SCIENTIFIC CALCULATOR

USER'S MANUAL

67-CS121-00

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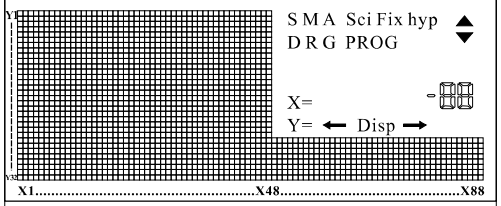
I.General Description

1.Display



S :- Indicates SHIFT key has been pressed.
A :- Indicates ALPHA key has been pressed.
M :- Indicates MODE key has been pressed.
DISP :- Indicates intermediate result is displayed.
D :- Indicates angular measurement in units of "Degrees".
R :- Indicates angular measurement in units of "Radians".
G :- Indicates angular measurement in units of "Gradients".

FIX :- Indicates specification of number of decimal places is being executed.
SCI :- Indicates specification of number of significant digits is being executed.
hyp :- Indicates hyp key has been pressed
i :- Indicates the display of imaginary number.
◄► :- Indicates number of characters exceeds limitation of screen.Non-displayed characters can be viewed by "scrolling" right or left,as indicated by arrow(s).
M, MIN :- Indicated the content in last calculation memory.
PROG :- Indicates the calculator is in programming mode.

2.Operation modes

When using ET-100,it is necessary to select the proper mode to meet your requirements.This can be done by pressing MODE to view the main menu and select the appropriate mode by moving the cursor to the right or the left.

Press MODE once to read first page of the main menu.

```
MODE?          ►
COMP    CMPLX
```

Press ► to select the mode.

```
MODE?          ►
COMP    CMPLX
```

As the icons "►"or"◄" appear, one can press ► or ◄ correspondingly to view the hidden menu.

```
MODE?          ◄
SD  REG BASE-N
```

After locationg the desired mode,press = to confirm and leave the main menu.
As you press MODE again,you can move to the menu to select function graph or parametric graph.

MODE

```
GRAPH?
FUNCT   PARAM
```

Or if you want to define the "degree" or "radian"or "gradient",you can press MODE again during the

display of "graph-selection"menu mentioned above.

Press MODE again.
(This sub-menu will be skipped in Base-N mode.)

```
ANGLE?
Deg  Rad  Gra
```

Select the angular unit by pressing ◄ or ► then followed by =.
Or if you want to define the answer display format, you can proceed to the following page by pressing MODE further.

(This sub-menu will be skipped in Base-N mode.)

```
FORMAT?
Fix  Sci  Norm
```

Press MODE once to leave the menu.

```
-
```

Calculation modes

COMP mode:- general calculations,including function calculations can be executed.

COMPLEX mode:- calculations including complex numbers can be executed. "CMPLX" appears on the dispay.

SD mode :- standard deviation calculation can be executed."SD"appears in the display.

REG mode :- regression calculations can be performed."LR"apperars in the display.

BASE-N mode:- binary,octal,deimal,hexadecimal conversion and calculations,as well as logical operations can be carried out."BASE-N"appears on the display.

Note :- The five calculation modes listed above are totally independent,and cannot be used together.

Note :- The calculation mode last selected is retained in memory when the power is switched OFF.

Angular measurement modes

Deg mode :- specify measurement in "degrees"

"D"symbol appears in display window.

Rad mode :- specify measurement in "radians"."R" symbol appears in display window.

Gra mode :- specify measurement in "grads"."G" symbol appears in display window.

With the exception of the BASE-N mode,these three angular measurement modes can be used in combination with the manual calculation modes.

Display modes

Fix mode :- specify number of decimal places."FIX" symbol appears in display window.

Sci mode :- specify number of significant digits. "SCI"symbol appears in display window.

Norm mode:- cancels "Fix" and "Sci" specifications. This operation also changes the range of the exponent display.When the results exceed the following limits,exponent is to be displayed.

Norm 1:$-10^{-2} > ,\text{or} |x| \geqslant 10^{10}$

Norm 2:$-10^{-9} > |x| ,\text{or} |x| \geqslant 10^{10}$

In combination with Fix,Sci or Norm mode, you can cause the exponent display for the number being displayed to change in multiples of 3 by pressing ENG.

* With the exception of the BASE-N mode,Fix Sci,and Norm modes can be used in combination with the manual calculations.
* Engineering display format is not available in Complex mode.
* The display mode last selected is retained in memory when the power is switched OFF.

3.Calculation priority sequence

This calculator employs true algebraic logic to calculate the parts of a formula in the following

Order:-

1.Coordinate transformation/integration,Pol(x,y)Rec(r, θ)$\int$dx

2.Type A functions:-
These functions are those in which the value is entered and than the function key is pressed,such as x^2,x^{-1},$x!$°' ",Engineering symbols.

3.Power/root,x^y , $\sqrt[x]{\ }$

4.Fractions,$a\frac{b}{c}$

5.Abbreviated multiplication format in front of π , memory or parenthesis,such as 2 π ,5A, π R,etc.

6.Type B functions:-
These functions are those in which the function key is pressed and then the value is entered such as ,$\sqrt{\ }$, $\sqrt[3]{\ }$,log,ln,e^x,10^x,sin,cos,tan,$\sin^{-1}$,$\cos^{-1}$,$\tan^{-1}$,sinh,cosh, tanh,$\sinh^{-1}$,$\cosh^{-1}$,$\tanh^{-1}$,Int,Frac,Abs,(-),(following in BASE-N mode only)d,H,b,o,Neg,Not.

7.Abbreviated multiplication format in front of Type B functions,such as ,$2\sqrt{3}$,A log2,etc.

8.×,÷

9.+,-

10.and(in BASE-N mode only)

11.or,$x$or,$x$nor(in BASE-N mode only)

* When functions with the same priority are used in series,execution is performed from right to left for: - $e^x \ln\sqrt{120} \rightarrow e^x\{\ln(\sqrt{120})\}$.Otherwise,execution is from left to right.
* Operations enclosed in parentheses are performed first.

4.Number of stacks

There is a memory area known as a"stack"for the temporary storage of low prority numeric values and commands(functions,etc).The numeric value stack has nine levels,while the command stack has 24.If a complex formula is employed that exceeds

the stack space available,a stack error(Stk ERROR) message will appear on the display.

Calculations are performed in the order of the highest calculation priority first.Once a calculation is executed,it is cleared from the stack.

5.Number of input/ouput digits and calculation digits

The allowable input/output range(number of digits) of this unit is 10 digits for a mantissa and 2 digits for the exponent.Calculations,however,are performed inernally with a range of 12 digits for a mantissa and 2 digits for an exponent.

Example: $3\times10^{5}\div7=$

3 EXP 5 ÷ 7 EXE	D 42857.14286
3 EXP 5 ÷ 7 - 42857	D 3E5÷7
EXE	D 0.14285714

Once a calculation is completed,the mantissa is rounded off to 10 digits and displayed.

Example: $3\times10^{5}\div7=$

3 EXP 5 ÷ 7 =	D 42857.14286
- 42857 =	D 0.14285714

6.Overflow and errors

If the operational range of the unit is exceeded,or incorrect inputs are made,an error message will appear on the display and subsequent operation will be impossible.This is carried out by the error check function.The following operations will result in errors:-

1.The answer,whether intermediate or final,or any value in memory exceeds the value of $\pm9.999999999\times10^{99}$.
2.An attempt is made to perform function calculations that exceed the input range.
3.Improper operation during statistical calculations, e.g.,attempting to obtain x or $x\sigma n$ without data input.
4.The capacity of the numeric value stack or the command stack is exceeded.
5.Input errors are made,e.g,5 × × 3 = .

When error message appears,most keys will become inoperative.In this case,press the AC key to return to normal operation.You can also press the ← or → key to cause the cursor to show the position of the error.

The following error messages will be dispalyed for the operations listed above:-

case(1)to case(3)	Ma ERROR
case(4)	Stk ERROR
case(5)	Syn ERROR
case(6)	Range ERROR

Besides pressing AC when an error occurs,you can also press ON key to clear the error.

7.Number of input characters

This calculator features a 79-step area for calculation execution.One function comprises one step.Each press of numeric or +,-,×,and ÷keys comprise one step.Though such operations as SHIFT x (x^{-1}key) require two key operations,they actually comprise only one function,and therefore,only one step.

These steps can be confirmed using the cursor.With each press of the ← or → key,the cursor is moved one step.

Input characters are limited to 79 steps.Usually,the cursor is represented by a blinking "_".

When numeric values or calculation commands are

input,they appear on the display from the left. Calculation results,however,are displayed from the right.

8.Corrections

To make corrections in a formula that is being input, use the ◄ and ► keys to move to the position of the error and press the correct keys.

Example: To change an input of 122 to 123:-

1 2 2	D 122_
◄	D 122
3	D 123_

Example: To change an input of cos60 to sin60:-

cos 6 0	D cos60_
◄ ◄ ◄	D cos60
sin	D Sin60

If after making corrections,input of the formula is complete,the answer can be odtained by pressing =, If,however,more is to be added to the formula,advance the cursor using the ► key to the end of the formula for input.

If an unnecessary character has been included in a formula,use the ◄ and ► keys to move to the position of the error and press the DEL key.Each press of DEL will delete one command(one step).

Example: To correct an input of 369× ×2to 369×2:-

3 6 9 × × 2	D 369× ×2_
◄ ◄ DEL	D 369×2

If a character has been omitted from a formula,use the ◄ or ► key to move to the position where the character should have been input,and press SHIFT followed by INS key.Each press of SHIFT INS will create a space for input of one command.

Example: To correct an input of 2.36^2 to $\sin 2.36^2$:-

2 · 3 6 x^2	D 2.36^2_
◄ ◄ ◄ ◄ ◄	D 2.36^2
SHIFT INS(DEL)	D [ ] $.36^2$
Sin	D SIN [ ] $.36^2$

When SHIFT INS are pressed,the space that is opened is displayed as .“ [ ] ”.The function or value assigned to the next key you press will be inserted in the [ ].To exit from the insertion mode,move the cursors,or press SHIFT INS,or press =.

Even after the = key has been pressed to calculate a result,it is possible to use this procedure for correction. Press the ◄ key to move the cursor to the place where the correction is to be made.

II.Manual Calculations

a.Arithmetic operations & Parenthesis calculations

- arithmetic operations are performed by pressing the keys in the same order as noted in the formula

- for negative values,press[(-)]before entering the value
- for mixed basic arithmetic operations, multiplication and division are given priority over addition and subtraction
- assuming that display mode Norm 1 is selected

Example	Operation	Display(lower)
23+4.5-53=-25.5	23[+]4.5[-]53[=]	-25.5
56×(-12)÷(-2.5)=268.8	56[×][(]-12[)][÷][(]-2.5[)][=]	268.8
12369×7532×74103=6.903680613×10 ^{12}	12369[×]7532[×]74103[=]	6.903680613^{12}
$(4.5\times10^{75})\times(-2.3\times10^{-79})=-1.035\times10^{-3}$	4.5[EXP]75[×]-2.3[EXP]-79[=]	-1.035^{-03}
$(2+3)\times10^{2}=500$	[(]2[+]3[)][×]1[EXP]2[=]	500.
$(1\times10^{5})\div7=14285.71429$	1[EXP]5[÷]7[=]	14285.71429
$(1\times10^{5})\div7-14285=0.7142857$ please note that internal calculation is calculated in 12digits for a mantissa and the result is displayed rounded off to 10 digits.	1[EXP]5[÷]7[-]14285[=]	0.71428571
3+5×6=33	3[+]5[×]6[=]	33.
7×8-4×5=36	7[×]8[-]4[×]5[=]	36.
1+2-3×4÷5+6=6.6	1[+]2[-]3[×]4[÷]5[+]6[=]	6.6
100-(2+3)×4=80	100[-][(]2[+]3[)][×]4[=]	80.
2+3×(4+5)=29	2[+]3[×][(]4[+]5[)][=] Closed parentheses occurring immediately before operation of the [=]key may be omitted.	29.
(7-2)×(8+5)=65	[(]7[-]2[)]×[(]8[+]5)[=] A multiplication sign [×] occurring immediately before an open parantheses can be omitted.	65.
10-{2+7×(3+6)}=-55	10[-][(]2[+]7[(]3[+]6)[=]	-55.

b.Percentage calculations

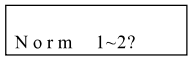
- Percentage cannot be executed in Base-N mode or CMPLX mode.

Example	Operation	Display(lower)
Percentage 26% of $15.00	15[×]26[shift][%](=)	3.9
Premium 15% increase from $36.20	36.2[×]15[shift][%](=)[+]	41.63
Discount 4% discount from $47.50	47.5[×]4[shift][%](=)[-]	45.6
Rate 75 is what% of 250?	75[÷]250[shift][%](=)	30.
Rate of change 141 is an increase of what % from 120?	141[-]120[shift][%](=)	17.5
Ratio of change 240 is decrease of what % from 300?	240[-]300[shift][%](=)	-20.

c.Specifying the Format of Calculation Results

You can change the precision of calculation results by specifying the number of decimal places or the number of significant digits.You can also shift the decimal place of a displayed value three places to the left or the right for one-touch conversions of metric weights and measures.

Upon power up reset,the display format is defaulted at Norm1.Each time you can press MODE to enter the menu and select the desired format in the sub-menu “FIX/Sci/Norm”.When you choose “Norm”,you can further select between Norm 1 or Norm 2 in the following window.



Key in either 1 or 2 to specify Norm 1 or Norm 2 respectively.

Norm 1:- all values less than 10^{-2} or greater than 10^{9} are automatically expressed as exponents.

Norm 2:- all values less than 10^{-9} or greater than 10^{9} are automatically expressed as exponents.

Note: You cannot specify the display format (Fix, Sci) while the calculator is in Base-N mode.

■ Specifying the Number of Decimal places

The clculator always performs calculations using a 10-digit mantissa and 2-digit exponent,and results are stored in memory as a 12-digit mantissa and 2-digit exponent no matter how many decimal places you specify.Intermediate results and final results are then automatically rounded off to the number of decimal places you have specified.

It should be noted that displayed results are rounded to the specified number of decimal places,but stored results are normally not rounded.

To specify the number of decimal places(Fix),select "FIX" in the sub-menu "Fix/Sci/Norm" and then you are asked to enter a value indicating the number of places (0~9) as below.

```
Fix  0~9?
```

At this time,you should be able to see "FIX"on the display. The number of decimal places specified will remain in effect until Norm1 or Norm2 is specified as described above or significant digits are specified by selecting "SCI"in the sub-menu "FIX/Sci/Norm".

Example	Operation	Display(lower)
100÷6=16.66666666..	100[÷]6[=]	16.66666667
specify 4 decimal places	[Mode][Mode][Mode] [Mode][=][4]	16.6667
cancel Specification	[Mode][Mode][Mode] [Mode][➡][➡][=][1]	16.66666667
200÷7×14=400	200[÷]7[×]14[=]	400.
Rounded to 3 decimal places	[Mode][Mode][Mode] [Mode][=][3]	400.000
	200[÷]7[=] The intermediate result is automatically rounded to the specified three decimal places.	28.571
The stored 10-digit result (28.571421857)is used when you continue the calculation by simply pressing[×]or any other arithmetic function key.	[×]	Ans×_
	14[=] (The final result is automatically rounded to the specified three decimal places.)	400.000
Cancel Specification by specifying Norm1 again.	[Mode][Mode][Mode] [Mode][➡][➡][=][1]	400.

■ Rounding the Intermediate Result

As the number of decimal places is specified,the intermediate result will be automatically rounded to the specified decimal places.However,the stored intermediate result is not rounded,In order to match the displayed value and the stored value, SHIFT RND can be input.

You can compare the final result obtained in the previous example with the final result of the following example.

Example	Operation	Display(lower)
200÷7×14=400	200[÷]7[×]14[=]	400.
Rounded to three decimal places	[Mode][Mode][Mode] [Mode][=][3]	400.00
	200[÷]7[=] (The intermediate result is automatically rounded to the specified three decimal places.)	28.571
Round the stored intermediate result to the specified three decima l places	[Shift][RND](0)	28.571
	[×]	Ans×
	14[=]	399.994
Cancel specification by specifying Norm l again.	[Mode][Mode][Mode] [Mode][➡][➡][=][1]	399.994

■ Specifying the Number of Signficant Digits

This specification is used to automatically round intermediate results and final results to the number of digits you have specified.

As with the number of decimal places,displayed results are rounded to the specified number of digits, but stored results are normally not rounded.

To specify the number of signficant digits(Sci),select "SCI"in the sub-menu "Fix/Sci/Norm"and then you ar asked to enter a value indicating the number of significant digits(0~9)as below.

Sci 0~9

(Note:"0"indicating 10 significant digits.)

Meanwhile,the "SCI"indicator will appear on the display.

Example	Operation	Display(lower)
100÷6=16.66666666...	100[÷]6[=]	16.66666667
Specify 5 significant digits	[Mode][Mode][Mode] [Mode][➡][=][5]	16.667^{01}
Cancel Specification by specifying Norm 1 again	[Mode][Mode][Mode] [Mode][➡][➡][=][1]	16.66666667

■ Shifting the Decimal Place

You can use the key ENG to shift the decimal point of the displayed value three places to the left or right. Each 3-place shift to the left is the same as dividing the value by 1000,and each sihft to the right is the same as multiplying by 1000.This means that this function is useful when converting metric weights and measures to other metric units.

Example	Operation	Display(lower)
123m×456=56088m =56.088km	123[×]456[=]	56088.
	[ENG]	56.088^{03}
78g×0.96=74.88g =0.07488kg	78[×]0.96[=]	74.88
	[Shift][⬅](ENG)	0.07488^{03}

d.Memory

This calculator contains 9 standard memories. There are two basic types of memories,i.e., "variable"memories,which are accessed by using the STO and RCL keys in combination with the alphabets A,B,C,D,E,F,M,X and Y.The independent memories,which are accessed by using the M+, Shift M- and SHIFT RCL and M keys. The variable memory and independent memory utilize the same memory area.Contents of both the variable and independent memories are protected even when the power is turned OFF.

■ Variable memories

Up to 9 values can be retained in memory at the same time,and can be recalled when desired.

Example: Input 123 into memory "A":-

AC/ON 123

123_

STO A (X.T)	A= 123.
AC/ON	_
SHIFT RCL (STO) A (X.T)	A= 123.

When formulas are input,the result of the formula's calculation is retained in memory.

Example: Input the result of 123× 456 into memory "B":-

AC/ON 123 × 456	123×456_
STO B (,,)	B= 56088.
AC/ON	_
SHIFT RCL (STO) B (,,)	B= 56088.

If a variable expression is entered,the expression is first calculated according to the values stored in the variable memories used in the expression.The result is then stored in the variable memory specified for the result.

Example: Input the result of A×B into memory"C":-

AC/ON Alpha A (X.T) × Alpha B (,,)	A×B_
STO C (Hyp)	C= 6898824.
AC/ON	_

SHIFT RCL (STO) C (hyp)	C= 6898824.

* Syn ERROR is generated when an attempt is made C=A×B)or multistatements(such as A×B:C×D), and the existing memory contents are retained.

When input is made in a format such as "A=log 2", where the variable is equal to the formula,the results of the calculation are input into the specified memory.

Example: Executing "A=log2":-

AC/ON Alpha A (X.T) Alpha = log 2	log 2_
=	0.301029995
STO A (X.T)	A= 0.301029995
AC/ON	_
SHIFT RCL (STO) A (X.T)	A= 0.301029995

Deleting memories

To delete all contents of variable memories,press Shift followed by Mcl = .

■ Independent memories

Addition and subtraction(to and from sum)results can be stored directly in memory.Results can also be totalized in memory,making it easy to calculate sums. The icon"M"will be lighted as long as M is not empty.

Example: Input 123 to independent memory.

AC/ON 1 2 3	123_
M+	123.

Recall memory data.

AC/ON	_
SHIFT RCL (STO) M (M+)	M= 123.

Add 25,subtract 12

25 M+ 12 M+ SHIFT M-	12.

Recall memory data.

AC/ON	_
SHIFT RCL (STO) M (M+)	M= 148.

To clear memory contents,press 0 STO M.

Addition/subtraction to or from sum in memory cannot be carried out with M+, SHIFT M- keys in SD mode and LR mode.

Difference between [STO][M][M+]and[M+] ,[Shift] [M-]:-

Both STO M and M+, SHIFT M- can be used to input results into memory,however when the [STO][M] operation is used,previous memory contents are cleared.When either M+ or SHIFT M- is used,value is added or subtracted to or from present sum in memory

Example: Input 456 into memory"M"using STO M procedure.Memory already contains value of 123.

AC/ON 1 2 3 STO M (M+)	M= 123.
AC/ON 4 5 6 STO M (M+)	M= 456.

AC/ON	_
SHIFT RCL (STO) M (M+)	M= 456.

Example: Input 456 into memory"M"using STO M Memory already contains value of 123.

AC/ON 1 2 3 STO M (M+)	M= 123.
AC/ON 4 5 6 M+	456.
AC/ON	_
SHIFT RCL M (M+)	M= 579.

e.Special Functions

■ Answer function

This unit has an answer function that stores the result of the most recent calculation. Once a numeric value or numeric expression is entered and = is pressed,the result is stored by this function.
To recall the stored value,press SHIFT ANS .When SHIFT ANS are pressed,"Ans"will appear on the display,and the value can be used in subsequent calculations.

Example: 123+ 456 =579
789- 579 =210

AC/ON 1 2 3 + 4 5 6 =	579.
7 8 9 - SHIFT ANS (-)	789-Ans_
=	210.

Numeric values with 12 digits for a mantissa and 2 digits for an exponent can be stored in the Ans memory.The Ans memory is not erased even if the power of the unit is turned OFF.Each time [=], [Shift] [%], [M+], [Shift] [M-], and [STO] oc=A~F,M,X,Y)is pressed, the value in the Ans memory is replaced with the new value produced by the calculation execution.When execution of a calculation results in an error,however, the Ans memory retains its current value.

Note:-Contents of Ans memory are not altered when [SHIFT] [RCL] =A~F,M,X,Y)is used to recall contents of variable memory.Also,contents of Ans memory are not altered when variables are input when the variable input prompt is displayed.

■ Omitting the multiplication sign(×)

When inputting a formula as it is written,from left to right,it is possible to omit the multiplication sign(×) in the following cases:-

(1)before the following functions:-
sin,cos,tan,$\sin^{-1}$,$\cos^{-1}$,$\tan^{-1}$,sinh,cosh,tanh,$\sinh^{-1}$,$\cosh^{-1}$, $\tanh^{-1}$,log,ln,10^{x},
e^{x},$\sqrt{\ }$,$\sqrt[3]{\ }$,Pol(x,y),Rec(r, θ)
example,2sin30,10log1.2,$2\sqrt{3}$,2Pol(5,12),etc.

(2)Before fixed numbers,variables and memories:-
example,2 π ,2AB,3Ans,etc.

(3)Before parentheses:-
example,3(5+6),(A+1)(B-1),etc.

■ Continuous calculation function

Even if calculations are concluded with the [=] key,the result obtained can be used for further calculations.In this case,calculations are performed with 10 digits for the mantissa which is displayed.

Example: To calculate÷3.14 continuing after 3×4=12:-

[AC/ON] [3] [×] [4] [=]	12.
(Continuing) [÷] [3] [·] [1] [4]	Ans÷3.14_
[=]	3.821656051

Example: To calculate1÷3×3=:

[AC/ON] [1] [÷] [3] [×] [3] [=]	1.
[1] [÷] [3] [=]	0.333333333
(Continuing) [×] [3]	Ans×3_
[=]	1.

This function can be used with Type A functions(x^{2},x^{-1}, $x!$),+,-,x^{y},$\sqrt{\ }$ and °’”.

Example: Squaring the result of 78÷6=13:-

[AC/ON] [78] [÷] [6] [=]	13.
(Continuing) [x^{2}]	Ans^{2}_
[=]	169.

■ Replay function

This function stores formulas that have been executed. After execution is complete,pressing either the [←] or [→] key will display the formula executed.
Pressing [→] will diaplay the formula from the

beginning,with the cursor located under the first character.
Pressing ◄ will display formula from the end ,with the cursor located at the space following the last character.After this,using the ► and ◄ to move the cursor,the formula can be checked and numeric values or commands can be changed for subsequent execution.

Example:

AC/ON 1 2 3 × 4 5 6 =	56088.
►	123×456
=	56088.
◄	123×456_

Example:4.12×3.58+6.4=21.496
4.12×3.58-7.1=7.6496

AC/ON 4.12 × 3.58 + 6.4 =	21.1496
◄	12×3.58+6.4_
◄ ◄ ◄ ◄	4.12×3.58+6.4
- 7.1	12×3.58-7.1 _
=	7.6496

The replay function is not cleared even when AC is pressed or when power is turned OFF,so contents can be recalled even after AC is pressed.

Replay function is cleared when mode or operation is switched.

■ Error position display function

When an ERROR message appears during operation execution,the error can be cleared by pressing the AC key,and the values of formula can be re-entered from the beginning.However,by pressing the ◄ or ► key, the ERROR message is cancelled and the cursor moves to the point where the error was generated.

Example:14÷0×2.3is input by mistake

AC/ON 14 ÷ 0 × 2.3 =	Ma ERROR
◄ (Or ►)	14÷0⨯2.3

Correct the input by pressing

◄ Shift INS (DEL) 1	14÷10×2.3
=	3.22

■ Multistatement function

* The multistatement function(using"◢" to separate formulas or statements)available in program calculations can also be used for manual calculations.
* When = is pressed to execute a formula input using the multistatement format,the formula is executed in order from the beginning.The calculation result up to the point of"◢"will be displayed till you press = again to continue the calculation.

Example:6.9×123=848.7
123÷3.2=38.4375

AC/ON 123 STO A (x.T) 6.9 × ALPHA A ALPHA ◢ (x^3) ALPHA A ÷ 3.2 =	Disp 848.7

"Disp"appears on the display when "◢"is used.

=	38.4375

* Even if "◢"is not input at the end of a formula,the final result will be displayed.
* Consecutive calculations containing multistatements cannot be performed.

  123×456◢×5

  invalid
* calculations can be performed while an intermediate result is displayed during execution interrupted by "◢ "

Example:5×6◢7×8

AC 5 × 6 ALPHA ◢ 7 × 8	D 5×6◢7×8_
=	D DISP 30.
sin SHIFT Ans	D DISP sin Ans
=	D DISP 0.5

When interrupt operation is completed,press = once again to execute.

=	D 56.

f.Scientific function

■ Trigonometric functions and inverse trigonometric functions

* Be sure to set the unit of angular measurement before performing trigonometric function and inverse trigonometric function calculations.

* The unit of angular measurement(degrees,radians, grads)is selected in sub-menu.
* Once a unit of angular measurement is set,it remains in effect until a new unit is set.Settings are not clared when power is switched OFF.
* This operation is invalid in the BASE-N mode When in the BASE-N mode,go back to COMP mode by selecting "COMP" in the main menu.

Example	Operation	Display
Sin 63°52'41" =0.897859012	[Mode][Mode][Mode][=] →"D" [sin]63[°,,,]52[°,,,]41 [°,,,][=]	0.897859012
Cos(π /3 rad)=0.5	[Mode][Mode][Mode][➡] [=]→"R" [cos][(][shift][π](EXP) [÷]3[)][=]	0.5
tan(-35 gra) =-0.612800788	[Mode][Mode][Mode][➡] [➡][=]→"G" [tan][-]35[=]	-0.612800788
2sin45°×cos65 =0.597672477	[Mode][Mode][Mode][=] →"D" 2[sin]45[cos]65[=]	0.597672477
$\sin^{-1}0.5=30$	[Shift][$\sin^{-1}$](sin)0.5[=]	30.
$\cos^{-1}(\sqrt{2}/2)=0.785398163\text{rad}$ $=\pi/4\text{rad}$	[Mode][Mode][Mode][➡] [=]→"R" [Shift][$\cos^{-1}$](cos)[(][√‾] 2[÷]2[)][=] [÷][Shift][π](EXP)[=]	0.785398163 0.25
$\tan^{-1}0.741=36.53844577°$ =36°32'18.4"	[Mode][Mode][Mode] [=]→"D" [Shift][$\tan^{-1}$](tan)0.741[=] [Shift][°,,,]	36.53844577 36°32'18.4"
If the total number of digits for degrees/minutes seconds exceed 11 digits, the higher order values are	Given display priority,and any lower-order values are not displayed.However,the entire value is stored within	The unit as a decimal value.
2.5 ×($\sin^{-1}0.8$-$\cos^{-1}0.9$) =68°13'13.53"	2.5 [×][(][Shift][$\sin^{-1}$](sin) 0.8[-][Shift][$\cos^{-1}$](cos)0.9[)] [=][Shift][°,,,]	68°13'13.53"

■ Logarithmic and exponential functions

The following operation is invalid in the BASE-N mode.When in the BASE-N mode,carry out calculation after selecting "COMP"mode in main menu.

Example	Operation	Display
$\log 1.23=8.9905111\times10^{-2}$	[log]1.23[=]	0.089905111
In90=4.49980967	[In]90[=]	4.49980967
Log456÷In456=0.434294481	[log]456[÷][In]456[=]	0.434294481
$10^{1.23}=16.98243652$	[Shift][10^x](log)1.23[=]	16.98243652
$e^{4.5}=90.0171313$	[Shift][e^x](ln)4.5[=]	90.0171313
$10^4\cdot e^{-4}+1.2\cdot10^{2.3}$ =422.5878667	[Shift][10^x](log)4[×][Shift][e^x](ln)[-]4[+]1.2[×][Shift][10^x](log)2.3[=]	422.5878667
$(-3)^4=-81$	[(][-]3[)][x^y]4[=]	81.
$-3^4=81$	[-]3[x^y]4[=]	-81.
$5.6^{2.3}=52.58143837$	5.6[x^y]2.3[=]	52.58143837
$\sqrt[7]{123}=1.988647795$	7[Shift][$\sqrt[x]{\ }$](x^y)123[=]	1.988647795
$(78-23)^{-12}=1.305111829\times10^{-21}$	[(]78[-]23[)][x^y][-]12[=]	1.305111829^{-21}
$2+3\times\sqrt[3]{64}-4=10$	2[+]3[×]3[Shift][x^y]64[-]4[=]	10.
$2\times3.4^{(5+6.7)}=3306232.001$	2[×]3.4[x^y][(]5[+]6.7[)][=]	3306232.001

■ Performing hyperbolic and inverse hyperbolic functions

The following operation is invalid in the BASE-N mode.When the user is in the BASE-N mode,he/she should go back to COMP mode before carrying out calculation.

Example	Operation	Display
sinh 3.6=18.28545536	[hyp][sin] 3.6[=]	18.28545536
cosh 1.23=1.856761057	[hyp][cos]1.23[=]	1.856761057
tanh2.5=0.986614298	[hyp][tan]2.5[=]	0.986614298
cosh 1.5-sinh 1.5 =0.22313016	[hyp][cos]1.5[-][hyp][sin]1.5[=]	0.22313016
$\sinh^{-1}30=4.094622224$	[hyp][Shift][$\sin^{-1}$]30[=]	4.091622224

Example	Operation	Display
$\cosh^{-1}(20/15)=0.795365461$	[hyp][Shift][$\cos^{-1}$](cos)[(]20[÷]15[)][=]	0.795365461
$x=(\tanh^{-1}0.88)/4$ =0.343941914	[hyp][Shift][$\tan^{-1}$](tan)0.88[÷]4[=]	0.343941914
$\sinh^{-1}2\times\cosh^{-1}1.5$ =1.389388923	[hyp][Shift][$\sin^{-1}$](sin)2[×][hyp][Shift][$\cos^{-1}$]1.5[=]	1.389388923
$\sinh^{-1}(2/3)\tanh^{-1}(4/5)$ =1.723757406	[hyp][Shift][$\sin^{-1}$](sin)[(]2[÷]3[)][+][hyp][Shift][$\tan^{-1}$](tan)[(]4[÷]5[)][=]	1.723757406

■ Coordinate transformation

* This scientific calculator lets you convert between rectangular coordinates and polar coordinates,i.e., $P(x,y)\leftrightarrow P(r,\theta)$
* Calculation results are stored in variable memory E and variable memory F. Contents of variable memory E are displayed initially.To display contents of memory F,press RCL F.
* With polar coordinates, θ can be calculated within a range of $-180^\circ<\theta\leqslant180^\circ$.(Calculated range is the same with radians or grads.)
* The following operation is invalid in the BASE-N mode.Before carry out calculation,one should switch back to COMP mode.

Example	Operation	Display
x=14 and y=20.7, what are r and θ°?	[Mode][Mode][Mode][=]→"D" [Shift][Pol(](+)14[,]20.7[)][=] [Shift][RCL](STO)[F](tan) [Shift][°,,,]	24.98979792(r) 55°55'42.2"(θ)
x=7.5 and y=-10, what are r and θ rnd?	[Mode][Mode][Mode]→[=]→"R" [Shift][Pol(](+)7.5[Shift][,](hyp)[-]10[)][=] [Shift][RCL](STO)[F](tan)	12.5(r) F= -0.927295218(θ)
Y=25 and θ=56°, what are x and y ?	[Mode][Mode][Mode][Mode][=]→"D" [Shift][Rec(](-)25[Shift][,](hyp)56[)][=] [Shift][RCL](STO)[F](tan)	13.9782259(x) 20.72593931(y)

Example	Operation	Display
r=4.5 and θ = 2 π /3rad, what are x and y?	[Mode][Mode][Mode][➡][=] "R"➔ [Shift][Rec(](-)4.5[Shift][,] (hyp)[(]2[÷]3[×][Shift][π] (EXP)[)][)][=] [Shift][RCL](Sto)[F](tan)	-2.25(x) 3.897114317(y)

■ Other functions($\sqrt{\ }$,x^2,x^{-1},x!,$\sqrt[3]{\ }$,Ran#)

The following operation is invalid in the BASE-N mode.When in the BASE-N mode,carry out calculation after going back to COMP mode.

Example	Operation	Display
$\sqrt{2}+\sqrt{5}$ =3.65028154	$\sqrt{\ }$ 2 + $\sqrt{\ }$ 5 =	3.65028154
$2^2+3^2+4^2+5^2$=54	2 x^2 + 3 x^2 + 4 x^2 + 5 x^2 =	54.
$(-3)^2$=9	((-) 3) x^2 =	9.
-3^2=-9	(-) 3 x^2 =	-9.
1/(1/3-1/4)=12	(3 SHIFT x^{-1} (x^2) − 4 x^{-1} SHIFT) SHIFT x^{-1} (x^2) =	12.
8!=40320	8 SHIFT x! ($\sqrt{\ }$) =	40320.
$\sqrt[3]{\ }$(36×42×49)=42	SHIFT $\sqrt[3]{\ }$ (x^3) (36 × 42 × 49) =	42.
Random number generation (number is in the range of 0.000 to 0.999)	SHIFT Ran# (•) =	0.792
$\sqrt{\ }$(1-$\sin^2$40) =0.766044443	MODE MODE MODE = →"D" $\sqrt{\ }$ ((1 − (sin 40) x^2) = SHIFT $\cos^{-1}$ (cos) SHIFT Ans ((-)) =	0.766044443 40.
1/2!+1/4!+1/6!+1/8! =0.543080357	2 SHIFT x! ($\sqrt{\ }$) SHIFT x^{-1} (x^2) + 4 SHIFT x! ($\sqrt{\ }$) SHIFT x^{-1} (x^2) + 6 SHIFT x! ($\sqrt{\ }$) SHIFT x^{-1} (x^2) + 8 SHIFT x! ($\sqrt{\ }$) SHIFT x^{-1} (x^2) =	0.543080357

■ Fractions

Fractions are input and displayed in the order of integer,numerator and denominator.

Example	Operation	Display
2/5+$3\frac{1}{4}$=$3\frac{13}{20}$ =3.65	2 $a\frac{b}{c}$ 5 + 3 $a\frac{b}{c}$ 1 $a\frac{b}{c}$ 4 = (Conversion to decimal) $a\frac{b}{c}$ Fractions can be converted to decimals,and then converted back to fractions.	3⌟13⌟20. 3.65
$3\frac{456}{78}$=$8\frac{11}{13}$	3 $a\frac{b}{c}$ 456 $a\frac{b}{c}$ 78 = SHIFT $\frac{d}{c}$ ($a\frac{b}{c}$)	8⌟11⌟13. 115⌟13.
$\frac{1}{2578}$ +$\frac{1}{4572}$ =6.066202547×10^{-4}	1 $a\frac{b}{c}$ 2578 + 1 $a\frac{b}{c}$ 4572 = When the total number of characters,including integer, numerator,denominator and delimiter mark exceeds 10,the input fraction is automatically displayed in decimal format.	6.066202547^{-04}
$\frac{1}{2}$×0.5=0.25	1 $a\frac{b}{c}$ 2 × 0.5 =	0.25
$\frac{1}{3}$×(-$\frac{4}{5}$)-$\frac{5}{6}$ =-$1\frac{1}{10}$	1 $a\frac{b}{c}$ 3 × -4 $a\frac{b}{c}$ 5 − 5 $a\frac{b}{c}$ 6 =	-1⌟1⌟10.
$\frac{1}{2}$×$\frac{1}{3}$+$\frac{1}{4}$×$\frac{1}{5}$=$\frac{13}{60}$	1 $a\frac{b}{c}$ 2 × 1 $a\frac{b}{c}$ 3 + 1 $a\frac{b}{c}$ 4 × 1 $a\frac{b}{c}$ 5 =	13⌟60.
($\frac{1}{2}$)/3=$\frac{1}{6}$	(1 $a\frac{b}{c}$ 2) $a\frac{b}{c}$ 3 =	1⌟6.
$\frac{1}{(\frac{1}{3}+\frac{1}{4})}$=$1\frac{5}{7}$	1 $a\frac{b}{c}$ (1 $a\frac{b}{c}$ 3 + 1 $a\frac{b}{c}$ 4) =	1⌟5⌟7.

g.Degrees,Minutes Seconds Calculations

You can perform sexagesimal calculations using degrees(hours),minutes and seconds.And convert between sexagesimal and decimal values.

Example	Operation	Display
To express 2.258 degrees in deg/min/sec.	2.258[Shift][°,,,][=]	2°15'8.8"
To peform the calculation: 12°34'56"×3.45	12[°,,,]34[°,,,]56[°,,,][×] 3.45[=]	43°24'31.2"

h.Binary,octal,decimal,hexadecimal calculations

*Binary,octal,decimal,hexadecimal calculations, conversions and logical operations are performed in BASE-N mode (press [MODE] [→] [→] [→] [→] [=])

*The number system(2,8,10,16)is set by respectively pressing [BIN], [OCT], [DEC], [HEX],A corresponding symbol "b","o","d",or"H",apears on the display.

*Number systems are specified for specific values by pressing [SHIFT],then the numbers system designator (b,o,d,h),immediately followed by the value.

*General function calculations cannot be performed in the BASE-N mode.

*Only integers can be handled in the BASE-N mode. If a calculation produces a result that inclueds a decimal value,the decimal portion is cut off.

*If values not valid for the particular number system are used,attach the corresponding designator(b,o, d or h),or an error message will appear.

Number system	Valid values
Binary	0,1
Octal	0,1,2,3,4,5,6,7
Decimal	0,1,2,3,4,5,6,7,8,9
Hexadecimal	0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F

*Negaive numbers in binary,octal,hexadecimal are expressed as two's complements.

*Number of digits displayed in each number system

Numbersystem	Number of digits displayed
Binary	Up to 10 digits
Octal	Up to 10 digits
Decimal	Up to 10 digits
Hexadecimal	Up to 8 digits

*Calculation range(in BASE-N mode)

Binary Positive : $0111111111 \geq x \geq 0$

Negative: $1111111111 \geq x \geq 1000000000$

Octal Positive :$3777777777 \geq x \geq 0$

Negative:$7777777777 \geq x \geq 4000000000$

Decimal Positive :$2147483647 \geq x \geq 0$

Negative: $-1 \geq x \geq -2147483648$

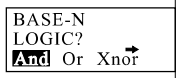
Hexadecimal Positive: $7FFFFFFF \geq x \geq 0$

Negative: $FFFFFFFF \geq x \geq 80000000$

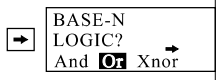
*Sub-menu for BASE-N operation

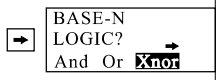
In the sub-menu,you can select operators AND,OR, XNOR,XOR,NOT,and NEG.

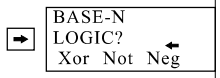
Press [SHIFT] [LOGIC] to open the menu



Press [→] consecutively to select the operator.







After locating the desired operator,press [=] to confirm and go back to input mode.

■ Binary,octal,decimal,hexadecimal conversions

Conversion using number system specification key

Value from a different number system input when a specific number system mode is being used.

Example	Operation	Display
What are the decimal values for $2A_{16}$ and 274_8?	MODE ➡ ➡ ➡ ➡ = DEC (√‾) → "d" SHIFT [h] (x^2) 2 SHIFT A(x.T) = SHIFT [o] (ln) 274 =	BASE-N 42^d 188^d
What are the hexadecimal values for 123_{10} and 1010_2?	HEX (x^2) → "H" SHIFT [d] (√‾) 123 = SHIFT [b] (log) 1010 =	$7B^h$ A^h
What are the octal values for 15_{16} and 1100_2?	OCT (ln) → "o" SHIFT [h] (x^2) 15 = SHIFT [b] (log) 1100 =	25^o 14^o
What are the binary values for 36_{10} and $2C_{16}$?	BIN (log) → "b" SHIFT [d] (√‾) 36 = SHIFT [h] (x^2) 2 SHIFT C =	100100^b 101100^b

Conversion using number system mode key

Calculation results can be converted to any specified number system by using the corresponding number system mode key.

Example	Operation	Display
How is 22_{10} expressed in binary, octal and hexadecimal number system?	MODE ➡ ➡ ➡ ➡ = (√‾) DEC ➡ "d" 22 = BIN (log) OCT (ln) HEX (x^2)	 22^d 10110^b 26^o 16^h

■ Basic arithmetic operations using binary, octal, decimal, hexadecimal values

Example	Operation	Display
$10111_2+11010_2$ $=110001_2$	MODE ➡ ➡ ➡ ➡ = BIN (log) → "b" 10111 + 11010 =	 110001^b
$B47_{16}-DF_{16}=A68_{16}$	HEX (x^2) → "h" B(,,) 47 − D(sin) F(tan) =	 $A68^h$
$123_8\times ABC_{16}$ $=37AF4_{16}=228084_{10}$	SHIFT [o] (ln) 123 × A(x.T) B(,,) C (hyp) = DEC (√‾)	$37AF4^h$ 228084^d
$1F2D_{16}-100_{10}=7881_{10}$ $=1EC9_{16}$	SHIFT [h] (x^2) 1F (tan) 2D (sin) − 100 = HEX (x^2)	 7881^d $1EC9^h$
$7654_8\div 12_{10}$ $=334.3333333_{10}$ $=516_8$	DEC (√‾) → "d" SHIFT [o] (ln) 7654 ÷ 12 = OCT (ln)	 334^d 516^o
$1234_{10}+1EF_{16}\div 24_8$ $=2352_8$ $=1258_{10}$	SHIFT [d] (√‾) 1234 + SHIFT [h] (x^2) 1E (cos) F(tan) ÷ 24 = DEC (√‾)	 2352^o 1258^d

■ Negative expressions

Example	Operation	Display
How is 110010_2 expressed as a negative?	MODE ➡ ➡ ➡ ➡ = BIN (log) → "b" LOGIC (x^3) ➡ ➡ ➡ ➡ ➡ = 110010 =	 1111001110^b
How is 72_8 expressed as a negative?	OCT (ln) → "o" LOGIC (x^3) ➡ ➡ ➡ ➡ ➡ = 72 =	 7777777706^o
How is $3A_{16}$ expressed as a negative?	HEX (x^2) → "H" LOGIC (x^3) ➡ ➡ ➡ ➡ ➡ 3A(x.T) =	 $FFFFFFC6^h$

■ Logical operations

Logical operations are performed through logical products(and),logical sums(or),negative(Not), exclusive logic sums(xor),and negation of exclusive logcal sums(xnor).

Example	Operation	Display
19_{16} AND $1A_{16}=18_{16}$	MODE → → → → = HEX (x^2) → "H" 19 LOGIC (x^3) = 1A (X.T) =	18^h
1110_2 AND 36_8 $=110_2$	BIN (log) → "b" 1110 LOGIC (x^3) = SHIFT [h] (x^2) 36 =	110^b
23_8 OR $61_8=63_8$	OCT (ln) → "o" 23 LOGIC (x^3) → = 61 =	63^o
120_{16} OR $1101_2=12D_{16}$	HEX (x^2) → "H" 120 LOGIC (x^3) → = SHIFT [b] (log) 1101 =	$12D^h$
1010_2 AND(A_{16}OR 7_{16})$=1010_2$	BIN (log) → "b" 1010 LOGIC (x^3) = (SHIFT [h] A (X.T) LOGIC (x^3) → = SHIFT [h] (x^2) 7) =	10^b
5_{16} XOR $3_{16}=6_{16}$	HEX (x^2) → "H" 5 LOGIC (x^3) → → → = 3 =	6^h
$2A_{16}$ XNOR $5D_{16}$ $=FFFFFF88_{16}$	HEX (x^2) → "H" 2A LOGIC (x^3) → → = 5D (sin) =	$FFFFFF88^h$
Negation of 1234_8	OCT (ln) → "o" LOGIC (x^3) → → → → → = 1234 =	7777776544^o
Negation of $2FFFED_{16}$	HEX (x^2) → "H" LOGIC (x^3) → → → → → = 2F (tan) FFE (cos) D (sin) =	$FFD00013^h$

IIi.Statistical calculations

This unit can be used to make statistical calculations including standard deviation in the SD mode,and regression calculation in the RED mode.

■ Standard deviation

In the SD mode,calculations including 2 types of standard deviation formulas ,mean,number of data, sum of data,and sum of square can be performed.

Data input

1.press MODE → → = to specify SD mode.
2.press SHIFT Scl = to clear the statistical memories.
3.Input data,pressing DT key (= M+)each time a new piece of data is entered.

Example: Data 10,20,30

Key operation:10 DT 20 DT 30 DT

* When multiples of the same data are input,two different entry methods are possible.

Example1: Data 10,20,20,30

Key operation:10 DT 20 DT DT 30 DT

The previously entered data is entered again each time the DT is pressed without entering data (in this case 20 is re-entered).

Example2: Data 10,20,20,20,20,20,20,30

Key operation:10 DT 20 SHIFT ; 6 DT 30 DT

By pressing SHIFT and then entering a semicolon followed by value that represents the number of items the data is repeated(6,in this case)and the DT key,the multiple data entries(for 20,in this case)are made automatically.

Deleting input data

There are various ways to delete value data, depending on how and where it was entered.