difference between the maximum and minimum values is computed.



Calculation equation : P-P = | maximum - value-minimum value |

● Average value (AVE)

The mean value for the specified range of data is computed.

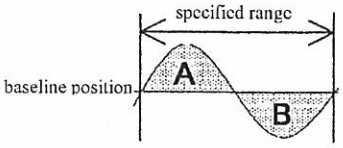
Calculation equation : $AVE = \sum \frac{D}{n}$

D: sample data in the specified range

n: number of data

● Area (AREA)

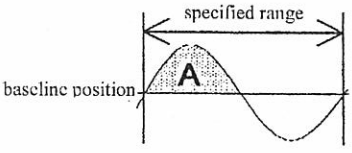
The area surrounded by the measured waveform and the base-line within the specified range is computed. Select the one you want from among ±All Area, +Area and -Area at the time of setting.



・ ±All Area ··· The aggregated area of both the positive and negative sides within the specified is calculated. (Example: the area of A+B of the figure at right)

Calculation equation : $\sum$ (ABS (D))

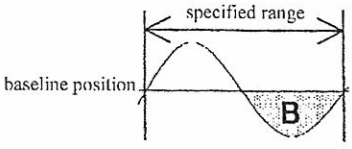
D: sample data within the specified range



・ +All Area ··· The area of the positive side within the specified range is calculated. (Example: the area of A of the figure at right)

Calculation equation : $\sum$ (+D)

D: sample data within the specified range



・ -All Area ··· The area of the negative side within the specified range is calculated. (Example: the area of B of the figure at right)

Calculation equation : $\sum$ (-D)

D: sample data within the specified range

● Effective value (RMS, root-mean-square value)

The effective value (root-mean-square value) for the specified range/zone of data is computed.

Calculation equation : $RMS = \sqrt{\frac{\sum D^2}{n}}$

D: sample data within the specified range

n: number of data

● Standard deviation (SD)

The standard deviation (SD) for the specified range/zone of data is computed.

Set the standard deviation parameter to select "n" or "n-1" for the denominator.

· N …… The standard deviation is calculated with the parameter 1/n for the data within the specified range.

Calculation equation : $SD = \sqrt{\frac{1}{n}\left(\sum D^2 - \frac{\left(\sum D\right)^2}{n}\right)}$

D: sample data within the specified range

n: number of data

· N-1 … The standard deviation is calculated with the parameter 1/(n-1) for the data within the specified range.

Calculation equation : $SD = \sqrt{\frac{1}{n-1}\left(\sum D^2 - \frac{\left(\sum D\right)^2}{n-1}\right)}$

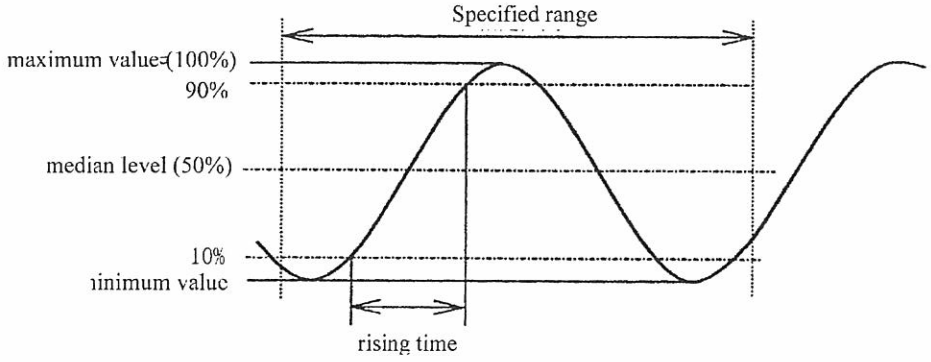
D: sample data within the specified range

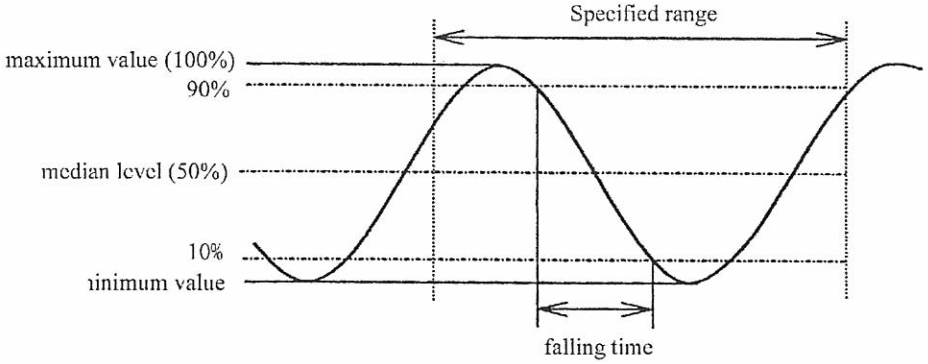
n: number of data

● Rising time or falling time

The rising time or the falling time is calculated in the following manner: to find the maximum and minimum values within the specified range of data, to find the waveform that first crosses the median level in the range and to calculate the time length between the 10% level time-point and the 90% level time-point for the waveform.

The calculation result is indicated in terms of the number of sample data. You can convert the calculation result into the time expression by the operation of (calculation result)x(sample speed).





2. Function Operation

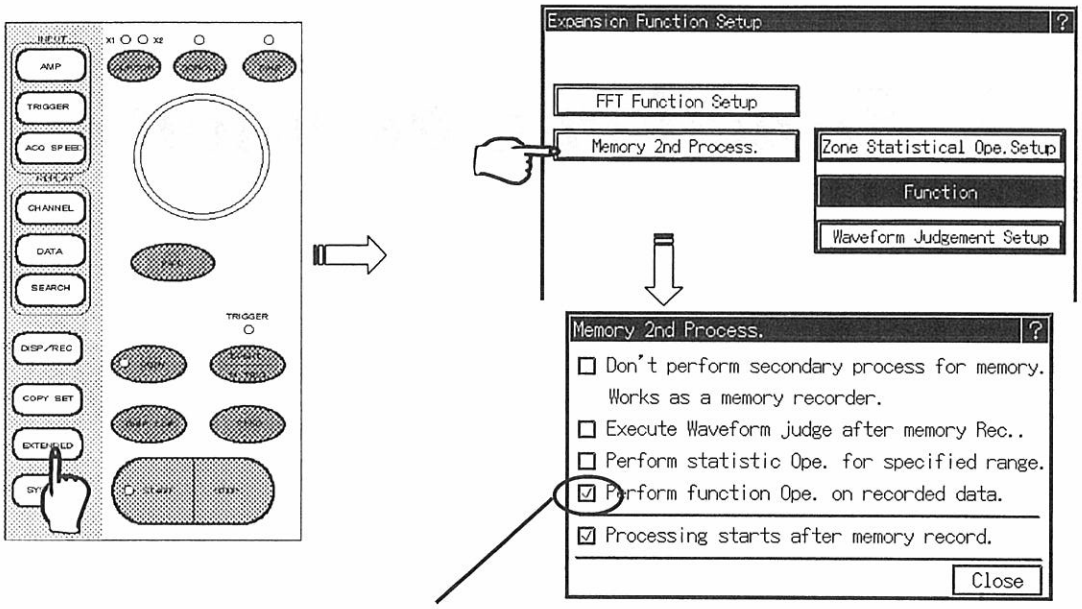
2.1 Function operation

◆ Function operation is applied and processed for the data compiled/stored in the memory. Function operation functions are valid in the memory mode for the measurement.

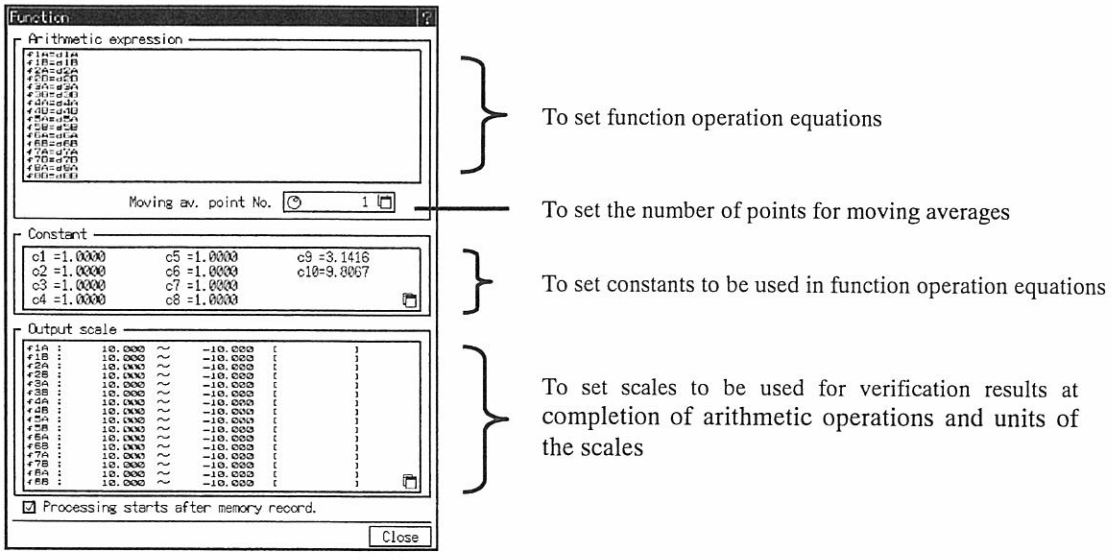
2.1.1. Performing function operation for playback data

1 Setting function operation for memory 2nd processing

To perform function operation, first press the <EXTENDED> key in the operating panel. Then, press the ⟨Memory 2nd Process.⟩ key and select the item of "performing function operation on recorded data".



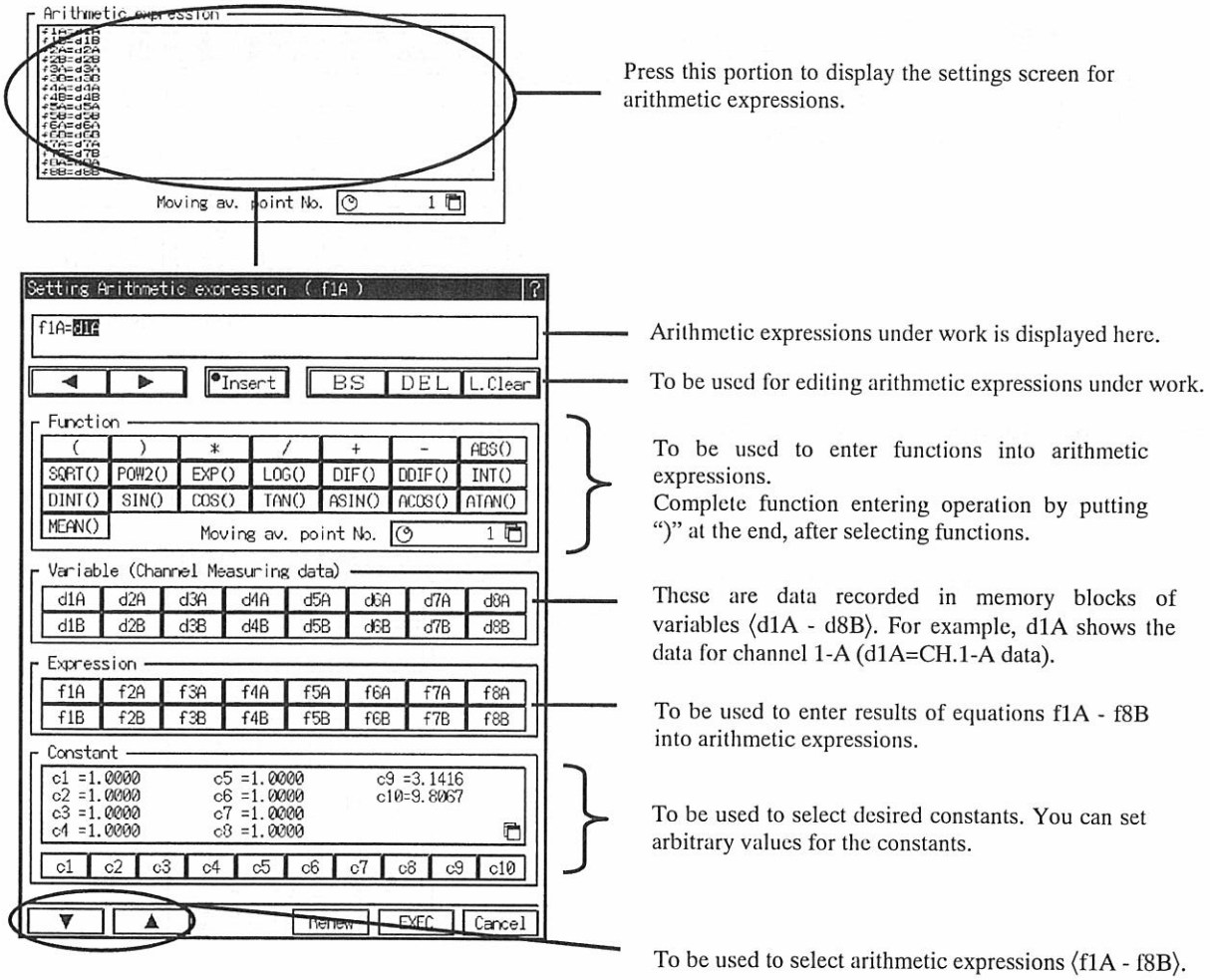
Once you have selected the item of "performing function operation on recorded data", you can set more details of the function operation.



NOTE The memory capacity is decreased to 1/4 of the original when the mode of function operation is set. Therefore, note that data in the memory is cleared when you switch to function operation [Function] at ⟨Memory 2nd Process.⟩. Also, the maximum number of memory block divisions turns to 32.

2 Establishing arithmetic expressions

Establish arithmetic expressions for function operation. A maximum of sixteen (16) equations/expressions can be set in ⟨f1A - f8B⟩. Select functions, variables, contants and expressions from the lists displayed in the following screen to establish arithmetic expressions.



Press this portion to display the settings screen for arithmetic expressions.

Arithmetic expressions under work is displayed here.

To be used for editing arithmetic expressions under work.

To be used to enter functions into arithmetic expressions.
Complete function entering operation by putting ")" at the end, after selecting functions.

These are data recorded in memory blocks of variables ⟨d1A - d8B⟩. For example, d1A shows the data for channel 1-A (d1A=CH.1-A data).

To be used to enter results of equations f1A - f8B into arithmetic expressions.

To be used to select desired constants. You can set arbitrary values for the constants.

To be used to select arithmetic expressions ⟨f1A - f8B⟩.

NOTE

Up to the total of 32 terms of functions, constants and variables can be placed in one equation. In addition, when an equation is selected as arithmetic expression, only one term can be placed in an equation following the preceeding equation.

NOTE

Any of the following functions must be used as the first term in an equation: DIF, DDIF, INT, DINT and MEAN. In addition, only one of these five(5) functions can be used in an equation.

NOTE

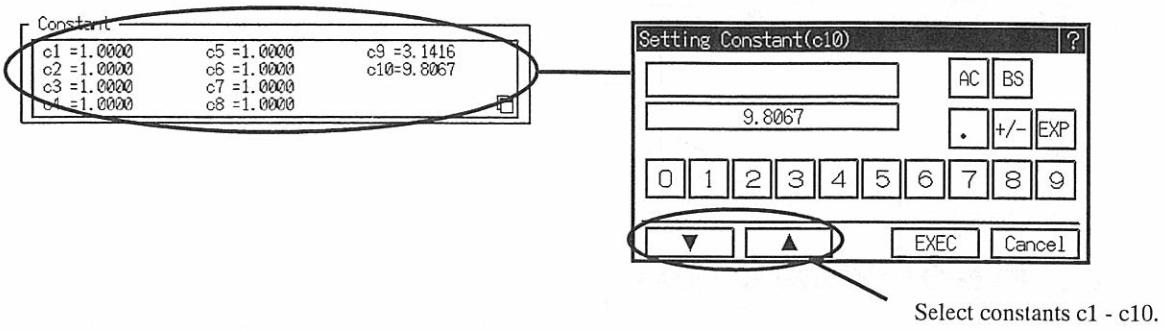
When variables (d1A - d8B) are used in arithmetic expression, the following channels are excepted from arithmetic operation:

- channels with their inputs set at "OFF".
- channels having event amplifiers.
- channels without input units mounted.

Meanwhile, arithmetic operation for variables is done with the scale set in the <AMP> screen. For example, when the user scale is used, operation is performed by using its output value.

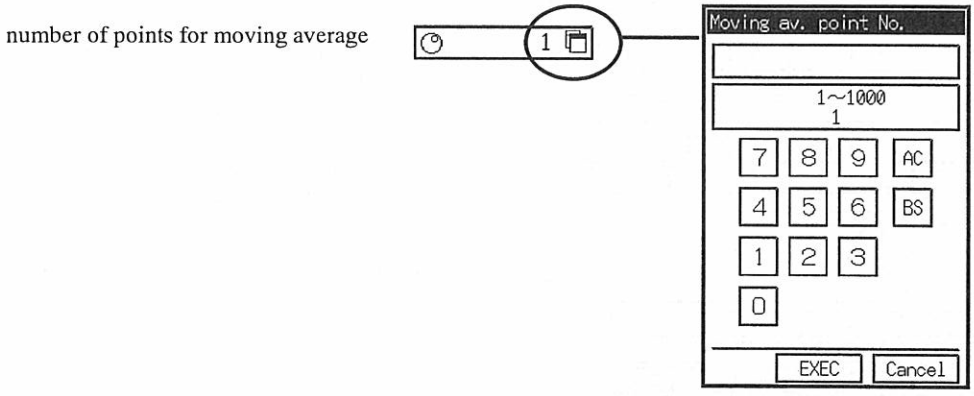
3 Setting constants for operation

Constants that are set arbitrarily can be used in function operations. Set a value of a constant concerned when you need one. Up to 10 constants ⟨c1 - c10⟩ can be used, and the range of values of constants to be set shall be within -9.999E-12 - 9.9999E-12.statistical operation".



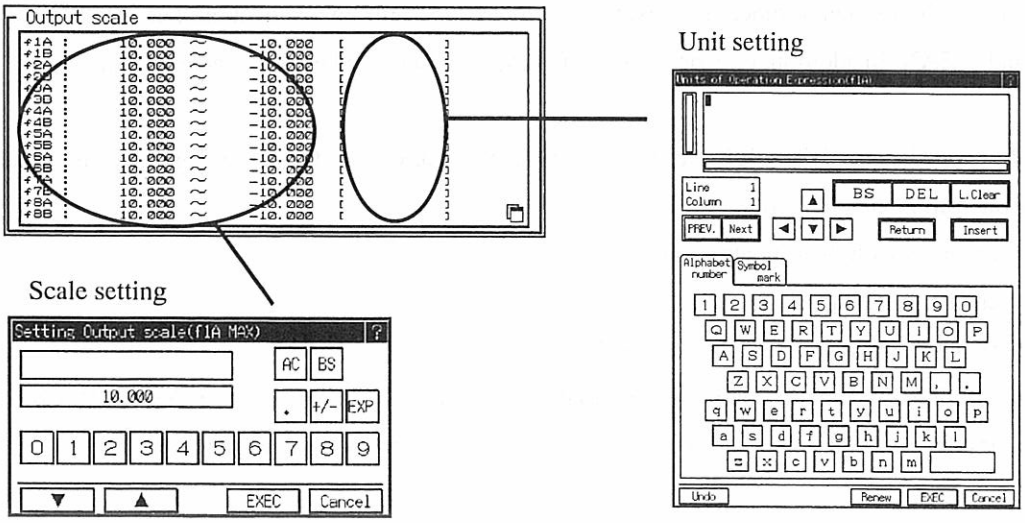
4 Setting number of points for moving average

Up to a maximum of 1000 points can be set for the number of points for moving averages (MEAN).



5 Setting number of points for moving average

Set the output scale for operation results of individual arithmetic expressions. Set the maximum and minimum scale values for arithmetic expressions [f1A - f8B], where the range of scale values to be set shall be within -9.999E-30 - 9.9999E-30. A maximum of 9 characters can be entered for the unit.



6 Executing function operation for playback data

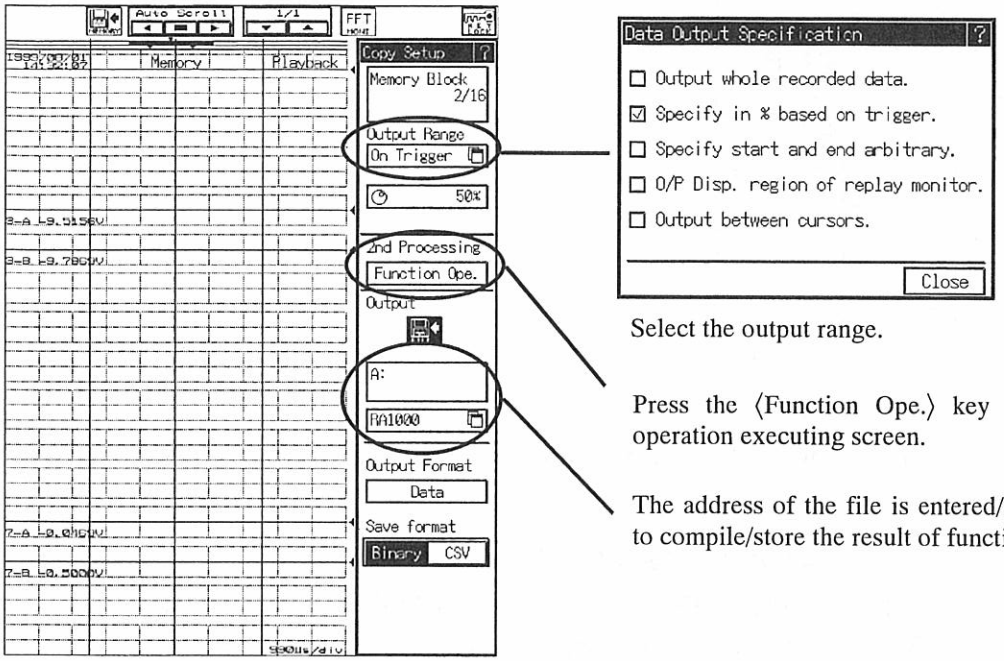
Upon completion of setting arithmetic expressions, let us conduct and execute function operations.

● Data selection

Press the <DATA> key to select the memory block data for which you want to apply operation.

● Operation range setting

After the data selection, press ⟨Output Range⟩ key in the <COPY SET> screen to enable operating range setting.



Select the output range.

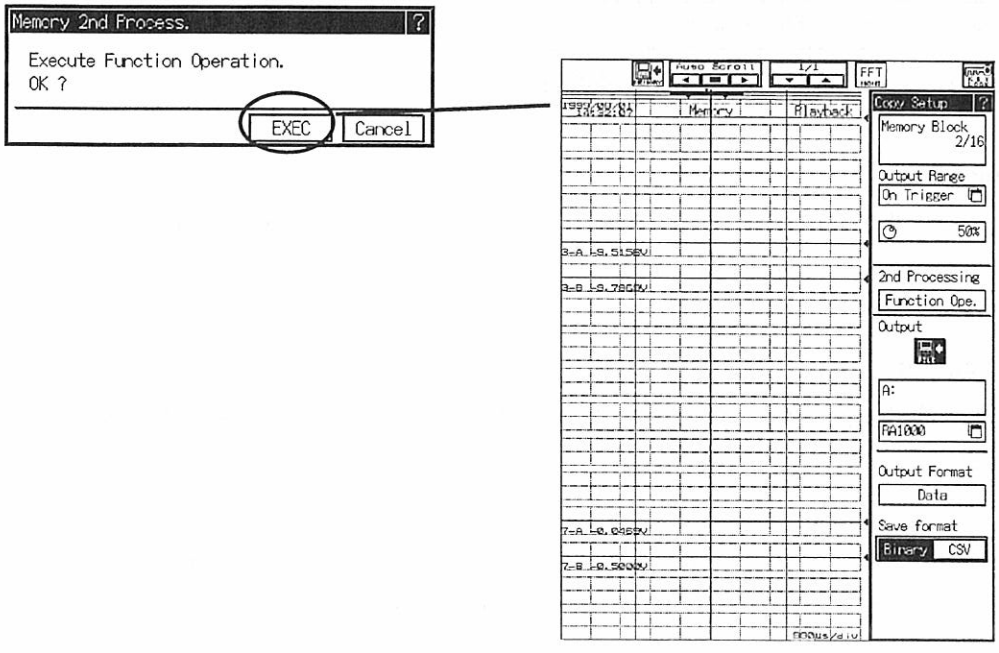
Press the ⟨Function Ope.⟩ key to open the operation executing screen.

The address of the file is entered/specified here to compile/store the result of function operation.

● Starting operation

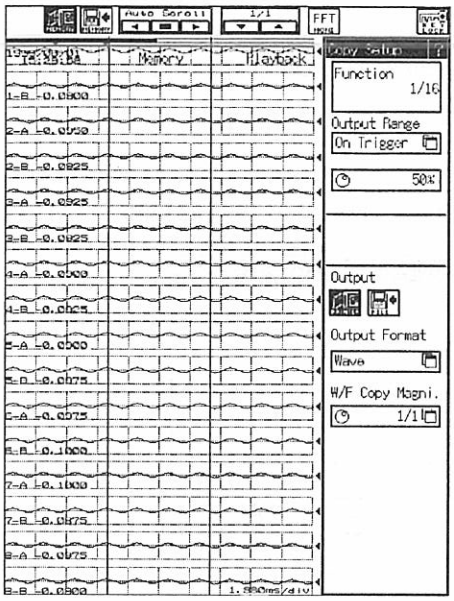
Upon completion of setting the operation range, press the ⟨Function Ope.⟩ key to open the operation executing window. Press the ⟨EXEC⟩ key to start operation.

Upon completion of function operation, the following screen of displaying the result of function operation appears, in which the operation result can be checked.



7 Operation result output

Press the <COPY SET> key to open the <Copy Setup> screen, where operation results can be output. The output can be recorded on the sheet or compiled/recorded in the file.

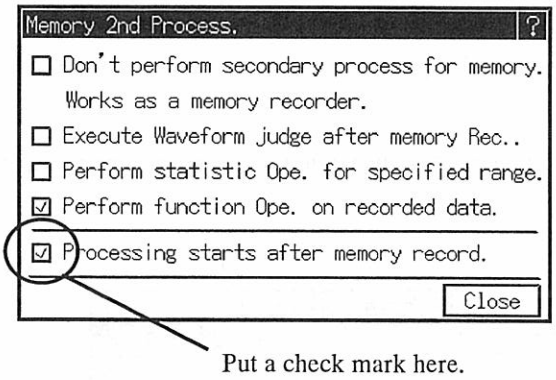


● **Copying function operation results**

Upon completion of output range and medium settings, press the <COPY> key to copy function operation results.

2.1.2. Performing automatic function operation

◆ Put a check mark at [Processing starts after memory record] in the 〈Memory 2nd Process〉 check box of the <EXTENDED> screen to perform automatic function operation.



Put a check mark here.

● **Memory recording/filing**

When the setting is such that processing starts after memory recording, function operation starts for the selected operating items after memory recording is completed.

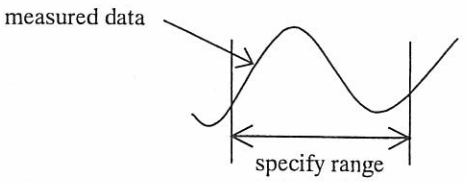
● **Calculation result output**

When the setting is such that processing starts after memory recording, function operation starts for the selected operating items after

☞ For more detailed information on the auto-copy or filing, refer to "Section 7 Memory mode -Recording high speed phenomena-" in the mainframe instruction manual, RA1000 series.

2.1.3. Function operation

Operations are performed for the specified range of data according to desired function equations/operation expressions.



An operation expression is set by combining functions, constants and variables as follows:

Example: $\underbrace{f2}_{\text{operation expression / equation}} = \underbrace{\mathrm{SIN}}_{\text{function}} \underbrace{(d1)}_{\text{variable}} * \underbrace{c1}_{\text{constant}}$

Operation expression

You can set a maximum of 16 equations, from f1 to f16, as operation expressions.

- You can place up to the total of 32 terms of functions, constants and variables in one equation.
- Results of equations f1 - f15 can be placed after each equation.(??Honbun wabunnoimi humei desu??)

Example: f2=f1+... (You cannot set as follows: f2=f3+...)

Functios

You can set the following functions:

1) The four rules of arithmetic (*, /, + and -)
2) Absolute value (ABS)
3) Square root (SQRT)

   Data to be computed must have positive values. If a negative value is entered, it will be treated as zero(0).

4) Second power (POW2)
5) Exponential (EXP)

   The range of values to be entered is +38.0 - -45.0. Any values entered that are beyond this range will be interpreted/treated as +38.0 or -45.0.

6) Common logarithmic (LOG)

   Data to be computed must have positive values. If zero(0) is entered, the output will be the maximum available negative value, i.e., -3.4 i 10^{38}. If a negative value is entered, the output will be zero(0).

7) First differential (DIF)
8) Second differential (DDIF)

   Operation of first and second differentials/derivatives uses Lagrange's interpolation formula of the 5th order, where the value of a point of interest is obtained from five(5) known values on both sides of the point. Designating measured values of n sample points, t_0, t_1, t_2, ..., t_n to be y_0, y_1, y_2,..., y_n, respectively, operation equations for the first differential/derivative are given as follows:

$$t_0 \quad Y_0 = \frac{1}{12h}\left(-25y_0 + 48y_1 - 36y_2 + 16y_3 - 3y_4\right)$$

$$t_1 \quad Y_1 = \frac{1}{12h}\left(-3y_0 - 10y_1 + 18y_2 - 6y_3 + y_4\right)$$

$$t_2 \quad Y_2 = \frac{1}{12h}\left(y_0 - 8y_1 + 8y_3 - y_4\right)$$

$$\vdots \qquad\qquad \vdots$$

$$t_i \quad Y_i = \frac{1}{12h}\left(y_{i-2} - 8y_{i-1} + 8y_{i-1} - y_{i+2}\right)$$

$$\vdots \qquad\qquad \vdots$$

$$t_{n-2} \quad Y_{n-2} = \frac{1}{12h}\left(y_{n-4} - 8y_{n-3} + 8y_{n-1} - y_n\right)$$

$$t_{n-1} \quad Y_{n-1} = \frac{1}{12h}\left(-y_{n-4} + 6y_{n-3} - 18y_{n-2} + 10y_{n-1} + 3y_n\right)$$

$$t_n \quad Y_n = \frac{1}{12h}\left(3y_{n-4} - 16y_{n-3} + 36y_{n-2} - 48y_{n-1} + 25y_n\right)$$

(Y: operation result; h: $\triangle$t)

Operation equations for the second differential/derivative are given as follows:

$t_0 \quad Y_0 = \frac{1}{12h^2}(35y_0 - 104y_1 + 114y_2 - 56y_3 + 11y_4)$

$t_1 \quad Y_1 = \frac{1}{12h^2}(11y_0 - 20y_1 + 6y_2 + 4y_3 - y_4)$

$t_2 \quad Y_2 = \frac{1}{12h^2}(-y_0 + 16y_1 - 30y_2 + 16y_3 - y_4)$

$\vdots \qquad \vdots$

$t_i \quad Y_I = \frac{1}{12h^2}(-y_{i-2} + 16y_{i-1} - 30y_i + 16_{i+1} - y_{i+2})$

$\vdots \qquad \vdots$

$t_{n-2} \quad Y_{n-2} = \frac{1}{12h^2}(-y_{n-4} + 16y_{n-3} - 30y_{n-2} + 16_{n-1} - y_n)$

$t_{n-1} \quad Y_{n-1} = \frac{1}{12h^2}(-y_{n-4} + 4y_{n-3} + 6y_{n-2} - 20y_{n-1} + 11y_n)$

$t_n \quad Y_n = \frac{1}{12h^2}(11y_{n-4} - 56y_1 + 114y_{n-2} - 104y_{n-1} + 35y_n)$

(Y: operation result; h: △t)

9) Single integral (INT)

10) Double integrals (DINT)

Operation of integrals, both single and double, uses the trapezoidal rule. Operation equations for the single integral is given as follows:

Po int: $t_0 \quad I_0 = 0$

Po int: $t_1 \quad I_1 = 1/2(d0 + d1) \bullet h$

Po int: $t_2 \quad I_2 = 1/2(d0 + d1) \bullet h + 1/2(d1 + d2) \bullet h = I_1 + 1/2(d1 + d2) \bullet h$

$\vdots$

Po int: $t_n \quad I_n = I_{n-1} + 1/2(d_{n-1} + d_n) \bullet h$

(I_0 - I_n: operation result data; h=△t: sample period)

Operation equations for double integrals is given as follows:

Po int: $t_0 \quad II_0 = 0$

Po int: $t_1 \quad II_1 = 1/2(I0 + I1) \bullet h$

Po int: $t_2 \quad II_2 = 1/2(I0 + I1) \bullet h + 1/2(I1 + I2) \bullet h = II_1 + 1/2(d1 + d2) \bullet h$

$\vdots$

Po int: $t_n \quad I_n = II_{n-1} + 1/2(I_{n-1} + I_n) \bullet h$

(II_0 - II_n: operation result data; h=△t: sample period)

11) Trigonometric function (SIN, COS, TAN, ASIN, ACOS and ATAN)

Parameters for SIN, COS and TAN are entered in the unit of radian. If an entered value is more than 1 (>1) for the parameter of ASIN or ACOS, the entered value is treated as 1 (=1). And, if an entered value is less than -1 (<-1) for the parameter of ASIN or ACOS, the entered value is treated as 1 (=-1).

12) Moving average (MEAN)

The number of points for the moving average can be chosen and set at any integer within the range of 1 - 1000.

If the actual number of points is less than the number of points set, processing operation is as follows: $\left(\sum_{T-0}^{T-i} D\right) / i$

In normal operation, processing operation is as follows: $\left(\sum_{T-i-N}^{T-i} D\right) / N$

DIF, DDIF, INT, DINT and MEAN shall be placed at the first term of operation expressions. In addition, only one function of these five functions is allowed to be used in one equation/expression.

● Variable

Measurement data of individual channels, d1 - d16, can be set as variables.

For example, d1=CH.1-A measurement data, d2=CH.1-B measurement data, ..., and d16=CH.8-B measurement data.

● Constant

Up to 10 values, c1 - c10, can be set as constants.

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