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Canon

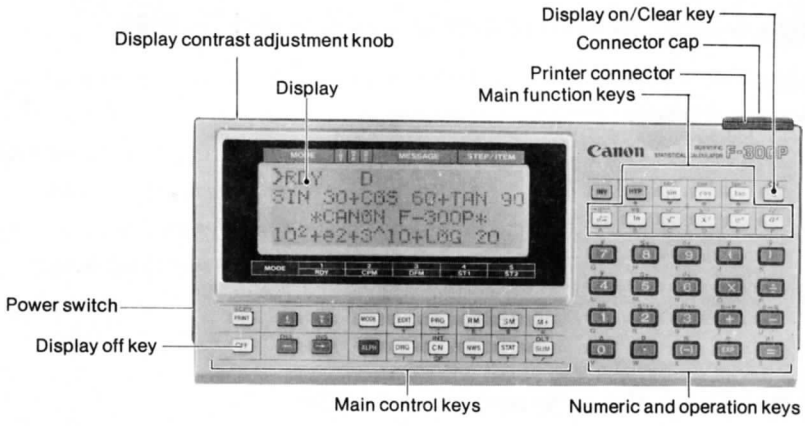
F-300P

SCIENTIFIC STATISTICAL CALCULATOR

INSTRUCTIONS

Congratulations on your purchase of the Canon F-300P. Your new programmable calculator was designed and manufactured with the utmost care and we are confident that it will give complete satisfaction. This instructions will help you to use the F-300P more effectively. Please read it carefully and perform the example exercises to familiarize yourself with all of the F-300P's many useful functions.

Contents

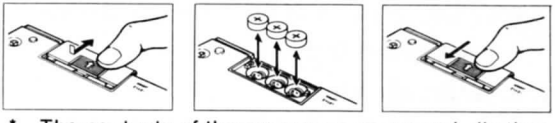


Battery Replacement

The display will become faint and hard to read when the batteries start to run down. When this happens, change the batteries as illustrated below. Use three (3) alkaline batteries: type LR-44 or three (3) silver oxide batteries: type G13.

WARNING

Keep coin-type batteries out of the reach of children. If batteries are swallowed, contact a physician immediately.



* The contents of the program memory and all other memories are cleared during battery replacement.

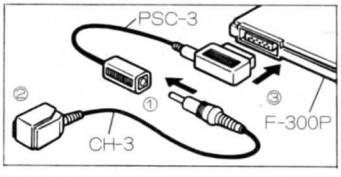
Protecting the Memory Contents during Battery Replacement

You can protect the memory contents during battery replacement by using the Canon Charger CH-3 (optional) and Canon PSC-3 (Power Supply Cord, optional) with the F-300P. Use the following procedure when attaching the CH-3 and PSC-3 to ensure memory protection.

1. Connect the CH-3 to the PSC-3 and then plug the CH-3 into an electrical outlet.
2. Make sure that the F-300P's power switch is ON (green). Then connect the PSC-3 to the printer connector of the F-300P.
3. Turn the F-300P's power switch OFF (black).
4. Replace batteries.
5. After battery replacement, turn the F-300P's power switch back ON just prior to disconnecting the PSC-3 from the F-300P.
6. Unplug the CH-3 from the electrical outlet.

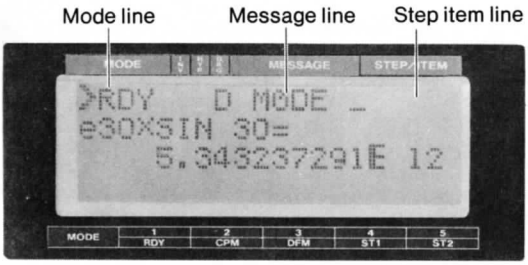
Operating the F-300P on AC Power

The Canon Charger CH-3 and PSC-3 can also be used to operate the F-300P on AC power. In this case the CH-3 functions only as an AC adaptor since the F-300P does not use rechargeable batteries. Use steps 1—3 as described in "Protecting the Memory Contents during Battery Replacements" to connect the CH-3 and PSC-3 with the F-300P.



* Be sure to turn the F-300P's power switch OFF (black) when operating the F-300P on AC power. Leaving the power switch ON during AC operation may damage the calculator's circuitry.

1) Large 4-level, 20-character Liquid Crystal Display

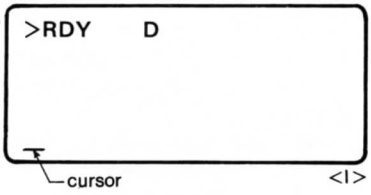


The top line displays information from the calculator, including the current operating status. The second to fourth lines display calculation expressions and results.

Let's take a closer look at the display.

1. **Turn the power switch on (green).**

   The display will be as shown in <I> at the right, indicating that the F-300P is in the general calculation mode (RDY) and that the angle unit is "degrees". This will be explained in more detail later.

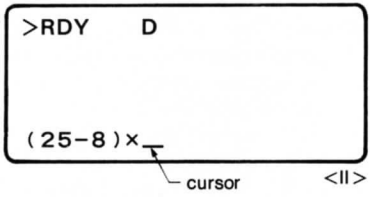


2. **Enter the expression.**

   For example, to enter (25−8) × 4, press the keys corresponding to each element in the expression:

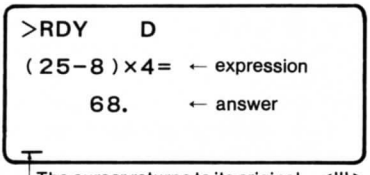
   [(] [2] [5] [−] [8] [)] [×] [4]

   Each element of the expression will be displayed as the corresponding key is pressed. The flashing cursor, originally displayed in the bottom left-hand corner, will move across the display as the expression is entered (<II>).



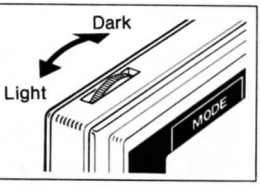
3. **The answer....**

   Finally press the [=] key. The display will be scrolled up two lines so that you can view the expression and the answer at the same time, as shown in <III>. The large display boasts several unique functions, including the capability to display more than one answer for certain calculations.



Display Contrast Adjustment

Use the display contrast adjustment knob located on the top left-hand side of the calculator to adjust the display to the desired brightness.



2) Memory Retention with the Display Off

1. Turn the display off

OFF

The display is cleared. If no entry is made for a period of 4 minutes, the internal timer will automatically turn the display off to prevent battery drain.

* In normal use, use the ON/C and OFF keys to turn the calculator on and off. Please note that turning the power off using the power switch clears all the programs and data stored in the calculator's memories.

2. Turn the display on again

ON/C

Let us assume that the status of the calculator was as shown in <III> when the OFF key was depressed and the display turned off. The same display will appear as soon as the ON/C key is pressed, indicating that the calculator has retained its status immediately prior to when the display was turned off. The F-300P has a memory protection feature which preserves expressions and data within the calculator even when the display is turned off. This means that calculations can be continued easily even after the calculator's display has been turned off temporarily using the OFF key. Let's try subtracting 12 from the result of the calculation described in the preceding section.

Press [−] [1] [2] . The display shown in <IV> will appear. Next press the [=] key. The answer will be displayed as shown in <V>.

```
>RDY     D
(25-8)×4=
      68.
      6.8E 01-12_
```

<IV>

Exponent indicator $6.8 \times 10 = 68$

3. Once again from the top.....

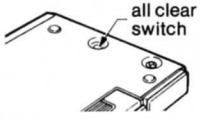
When the display is on, ON/C acts as a clear key. Pressing it clears the calculation currently in progress and restores the display to the initial status <I>. Data and expressions previously stored in the memory are not affected.

```
>RDY     D
      6.8E 01-12=
      56.
```

<V>

4. All Clear

Turning the power off using the power switch clears all the programs and data stored in the calculator's memories. The slightly recessed all clear switch located on the back of the calculator's main body performs the same function. Sometimes immediately after battery replacement, the keys lock and the display functions erratically. To restore the calculator to normal status, depress the all clear switch using the tip of a ballpoint pen.

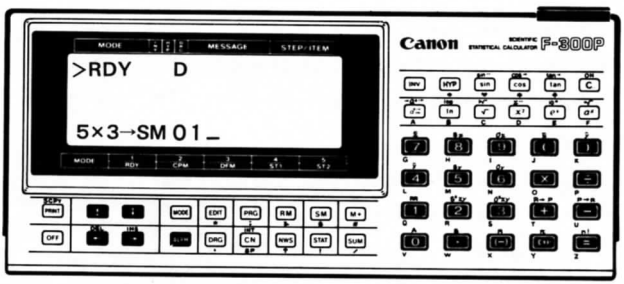


3) 3-Level Shift Keys

Each of the F-300P's keys have 3 functions that can be activated by simply changing the calculation mode.

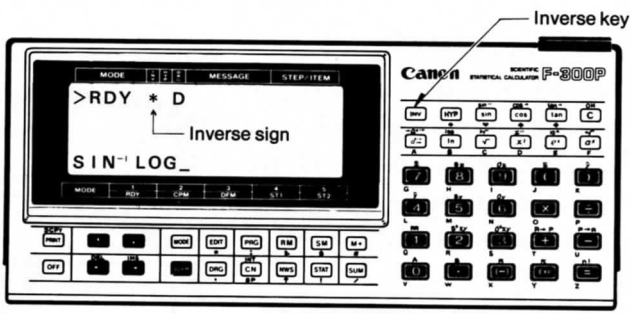
1. Simple Key Operation (Normal Mode)

The function indicated on the keytop is activated or numbers on the keytop is entered.



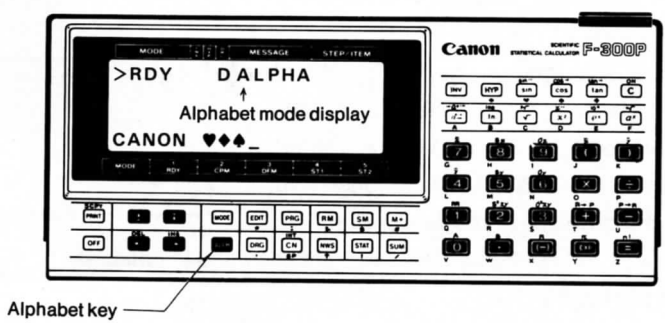
2. Key Operations Preceded by [INV] (Inverse Mode)

This activates the function indicated in green above the key.



3. Key Operations Preceded by [ALPH] (Alphabet Mode)

This mode is used to enter the characters and symbols indicated in red below each key (see page 8).

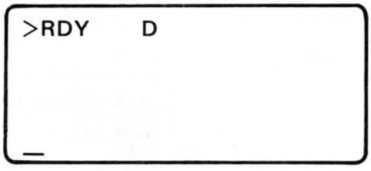


4) Choice of 5 Modes

Press keys [1] through [5] after first pressing the [MODE] key. The display will appear as shown below, indicating the following functions.

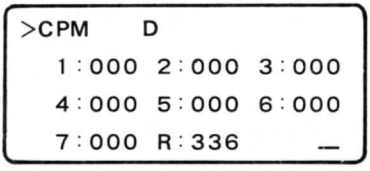
[MODE] [1] RDY (Ready) Mode

This is the mode for general calculations. As explained earlier, this mode is used to input expressions and perform calculations (page 23). Program input (the storage of algebraic expressions) is also carried out in this mode (page 33).



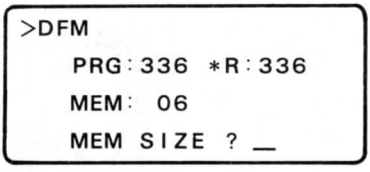
[MODE] [2] CPM (Clear Program Memory) Mode

The CPM mode allows you to determine what programs are currently stored in the memory and how much memory is being used (page 38). It is also used when erasing specific programs or clearing all memory contents (page 38).



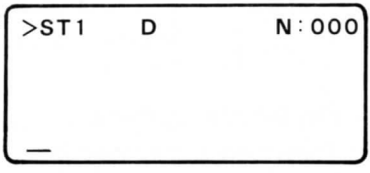
[MODE] [3] DFM (Define Memory) Mode

The F-300P has 6 memories for storing data. This mode is used to change the number of memories (pages 25, 38). The current number of memories and the size of the program area are displayed (page 38).



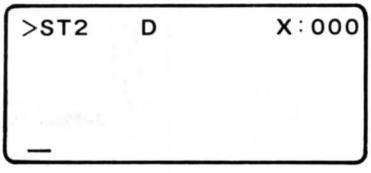
[MODE] [4] ST1 (Statistic 1)

This is the mode for single-variable statistical calculations. Simply input data one after another and the F-300P will simultaneously calculate and display the mean, population standard deviation, and sample standard deviation (page 43).



[MODE] [5] ST2 (Statistic 2)

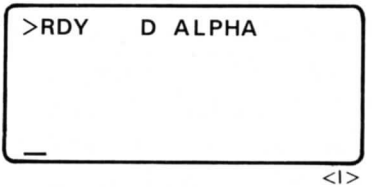
This mode is used for two-variable statistical calculations. As with ST1, simply input the data and the F-300P will calculate and display the gradient of the regression line, the intercept and coefficient. ST2 can also be used to calculate 11 different statistical values (page 45).



5) Input of Alphabetic Characters and Symbols

Press [ALPH] to set the calculator in the alphabetic mode ([MODE] [1]). The first line of the display will appear as shown in <I>.

1. Entering Alphabetic Characters and Symbols



<I>

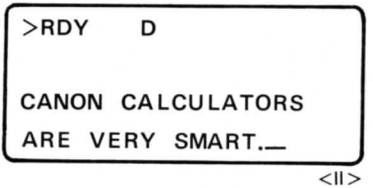
The calculator is locked in this mode until the [ALPH] key is pressed again. Just key in as many characters as required. To produce the display shown in <II>, for example, press the following keys:

[√] [a'b'c] [6] [×] [6] [CN] [√] [a'b'c] [4] [√] [−]
C A N O N SP C A L C U

[4] [a'b'c] [+] [×] [2] [3] [CN] [CN] [CN] [a'b'c] [2]
L A T O R S SP SP SP A R

[e^x] [CN] [0] [e^x] [2] [EXP] [CN] [3] [5] [a'b'c] [2]
E SP V E R Y SP S M A R

[+] [INV] [•] [ALPH]
T



<II>

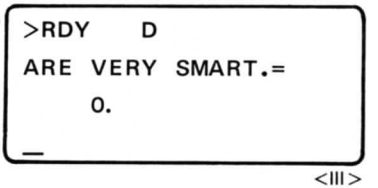
([CN] SP represents the space key.)

Pressing [INV] when the calculator is in the alphabet mode allows you to use the following number keys as characters:

[•] [0] ~ [9], [+], [−], [×], [÷], [(−)], [(], [)], [=], [π] EXP

2. Insertion of Memos and Comments for Use during Calculation

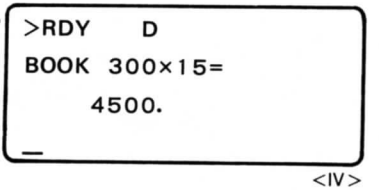
Press the [=] key. "0" will appear on the display as shown in <III>. This is because characters entered in this mode have absolutely no effect on calculations. This feature permits the type of operation shown in <IV>.



<III>

Press the following keys.

[ALPH] [ln] [×] [×] [□] [CN] [ALPH] [3] [0] [0]
B O O K SP
[×] [1] [5] [=]

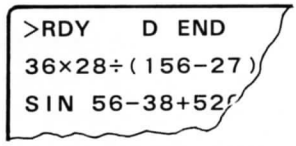


<IV>

The insertion of this kind of comment clarifies the calculation for other users. This feature is even more convenient when Canon's optional Thermal Printer X-711 is attached.

The Line Buffer (LB)

Expressions and characters entered into the F-300P are initially stored in the line buffer (LB). Calculations are performed when an execution key such as [=] is pressed. The line buffer can hold up to 83 (75 in the ST2 mode) numbers, functions, letters, symbols, etc. When the entry exceeds 83 characters, the word "END" appears on the message line of the display. The calculator will not accept any further key inputs and it will be necessary to divide the calculation up into manageable units.



6) Easy Error Diagnosis

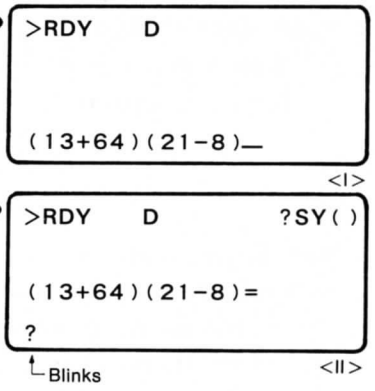
Consider the following problem.

(13+64)(21−8)=

Try performing the calculation.

Pressing [=] should produce the result shown in <II>.

An error has occurred. The message "?SY( )" appears in the upper right-hand corner of the display, indicating an error in parentheses usage.



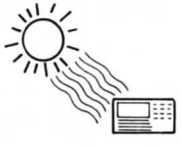
The cause of the problem is the omission of the multiplication symbol "x" between the parenthese. Though this omission is acceptable in mathematics, the calculator is not equipped to make this judgement. Entries must be made without abbreviations. If an error occurs, either erase the expression with the [C] key or display it for correction using [EDIT] [•] . The F-300P can diagnose the causes of errors and display 23 different error messages. This capability makes it easy to locate the source of an error. (The messages are listed at the end of these instructions starting on page 51.)

Special Precautions during Use

* The F-300P is composed of an LSI and other precision electronic parts. It should not be used under any of the following conditions.

In locations subject to extreme temperature variations or high humidity.

In locations where the air is dusty or salty.



In direct sunlight.

* Do not clean the F-300P with volatile liquids like thinners or benzine or with wet cloths. Always use a soft, dry cloth.

3 Key Functions

1) Control/Editing Keys

1 Display ON/OFF Keys

[OFF] **Display off key:** Turns the display off.

[ON/C] **Display on/clear key:** 1) Turns the display on.

2) If the display is on, clears the memory of expressions currently entered and turns all sub-modes off (except the program input/edit sub-modes).

2 Mode Setting Keys

[MODE] **Mode key:** Sets the calculator's mode when followed by [1] — [5].

- [1] **RDY mode:** For general and programmed calculations
  - [ALPH] **Alphabet key:** Sets the alphabet mode for displaying letters and symbols. Turn off by pressing [ALPH] again.
  - [EDIT] **Edit key:** Sets the program entry/edit mode. When followed by [1] — [7], permits entry or editing of the corresponding program. Depressing the [EDIT] key and then the [·] key permits editing of the contents of the line buffer.
  - [PRG] **Program key:** Sets the program execution sub-mode. Follow with [1] — [7] to execute the program of the corresponding number. If this key is pressed while the calculator is in the edit sub-mode, the program currently being entered or edited will be executed.
- [2] **CPM mode:** Displays the amount of memory (number of steps) currently being used by each program. When followed with [1] — [7], deletes the corresponding program. Pressing the [·] key clears the entire memory.
- [3] **DFM mode:** Displays the number of memories and the area of memory currently available for programs. The number of memories can then be changed by inputting a two-digit number between [0] [6] and [4] [8].
- [4] **ST1 mode:** For one-variable statistical calculations. Simply input data and the F-300P will automatically calculate means, standard deviation, and other statistical values.
- [5] **ST2 mode:** For two-variable statistical calculations. Just enter the data and the calculator will automatically perform linear regression calculations.

3 Calculation/Display Keys

[INV] **Inverse key:** Provides a shift function to access the characters indicated in green above the various keys. An "*" appears on the display when this key is depressed.

[DRG] **Degree-radian-gradient key:** Defines the unit of an angle. The unit is changed each time the key is depressed (D→R→G→D→···). (D=degree, R=radian, G=gradient; right angle=90(D)=$\frac{\pi}{2}$(R)=100(G))

[CN] **Change notation key:** Switches the floating display to the exponential display or vice versa. Valid only when the results of a calculation are being displayed. Values to be converted to integer form must be within the following range: 0 or $10^{-10}<|x|<10^{10}$.

[INV] [INT/CN] **Integer sub-mode key:** Activates the integer sub-mode. Valid after [=] is pressed and during substitution into memory using the [SM] or [M+] key, it converts the results of calculations into integers. Cancelled by pressing [C] or changing the mode.

If the [SM] or [M+] key is used for expressions in the integer sub-mode, the value is first converted into integers and then stored or accumulated in the specified memories.

[HYP] **Hyperbolic key:** Used to calculate hyperbolas and inverse hyperbolas. An * appears on the display when this key is depressed.

4 Memory Keys

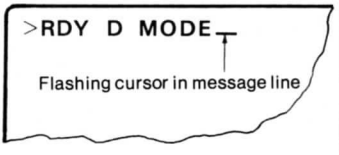
[M+] **Memory plus key:** The value entered or calculated immediately prior to depressing this key is added to the memory specified by the corresponding number.

[SM] **Store memory key:** The value entered or calculated immediately prior to depressing this key is stored in the memory specified. Data previously stored in that memory is deleted.

[RM] **Recall memory key:** Recalls the contents of the specified memory when depressed before the memory number ([0][1] ~ [4][8]).

Note

Depressing a control key may cause a flashing cursor to appear on the display, usually in the message line at the top (see diagram at right). If another control key is depressed while the cursor is still flashing, meaningless characters may be displayed. However, this will not affect subsequent calculations.



5 **Edit Keys**

[↑] [↓] **Line up, line down keys:** Used when entering expressions or comments of two or more lines. Scrolls the expressions up or down one line and moves the cursor to the beginning of the line. With one-line expressions, the cursor simply returns to the beginning of the line.

[←] [→] **Cursor left/right keys:** Shifts the cursor one position to the left or right.

[INV] [DEL ←] **Delete key:** Deletes the blinking character at the current cursor position.

[INV] [INS →] **Insert key:** Inserts a space immediately before the character at the current cursor position, permitting the entry of one character.

The above keys are only valid during the entry of calculation expressions or comments.

6 **Print Keys**

[NWS] **Normal, wide, small characters key**

[PRINT] **Print key**

[INV] [SCPY PRINT] **Screen copy key**

These keys can be used only when the Canon Thermal Printer X-711 is attached to the F-300P. See page 54 for further details.

2) Calculation and Coefficient Keys

1 **Value (1)**

[0] — [9] **Numeric keys:** In addition to functioning as ordinary numeric keys, this group is also used to specify mode or memory numbers.

[·] **Decimal point key**

2 **Value (2)**

[INV] [π EXP] **π key:** Used for constant π (circle ratio = 3.141592654).

Abbreviated multiplication is permitted in the Value (2) mode only when a certain value is being multiplied by π. The [RM] key can be used in the same way.

Example: [5] [INV] [π EXP] $= 5\pi = 5 \times \pi$

[3] [RM] [0] [1] [RM] [0] [2] = 3 RM01 RM02 (display)

$= 3 \times$ (contents of memory 01) $\times$ (contents of memory 02).

3 Parentheses, Minus Sign, Exponent Keys

[(] [)] **Open and close parenthesis keys:** Always used in pairs.

[(−)] **Minus sign key:** Alters the positive/negative sign of the value immediately following it (sign change).

Example: [(−)] [1] [5] $= -15$

This calculator displays the minus sign as a "small minus," and distinguishes it from the minus sign used in subtraction. When the printer is used, however, they are both printed out in the same way. Be careful when using this key in parentheses and memory calculations. For details, refer to page 25.

[EXP] **Exponent key:** It is possible to input a 10-digit mantissa and its sign and a 2-digit exponent and its sign.

Example: [1] [•] [3] [9] [2] [EXP] [(−)] [2] [8]

$= 1.392\text{E-}28$ (displayed) $= 1.392 \times 10^{-28}$

- Enter up to 2 digits for the exponent. If more than 2 digits are entered, the last 2 digits depressed are retained as the exponent.
  Example: [9] [•] [8] [8] [EXP] [1] [2] [3] [4] [=] 9.88E34
- Decimal points entered as part of an exponent are ignored.
  Example: [1] [•] [2] [4] [EXP] [1] [•] [2] [=] 1.24E12
- Minus signs entered between digits in the exponent are ignored.
  Example: [1] [•] [5] [EXP] [(−)] [3] [(−)] [2] [=] 1.5E−32

4 Function Keys Preceded and Followed by Values

Functions in which the calculation symbol is always preceded and followed by values (e.g. 2×3, $\sqrt[8]{128}$) are referred to as 2-value functions (indicated by F3 in error messages).

[+] **Addition key**

[−] **Subtraction key**

[×] **Multiplication key**

[÷] **Division key**

[a^x] **Power key**

Example: [3] [a^x] [5] $= 3\text{^}5$ (display) $= 3^5$

[INV] [$\sqrt[x]{\ }$ / a^x] **Power root key**

Example: [6] [INV] [$\sqrt[x]{\ }$ / a^x] [7] [2] [9] $= 6\sqrt[x]{\ }726$ (display)
$= \sqrt[6]{729}$

If you are extracting the root of a numeric expression, the expression must be enclosed in parentheses.

Example: [5] [INV] [$\sqrt[x]{\ }$ / a^x] [(] [3] [2] [×] [8] [)] $= \sqrt[5]{32 \times 8}$

5 Function Keys Followed by Values

Functions in which the calculation symbol is always followed by values (e.g. SIN 30, LOG 51), are referred to as value-suffix functions (indicated by F1 in error messages).

(1) Trigonometric and Inverse Trigonometric Functions

First specify the angle unit to be used with the [DRG] key.

[sin] **Sine key** Example: (D) [sin] [3] [0] = SIN 30°

[cos] **Cosine key** (R) [cos] [(] [INV] [π] [÷] [6] [)] = $\cos\frac{\pi}{6}$

[tan] **Tangent key**

[INV] [sin⁻¹] **Arcsine key**

[INV] [cos⁻¹] **Arccosine key**

[INV] [tan⁻¹] **Arctangent key**

Note:
Be careful about accuracy in calculations using the constant π when the angle unit is set to rad. Errors of up to ± 1 may appear in the ninth column.
Example: TAN 15π = −1.74···E-10 (display).

(2) Exponents and Logarithms

[e^x] **Exponential function key**

Example: [e^x] [1] [0]

= e10 (display) = e^{10}

[INV] [10^x] **Common exponent key**

Example: [INV] [10^x] [1] [.] [2]

= 10 1.2 (display) = $10^{1.2}$

[ln] **Natural logarithm key**

Example: [ln] [2]

= LN 2 (display) = ln 2

[INV] [log] **Common logarithm key**

Example: [INV] [log] [8] = LOG 8 (display)

= log 8

(3) Square Roots and Cube Roots

[√] **Square root key**

Example: [√] [3] [0] = $\sqrt{}$30 (display)

= $\sqrt{30}$

[INV] [$\sqrt[3]{\ }$] **Cube root key**

Example: [INV] [$\sqrt[3]{\ }$] [(] [5] [÷] [2] [)]

$= \sqrt[3]{(5 \div 2)}$ (display)

$= \sqrt[3]{5 \div 2}$

(4) Hyperbolas and Inverse Hyperbolas

[HYP] [sin] **Hyperbolic sine key**

Example: [HYP] [sin] [1] [0]

= SIN H 10 (display) = sinh 10

[HYP] [cos] **Hyperbolic cosine key**

[HYP] [tan] **Hyperbolic tangent key**

[HYP] [INV] [$\sin^{-1}$] **Arc-hyperbolic sine**

[HYP] [INV] [$\cos^{-1}$] **Arc-hyperbolic cosine**

[HYP] [INV] [$\tan^{-1}$] **Arc-hyperbolic tangent**

6 Functions Preceded by Values

These functions are referred to here as value-prefix functions (indicated by F2 in error messages). Calculation signs are always preceded by values (e.g. 35^2, 10!).

[x^2] **Square key**

[INV] [x^{-1}] **Reciprocal key**

[INV] [n!] **Factorial key**

Example: [6] [INV] [n!] = 6!

[°'"] **Sexagecimal-decimal conversion key:**

Sexagecimal notation is used to enter degree, 2-digit minute, and second values in decimal point form.

Example: [6] [•] [1] [2] [5] [4] [7] [7] [°'"]

$= 6.125477°\,'\,''$ → (display)

= 6 deg. 12 min. 54.77 sec.

With [=] the result would be

$= 6.215213888°$

7 Functions Preceded by Expressions

These functions are referred to as expression-suffix functions (indicated by F4 in error messages) and are entered after values and expressions.

[=] **Equal key:** Displays the result.

[INV] [$\rightarrow d^{\circ}{}'{}''$] **Decimal-sexagesimal conversion key:**

Decimal integers are treated as degrees and displayed in degrees, minutes, and seconds.

Example: [6] [.] [2] [1] [5] [3] [INV] [$\rightarrow d^{\circ}{}'{}''$]

$= 6.2153 \rightarrow {}^{\circ}\,{}'\,{}''$ (display)

With [=] the result would be

$= 6^{\circ}12'55.08''$ (display).

Performing decimal operations after conversion will result in errors.

8 Coordinates Conversion Key

First specify the angle unit to be used with the [DRG] key.

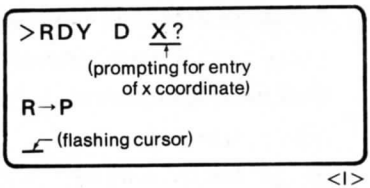
[INV] [R→P] **Rectangular-polar coordinate conversion key**

Operation:

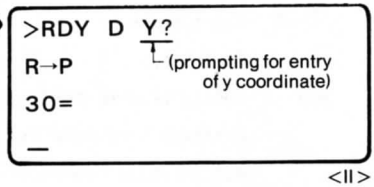
[INV] [R→P]

The calculator will prompt you to enter the x coordinate.

For example, [3] [0] [=] will produce the display shown in <II>. The next prompting will indicate entry of the y coordinate.



<I>

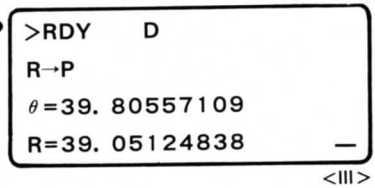


<II>

Let's input

[2] [5] [=]

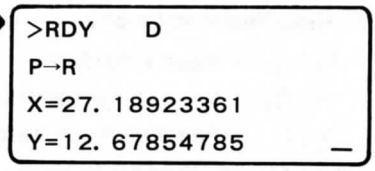
The display will change as shown in <III>, showing both the argument θ and the radius R.



<III>

[INV] [P→R / +] **Polar-rectangular coordinate conversion key**

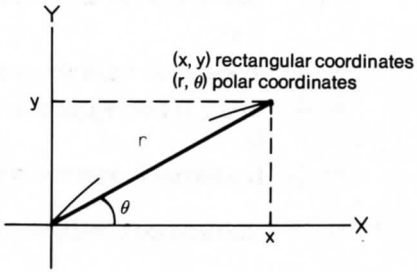
Operates like the [R→P / +] key. Input the radius R and the argument θ according to the promptings and the display will show both the x and y coordinates. (<IV>)



<IV>

Note: The relationship between rectangular and polar coordinates is shown at the right.

The results of coordinate conversion calculations are automatically sent to the printer if a printer is attached.



9 Statistical Keys (Used in ST1 and ST2 Modes)

(1) Keys Common to Both ST1 and ST2

[SUM] **Data entry key:** Inputs statistical data.

Operation: (data) [SUM]

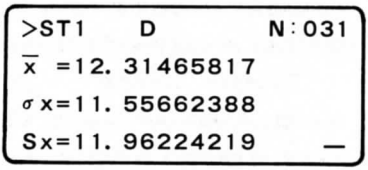
The calculation results can also be used as data.

[INV] [DLT / SUM] **Data delete key:** Deletes data already entered.

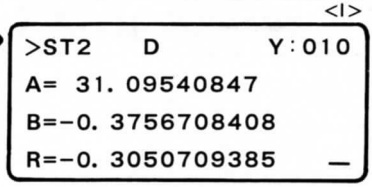
Operation: (data) [INV] [DLT / SUM]

[STAT] **Statistical amount recall key**

In the ST1 mode this operation displays the mean and the population and sample standard deviations. In the ST2 mode it simultaneously shows the intercept and gradient of the regression line and the correlation coefficient. (<I>, <II>)



<I>



<II>

[INV] [x̄ / 7] x **Mean value key** $\Sigma x/n$

[INV] [Sx / 8] x **Sample standard deviation key** $\sqrt{(\Sigma x^2 - n\bar{x}^2)/(n-1)}$

[INV] [σx / 9] x **Population standard deviation key** $\sqrt{(\Sigma x^2 - n\bar{x}^2)/n}$

Each statistical amount is shown separately (n: no. of data)

(2) Keys Reserved for ST2

[INV] [$\bar{y}$ 4] **y Mean value key** $\Sigma y/n$

[INV] [Sy 5] **y Sample standard deviation key** $\sqrt{(\Sigma y^2 - n\bar{y}^2)/(n-1)}$

[INV] [σy 6] **y Population standard deviation key** $\sqrt{(\Sigma y^2 - n\bar{y}^2)/n}$

[INV] [RR 1] **Multiple correlation (contribution ratio) key** R^2

[INV] [S^2xy 2] **Sample covariance key** $\dfrac{\Sigma xy - \Sigma x\Sigma y/n}{n-1}$

[INV] [σ^2xy 3] **Population covariance key** $\dfrac{\Sigma xy - \Sigma x\Sigma y/n}{n}$

[INV] [A 0] **Intercept of regression line key** $(\Sigma y - B\Sigma x)/n$

[INV] [B .] **Gradient of regression line key** $\dfrac{\Sigma xy - \Sigma x\Sigma y/n}{\Sigma x^2 - (\Sigma x)^2/n}$

[INV] [R (−)] **Correlation coefficient key** $\dfrac{n\Sigma xy - \Sigma x\Sigma y}{\sqrt{\{n\Sigma x^2 - (\Sigma x)^2\}\{n\Sigma y^2 - (\Sigma y)^2\}}}$

Each statistical value is shown separately (n: no. of data pairs)

[INV] [$\hat{x}$ 1] **Estimate (x) key:** Enter value (y) to estimate x
Operation: (Value y) [INV] [$\hat{x}$ 1]

[INV] [$\hat{y}$ 1] **Estimate (y) key:** Enter value (x) to estimate y
Operation: (Value x) [INV] [$\hat{y}$ 1]

Note

General calculations using these statistical values are possible in the statistical calculation mode, but operations using them directly as values following 2-value functions or value-suffix functions are not.

Example: To find e^A . . . [e^x] [INV] [A 0] [=]

A is displayed, but no calculation is performed. In this case, the value should be stored in memory prior to the calculation:

Example: [INV] [A 0] [SM] [0] [8] [=] , then: [e^x] [RM] [0] [8] [=]

10 Function Entry Ranges and Calculation Accuracy

Function	Operation Range		Normal Accuracy
sin x cos x tan x	DEG	$\|x\| \leqq 99999°$	±0 in 10th column
	RAD	$\|x\| \leqq 1745.32925$	
	GRAD	$\|x\| \leqq 111111°$	
$\sin^{-1}$	$\|x\| \leqq 1$		±1 in 10th column
$\cos^{-1}$	$\|x\| \leqq 1$		±1 in 10th column
$\tan^{-1}$	$\|x\| \leqq 9.999999999 \times 10^{99}$		±1 in 10th column
ln x log x	$x > 0$		±1 in 10th column
e^x	$-227.9559242 \leqq x \leqq 230.2585092$		±1 in 10th column
10^x	$\|x\| < 100$		±1 in 10th column
$\sqrt{x}$	$x \geqq 0$		±1 in 10th column
$\sqrt[3]{x}$	$0 \leqq \|x\| \leqq 9.999999999 \times 10^{99}$		±1 in 10th column
x^2	$\|x\| < 10^{50}$		±1 in 10th column
x^{-1}	$10^{-99} \leqq \|x\| \leqq 10^{99}$		±1 in 10th column
n!	$0 \leqq n \leqq 69$ (n: natural number)		±1 in 10th column
a^x	$a \geqq 0$, (Note: When $a = 0$, $x \geqq 0$)		±1 in 10th column
$\sqrt[x]{a}$	$a \geqq 0, x \neq 0$		±1 in 10th column
sinh x	$-227.9559242 \leqq x \leqq 230.2585092$		±1 in 10th column
cosh x	$\|x\| \leqq 230.2585092$		±1 in 10th column
tanh x	$\|x\| \leqq 9.999999999 \times 10^{99}$		±1 in 10th column
$\sinh^{-1}$ x	$\|x\| \leqq 9.999999999 \times 10^{99}$		±1 in 10th column
$\cosh^{-1}$ x	$1 \leqq x \leqq 9.999999999 \times 10^{99}$		±1 in 10th column
$\tanh^{-1}$ x	$\|x\| < 1$		±1 in 10th column
$\rightarrow a^{\circ\prime\prime\prime}$	$2.777777778 \times 10^{-99} \leqq x \leqq 9.999999999 \times 10^{99}$ Note: DEG. MIN. SEC. displayed when $10^{-5} \leqq x < 10^5$		±1 in 10th column
R→P	$\|x\| < 10^{99}, \|y\| < 10^{99}$		±1 in 10th column
P→R	DEG	$\|x\| \leqq 99999$	±1 in 10th column
	RAD	$\|x\| \leqq 1745.32951$	
	GRAD	$\|x\| \leqq 111111$	

3) Key Usage for Each Mode

Mode		RDY	CPM	DFM	ST1	ST2
Value	0—9	○	○	○	○	○
	(Decimal point)	○	○	×	○	○
RM		○	×	×	○	○
M+, SM	01—03	○	×	×	×	×
	04—06	○	×	×	○	×
	Others	○	×	×	○	○
P→R, R→P		○	×	×	×	×
Function (F1—F4)		○	×	×	○	○
Statistical keys (common)		×	×	×	○	○
Statistical keys (two-variable)		×	×	×	×	○
DRG		○	○	○	○	○
CN		○	×	×	○	○
INT		○	×	×	○	×
EDIT, PRG		○	×	×	×	×
ALPHA		○	×	×	×	×
↑, ↓, ←, →	Input keys	○	×	×	○	○
INS, DEL	Others	×	×	×	×	×
PRINT		○ (When in EDIT PRG mode ×)	×	×	× (LB only ○)	× (LB only ○)
SCPY		○	○	○	○	○
NWS		○	○	○	○	○

○ · · · · · Key can be used in corresponding mode.

× · · · · · Key does not function in corresponding mode even if pressed.

1) Entering Expressions

1. Input expressions as they are written

Calculation expressions (including those for functional calculations) can be entered into the F-300P in virtually the same form as in general usage. For example, the expression:

$$\{(4-3.6+5)\times 0.8-6\}\times 4.2$$

would be entered as:

((4 − 3 • 6 + 5) × 0 • 8 − 6) × 4 • 2 =

Apart from the fact that there is no distinction between the shapes of the parentheses, the entry is exactly the same as the original expressions. However, calculations are not executed until the = key is depressed. The expression is stored in its original form in an area of memory known as the line buffer. Since the expression entered remains on the display (<I>), it is easy to check the type of calculation in progress. The expression can be corrected at any time (see below). Even after you depress the = key, the contents of the line buffer can be recalled and edited using EDIT • operations.

```
((4−3. 6+5)×0. 8−6)×4.
2_
```
<I>

Example 1.

Expression: 3 sin 65° =

DRG : D

Operation: 3 × sin 6 5 =

Result: 2.718923361

Display:

```
>RDY   D
3×SIN 65=
      2. 718923361
_
```

Example 2.

Expression: $10^{\log 20} \times \log 30 =$

Operation: INV 10^x (e^x) INV log (ln) 2 0 ×
INV log (ln) 3 0 =

Result: 29.5424251

Display:

```
>RDY   D
10LOG 20×LOG 30=
      29. 5424251
_
```

Correcting the Expression

Let us assume that the 0.8 shown in Fig. <I> should have been 1.8. Use the edit key in the bottom left hand corner to move the cursor to the 0. The 0 will flash. Input the correct value 1 and press the = key.

Operation: ↧ → → → ··· → (Move to 0)
1 (Correct value)
=

```
                Position the cursor
((4−3. 6+5)×↓. 8−6)×4.
```

Refer to the section on Edit Keys (Page 14).

If the expression is long, only part of it is displayed after the = key is depressed.

2. Calculation Priority

Calculation expressions input from the line buffer are executed in the following order.

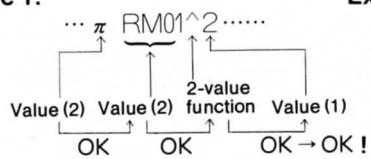
1. Value-prefix functions
2. a^x or $\sqrt[x]{\ }$ immediately preceded by a multiplication sign (x)
   Example: 2 RM01 ^2 ($2x^2$)
3. Abbreviated multiplication
4. Value-suffix functions
5. a^x (power), $\sqrt[x]{\ }$
6. x, ÷
7. +, −
8. =

- In expressions which include parentheses (up to 16 levels possible), the contents of the innermost pair is processed first.
- The last value (or intermediate result; e.g. (3+2)) displayed before →SM or →M is stored in the memory.
- →° ′ ″ affects only the preceding calculation result. Performing subsequent decimal operations will cause errors.

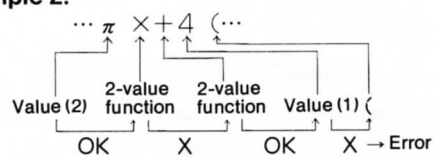
3. Error Mattrix

Using any of the combinations marked with an X in the following table for expressions will cause an error.

Example 1.



Example 2.



Next operation / First operation	Value (1)	Value (2)	(	)	Value-suffix function	Value-prefix function	2-value function	Expression suffix function
Value (1)			X		X			
Value (2)	X		X		X			
(				X		X	X	X
)	X	X	X		X			
Value-suffix function				X		X	X	X
Value-prefix function	X		X		X			
2-value function				X		X	X	X
Expression suffix function				X		X	X	

Precautions To Be Taken When Using the Minus Sign, etc.

Inputting calculation expressions just as they are written is extremely convenient, but there are occasions when calculations are not performed according to the expression. A good example of this is root calculation — the expression preceding the root symbol must be enclosed in parentheses to clearly delineate the extent to which the root calculation applies. The same applies when using the minus sign (sign change) key. Look at this example:

Expression: $-(6-3)+5$

Operation:

 [(−)] [(] [6] [−] [3] [)] [+] [5] [=]

Answer: −8 (wrong)

When a minus sign is placed before parentheses, the extent to which it applies must always be defined by parentheses, too. In other words:

Expression: $-(6-3)+5$

Operation:

 [(] [(−)] [(] [6] [−] [3] [)] [)] [+] [5] [=]

Answer: 2 (correct)

2) Memory Usage

1. Specifying Memory Numbers (01 to 06)

The calculator can store six different sets of data. The memories are numbered from 01 to 06. Be sure to specify the memory numbers with 2 digits when performing memory calculations.

Example 1. [5] [SM] [0] [1] [=] ..... Stores 5 in memory 01.

Example 2. [3] [M+] [0] [2] [=] ..... Adds 3 to memory 02.

Naturally, results from calculations completed or in progress can also be stored in the memories.

Example 3. [(] [3] [+] [8] [)] [SM] [0] [3] [×] [1] [5] [=] [M+] [0] [4] [=]

Stores 3+8 in memory 03 and adds the result of (3+8) × 15 to memory 04.

The procedure for recalling data from the memories is [RM] (memory number) [=] . Use this function to confirm that the values in the previous examples are correctly stored in the memories. An important point to remember is that with [SM] and [M+] , it is the values entered immediately before these keys are depressed that are stored or added:

Example 4. [3] [+] [5] [SM] [0] [1] [=] Result = 8 (5 stored in memory 01)

Example 5. [(] [3] [+] [5] [)] [SM] [0] [2] [=] Result = 8 (8 stored in memory 02)

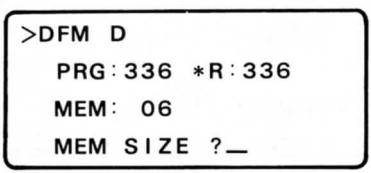
Example 6. [(−)] [(] [3] [+] [5] [)] [SM] [0] [3] [=]
Result = −8 (8 stored in memory 03)

Example 7. [(] [(−)] [(] [3] [+] [5] [)] [)] [SM] [0] [4] [=]
Result = −8 (−8 stored in memory 04)

When storing intermediate calculation results, be sure to specify the range of input by using parentheses, taking particular care when using the minus sign.

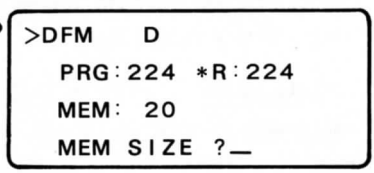
2. Expansion to 48 Memories

For calculations which cannot be executed with 6 memories, it is possible to expand the number up to 48. This operation is carried out in the DFM mode ([MODE] [3]). When the calculator is in this mode, the display is as shown in <I>.



<I>

When the F-300P displays the prompting for the number of memories, enter a 2-digit number between 06 and 48 (e.g. [2] [0]). The display will appear as shown in <II> to indicate that setting is complete. After returning to the RDY mode ([MODE] [1]), it will be possible to use 20 memories.



<II>

Note: Extended memories use the same memory area as the program function. Using more memories reduces the program area. For detailed information, see page 38.

3) Examples

Depress [MODE] [1] to set the RDY mode.

1. General Calculations

Expression	Operation	Display
(1)Addition		
$8+3+5.5=16.5$	8 [+] 3 [+] 5.5 [=]	>RDY D 8+3+5. 5= 16. 5
(2)Subtraction		
$3-5=-2$	3 [−] 5 [=]	>RDY D 3−5= −2
(3)Multiplication		
$3.6\times1.7=6.12$	3.6 [×] 1.7 [=]	>RDY D 3. 6×1. 7= 6. 12
(4)Division		
$592\div4.8$ $=123.3333333$	592 [÷] 4.8 [=]	>RDY D 592÷4. 8= 123. 3333333
(5)Mixed calculations		
$3.2+6.4\times2.8\div5.1$ $=6.71372549$	3.2 [+] 6.4 [×] 2.8 [÷] 5.1 [=]	>RDY D 3. 2+6. 4×2. 8÷5. 1= 6. 71372549
(6)Calculations with signs		
-6.5×20.2 $=-131.3$	[(−)] 6.5 [×] 20.2 [=]	>RDY D −6. 5×20. 2= −131. 3
(7)Exponential calculations		
$(1.23\times10^{23})\times(4.56\times10^{-44})=5.6088\times10^{-21}$	1.23 [EXP] 23 [×] 4.56 [EXP] [(−)] 44 [=]	>RDY D 1. 23E23×4. 56E−44= 5. 6088E−21
(8)Parentheses calculation		
$\{(4-3.6+5)\times8-6\}\times4.2=156.24$	[(] [(] 4 [−] 3.6 [+] 5 [)] [×] 8 [−] 6 [)] [×] 4.2 [=]	>RDY D ((4−3. 6+5)×8−6)×4. 2 =156. 24

2. Basic Function Calculations

Expression	Operation	Display
(1)Trigonometric functions		
$\sin 53°$ $=0.7966355101$	[DRG]→D [sin]53[=]	>RDY D SIN 53= 0. 7986355101
$\cos\frac{\pi}{6}^{RAD}$ $=0.8660254038$	[DRG]→R [cos] [(] [INV] [π/EXP] [÷] 6 [)] [=]	>RDY R COS (π÷6)= 0. 8660254038
$\tan 65^{GRAD}$ $=1.631851687$	[DRG]→G [tan]65[=]	>RDY G TAN 65= 1. 631851687
(2)Inverse trigonometric functions		
$\sin^{-1}0.3$ $=17.45760312°$	[DRG]→D [INV] [sin⁻¹/sin] [.]3[=]	>RDY D SIN⁻¹ .3= 17. 45760312
$\cos^{-1}0.8$ $=0.6435011088^{RAD}$	[DRG]→R [INV] [cos⁻¹/cos] [.]8[=]	>RDY R COS⁻¹ .8= 0. 6435011088
$\tan^{-1}1=50^{GRAD}$	[DRG]→G [INV] [tan⁻¹/tan] 1 [=]	>RDY G TAN⁻¹ 1= 50.
(3)Exponential functions		
$e^{22}=3584912846$	[e^x]22[=]	>RDY D e22= 3584912846.
$10^{2.3}=199.5262315$	[INV] [10^x/e^x]2.3[=]	>RDY D 10 2. 3= 199. 5262315

(4)Logarithmic functions

ln123 =4.812184355	[ln]123[=]	>RDY D LN 123= 4.812184355
log123 =2.089905112	[INV] [log/ln]123[=]	>RDY D LOG 123= 2.089905112

(5)Square and cube roots

$\sqrt{30}$=5.477225575	[√]30[=]	>RDY D √ 30= 5.477225575
$\sqrt{4.8+1.7}$ =2.549509757	[√][(]4.8[+]1.7[)][=]	>RDY D √ (4.8+1.7)= 2.549509757
$\sqrt[3]{16}$=2.5198421	[INV] [∛]16[=]	>RDY D ∛ 16= 2.5198421

(6)Squares and reciprocals

1.33^2=1.7689	1.33[x^2][=]	>RDY D 1.33²= 1.7689
$\frac{1}{123}$=8.130081301×10^{-3}	123[INV] [x^{-1}/$\sqrt{x}$][=]	>RDY D 123⁻¹= 8.130081301E-03

(7) Power calculation and multiple roots

$5.43^{3.2}$ =224.5739897	5.43[a^x]3.2[=]	>RDY D 5.43^3.2= 224.5739897
$\sqrt[2.8]{135}$ =5.765453699	2.8[INV] [$\sqrt[x]{a}$/$\sqrt[x]{a^x}$]135[=]	>RDY D 2.8^x √ 135= 5.765453699

(8) **Hyperbolic function**

sinh1.23 =1.564468479	[HYP] [sin] 1.23 [=]	>RDY D SINH 1.23= 1.564468479
cosh34 =2.917308713×10^{14}	[HYP] [cos] 34 [=]	>RDY D COSH 34= 2.917308713E14
tanh1.23 =0.8425793257	[HYP] [tan] 1.23 [=]	>RDY D TANH 1.23= 0.8425793257

(9) **Inverse hyperbolic functions**

$\sinh^{-1}1.5\times10^{25}$ =58.66323961	[INV] [HYP] [sin^{-1}] 1.5 [EXP] 25 [=]	>RDY D SINH^{-1}1.5E25= 58.66323961
$\cosh^{-1}1.5$ =0.9624236501	[INV] [HYP] [cos^{-1}] 1.5 [=]	>RDY D COSH^{-1}1.5= 0.9624236501
$\tanh^{-1}0.4$ =0.4236489302	[INV] [HYP] [tan^{-1}] [•] 4 [=]	>RDY D TANH^{-1}.4= 0.4236489302

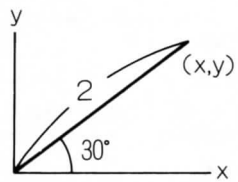
(10) **Factorials**

10 ! =3628800	10 [INV] [n!] [=]	>RDY D 10!= 3628800.

(11) **Sexagesimal-decimal conversion**

Decimal-sexagesimal conversion 123°45'06.78" →123.7518833°	123.450678 [°'"] [=]	>RDY D 123.450678°'"→= 123.7518833
2.3456° →2°20'44.16"	2.3456 [INV] [→°'"] [=]	>RDY D 2.3456→°'"= 2° 20' 44.16"

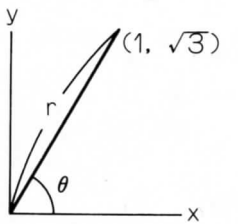
(12) Rectangular-polar coordinate conversion



x=1.732050808
y=1

1) DRG →D 2) INV P→R (−)	>RDY D R? P→R
3) 2 =	>RDY D θ? P→R 2=
4) 30 =	>RDY D P→R X=1. 732050808 Y=1.

(13) Polar-rectangular coordinate conversion



r=2
θ=60°

1) DRG →D 2) INV R→P (+)	>RDY D X? R→P
3) 1 =	>RDY D Y? R→P 1=
4) √ 3 =	>RDY D R→P θ = 60. R= 2.

- Coordinate conversion calculation results are automatically printed when a printer is attached.

3. Combined Calculations

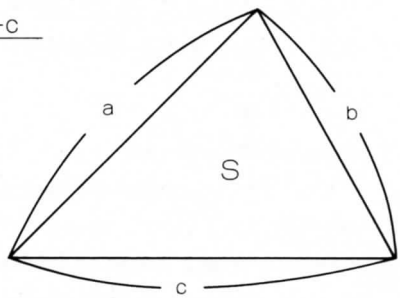
Expression	Operation	Display
(1) Logarithmic mean		
$\overline{L}=\frac{4-8}{\ln 4-\ln 8}$ $=5.770780164$	(4−8)÷(ln 4−ln 8)=	>RDY D (4−8)÷(LN 4−LN 8)= 5. 770780164
(2) Geometric mean		
$\overline{G}=\sqrt[3]{1.23\times1.48\times1.5}$ $=1.397717369$	3 INV $\sqrt[x]{\ }$ (or INV $\sqrt[3]{\ }$) (1.23×1.48×1.5)=	>RDY D 3^x √(1. 23×1. 48×1. 5)= 1. 397717369
(3) Trigonometric functions for angles using minutes and seconds		
cos76°54′32.1″ $=0.2264997296$	cos 76.54321 $a^{\circ\prime\prime}$ =	>RDY D COS 76. 54321°′″→ = 0. 2264997296
(4) Permutation, combination		
${}_5P_3=\frac{5!}{(5-3)!}=60$	5 INV $n!$ ÷ (5−3) INV $n!$ =	>RDY D 5!÷(5−3)!= 60.
${}_5C_3=\frac{5!}{3!\times(5-3)!}=10$	5 INV $n!$ ÷ (3 INV $n!$ × (5−3) INV $n!$)=	>RDY D 5!÷(3!×(5−3)!)= 10.
(5) The probability that 3 out of 4 times, a coin when tossed, will land heads up.		
${}_4C_3\times(\frac{1}{2})^4=0.25$	4 INV $n!$ ÷ (3 INV $n!$ × (4−3) INV $n!$) × 2 INV x^{-1} x^2 a^x 4 =	>RDY D 4!÷(3!×(4−3)!)×2^-1^4= 0. 25

The functions of the F-300P include the storage of algebraic expressions in the memory and the execution of calculations in which values are entered into variables. First, some examples.

1) Entering Algebraic Expressions into the Memory

1 **Example:** Calculate the area of a triangle using Heron's equation. The area (S) of the triangle shown at right can be expressed as:

$$S=\sqrt{s(s-a)(s-b)(s-c)} \qquad s=\frac{a+b+c}{2}$$



This is Heron's equation. Elements a, b, c, and s in the equation cannot be entered into the calculator as they are. With the F-300P, memories 01 to 06 are used for variables like these. Instead of the variables a, b, c, and s, use [RM] 01, [RM] 02, etc. By pressing the [SM] or [M+] key during the calculation, it is possible to automatically assign intermediate results to the variables. The actual procedures are as follows.

Since s is the value that will be calculated, this variable will be used frequently. We will assign it to memory 04.

s = (([RM] 01 + [RM] 02 + [RM] 03) ÷ 2) [SM] 04

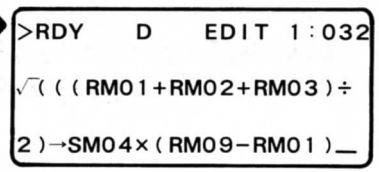
([RM] 01 – [RM] 03 correspond to a, b and c in the above equation respectively.)

Assemble the expression using this function. To calculate area S:

$$S=\sqrt{(\underbrace{([RM]01+[RM]02+[RM]03)\div 2}_{s})\ [SM]04\times(\underbrace{[RM]04-[RM]01}_{s-a})\times(\underbrace{[RM]04-[RM]02}_{s-b})\times(\underbrace{[RM]04-[RM]03}_{s-c})}$$

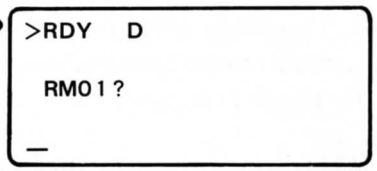
s is stored in memory 04

Let's use this in an actual calculation. First press [EDIT] [1] (program no. 1) in the RDY mode (see <I>). Enter the expression above as it is written. The number shown in the upper right-hand corner of the display increases by one each time a key is pressed. This figure indicates the number of steps making up the program. The final [=] key can be omitted.

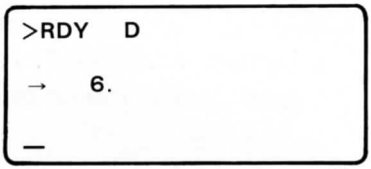


<I>

Pressing [PRG] starts execution. The prompting "RM01?" will appear as shown in <II>. Let's enter [5] [=] for variable a. Respond to "RM02?" and "RM03" in the same way by entering 4 [=] and 3 [=]. Next the prompting "RM04?" will appear. Since values stored during programming will be used for this, we simply press the [=] key. The result will be displayed as shown in <III>. To run the program again, enter [PRG] [1].



<II>



<III>

2 Program Auto Repeat

Calculation expressions stored in this way can be accessed any time by simply entering the program number. When using the same expressions to process large amounts of data, however, it is inconvenient to run the program repeatedly by entering [PRG] [1]. The F-300P features an auto repeat function to solve this problem.

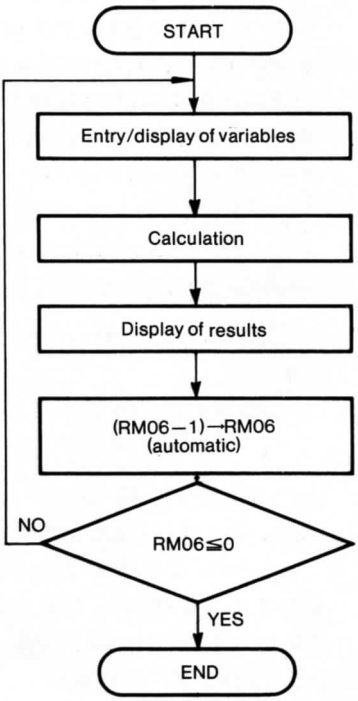
(1) Enter the number of repetitions

Memory 06 functions as the F-300P's counter during program calculations. Each time the program is completed, the value in memory 06 is decreased by 1. The program repeats until this value is 0 or less (see the diagram at the right).

If S will be calculated using Heron's equation with 10 sets of data, we first store the value 10 to memory 06.

[1] [0] [SM] [0] [6] [=]

Then execute by pressing [PRG] [1]. Each time a calculation is completed the display will revert from <III> to <II> and the prompting for data input will be displayed. After 10 repetitions, the operation will end.

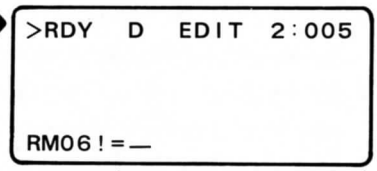


Program Flow

(2) Using the counter memory as a variable

Although memory 06 has a special counter function, it can also be used like the other memories as a variable for an algebraic expression. The simplest example of this would be:

(☞) (EDIT 2)
RM 0 6 INV n! = =
(PRG)



(Factorial calculation program)

The calculator will first display the prompting "RM06?". If we enter 10, for example, and then simply press the = key repeatedly, the results are displayed in succession (10!, 9!, 8!.....1!). In addition to functioning as a counter, the value in RM06 can also be used in a calculation expression.

Key Operations during Program Repetitions

Promptings (e.g. "RM03?") are displayed to tell you to input values for the variables (memories). To input a new value, enter (new value) = . To use the value already in the memory, simply depress = . To stop a repeating program, depress C .

To stop program execution, depress the C key. If the mode is changed to EDIT during program execution without depressing the C key, the ALPH key may not function. When this happens, depress the C key and then change the mode to EDIT.

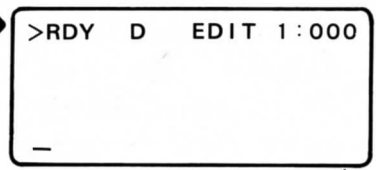
2) Programmed Calculation Functions

1 Programmed Calculation Procedures

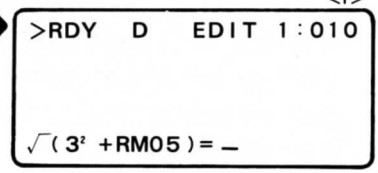
In the preceding pages you have seen some actual examples of programmed calculations. We will now examine the procedures and functions involved in greater detail. Programmed calculations are executed in the RDY mode (MODE 1).

(1) Program Entry (EDIT sub-mode)

After depressing the EDIT key, enter a number between 1 and 7 (<I>). Since the F-300P can store up to 7 algebraic expressions, each must be assigned a number in the same way as the memories. Enter the calculation expression in exactly the same way as for general calculations (<II>).



<I>



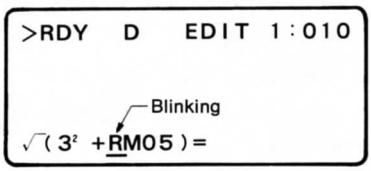
<II>

- The counter is displayed in the upper right-hand corner of the display to indicate the number of steps in the program. One key operation is equivalent to one step. (Keys like [INV] are not included.) All the memories combined can hold calculation programs with a maximum of 336 steps. A single program of 336 steps is also possible, so long calculation expressions that would cause the line buffer to overflow in the general calculation mode can be executed using the program memories.
- Memories 01 to 06 can be used as variables. When they are used in programs, the calculator will display promptings like "RM01?" each time the program is executed, so that you can input values for the variables. Memory 06 also functions as a repetition counter.
- The memory area used for storing programs is independent of the line buffer. However, the line buffer is cleared when values are input during the execution of programs using memories 01—06.

(2) Program Editing (EDIT Sub-Mode)

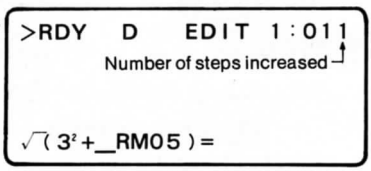
Programs stored in the memory can be edited at any time except during execution.

Access the program you want to edit by entering [EDIT] [1] — [7] . This procedure is not required when editing programs currently being entered.



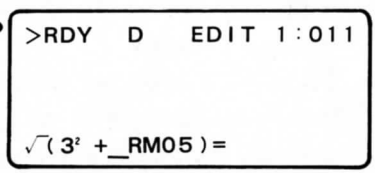
[←][←][←][←][←] : Move the cursor

Move the cursor using the edit keys ([↥][↧] [←][→]) to add, delete, and correct values, etc. <III> shows the procedures for inserting a minus sign into the expression shown in <II> on previous page.



[INV] [INS/→] : Create a space for the insertion.

- When an edited program is accessed, the contents are scrolled up a line at a time on the display. To stop the scrolling, press the [EDIT] key. Please note that since the step number display also stops simultaneously, it does not necessarily indicate the total number of steps taken up by the program. Moreover, additions or deletions to the program will increase or reduce the number of steps accordingly.



[(−)] : Insert a minus sign. <III>

(3) Program Execution (PRG Sub-Mode)

For programs already stored, press [PRG] followed by the number of the program ([1] – [7]).

A program being entered or edited (EDIT Sub-Mode) can be executed simply by pressing [PRG] . During execution, the letters PRG are displayed on the message line (<IV>).

<IV>

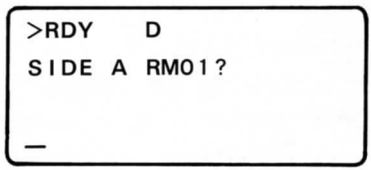
When the printer is in use, the values input into variables RM01 to RM06 and the results of the programmed calculation will be automatically printed out. This is very useful for subsequent studies of the results.

Entering Alphabetic Characters

Comments consisting of alphabetic characters can be inserted into programs to make data input and results more readily understood. With the Heron's equation program on page 33, for example, inserting the following characters results in the display shown in <V>.

$\sqrt{\ }$(((ALPH 3 S 9 I x^2 D e^x E CN SP $a^{b/c}$ A ALPH

RM 01+ .....



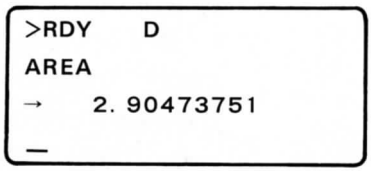
<V>

It is clear at a glance that the item currently being entered is side A.

Inserting the following characters after the [=] sign scrolls the answer down one line on the display as shown in <VI>.

=ALPH SUM / $a^{b/c}$ A 2 R e^x E $a^{b/c}$ A ALPH

↑ specifies new line



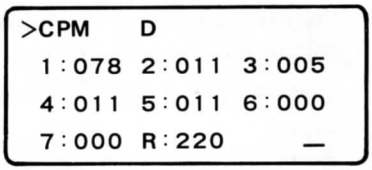
<VI>

When using numbers, parentheses and mathematical symbols in messages, use the [INV] key in the Alphabet Mode. Numbers and symbols entered in this way do not affect the calculations.

Example: Entering ALPH $\sqrt[x]{\ }$ F INV (–) INV 3 INV 0 INV 0 $\div$ P ALPH displays the word F-300P.

2 Clearing Programs and Memories

Programs and memories are cleared in the CPM mode (MODE 2). In this mode the display contains the following information:

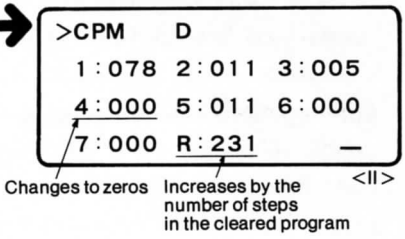


<I>

Numbers 1—7 : The number of steps in each program

R : The number of program steps still available for use

Input the number of the program you want to clear (1 — 7). To clear the contents of the entire memory, press • (the decimal point). Pressing 4 when the display is as shown in <I>, produces display <II>, confirming that the specified memory has been cleared.



<II>

Note: To clear individual memories, (e.g. memory 01), press the following keys in the RDY mode:

0 SM 0 1 =

3 Memory Expansion

It is possible to increase the number of memories used during programmed calculations. However, extended memories numbered higher than 07 cannot be used as variables. Instead, they function as constants, usually on the basis of values entered beforehand.

Examples: **Entering a value into a variable**

When the prompting "RM01?" is displayed, it is possible to enter the contents of memory 08 into the variable by pressing RM 0 8 . The value in memory 08 is then stored in memory 01.

Using the contents of a memory as a constant in an expression

In the Heron's equation on page 33, a value was specified for memory 04 in the expression and no other input was necessary. Instead of memory 04, memory 07 or 08, etc. can be used in the program.

Memory expansion is carried out in the DFM Mode ([MODE] [3]).
See <III>.

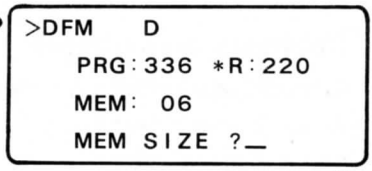
The contents of the display are as follows:

PRG: Number of steps in the program area

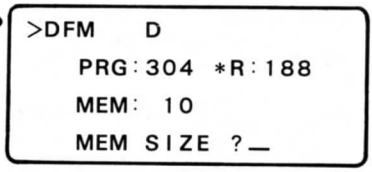
*R : Number of steps available for use in programs

MEM: Number of memories

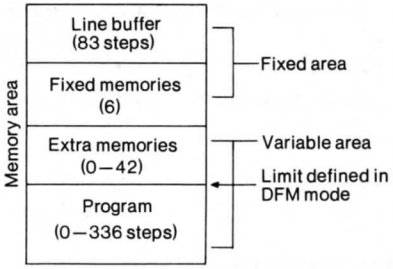
If you intend to use 10 memories, enter [1] [0] to produce the display shown in <IV>. The program area is reduced in direct proportion to the increase in the number of memories, since memories and programs share the same memory area. This relationship is shown in the diagram on the right. For each extra memory, the program area is reduced by 8 steps. Using too many memories may leave insufficient area for storing programs.



<III>



<IV>



1 memory = 8 steps

4 Functions That Cannot Be Used during Programming

Almost all the functions of the F-300P can be used for programmed calculations. However, the following keys may not be used.

(1) Coordinate conversion keys (R→P, P→R)

(2) Statistical keys

The following are not valid in the EDIT sub-mode.

(1) Clear key

(2) CN key

(3) Print key (The screen copy function can be used — [INV] [SCPY PRINT])

3) Applied Examples

Set out below are some examples of program applications.

Financial: Loan Calculations

Calculate equal monthly payments (PMT) on a loan of PV dollars over N years at an annual interest rate of I%.

Calculation expression:

$$PMT = PV \times \frac{i}{1-(1+i)^{-n}}$$

where

$$i = \frac{I}{12 \times 100} \quad \text{(interest per month)}$$

$n = N \times 12$ (number of months)

Preparation of variables and memory:

Principal	PV	RM01	[ALPH] [÷] [2] [9] [6] [√] [9] [÷] [$a^{b/c}$] [4] [ALPH] [RM] 01 P R I N C I P A L
Annual Interest	I	RM02	[ALPH] [9] [6] [+] [e^x] [2] [e^x] [3] [+] I N T E R E S T [INV] [(] [EXP] [INV] [)] [ALPH] [RM] 02 Y
Period	N	RM03	[ALPH] [÷] [e^x] [2] [9] [×] [x^2] [ALPH] [RM] 03 P E R I O D

Key operations:

[EDIT] [3] (Could be any number between 1—7)

[ALPH] [÷] [2] [9] [6] [√] [9] [÷] [$a^{b/c}$] [4] [ALPH] [RM] 01 [×] [(] [ALPH]
P R I N C I P A L

[9] [6] [+] [e^x] [2] [e^x] [3] [+] [INV] [(] [EXP] [INV] [)] [ALPH] [RM] 02 [÷] 12
I N T E R E S T Y

00 [÷] [(] 1 [−] [(] 1 [+] [RM] 02 [÷] 1200 [)] [a^x] [(] [ALPH] [÷] [e^x] [2]
P E R

[9] [×] [x^2] [ALPH] [(−)] [RM] 03 [×] 12 [)] [)] [)] [=] [ALPH] [5] [×] [INV] [▪]
I O D M O

[CN] [÷] [5] [+] [INV] [▪] [ALPH]
SP P M T

(76 steps)

Execution:

When the principal: $10,000, annual interest rate: 9%, payment over 10 years.

Step	Display (before entry)	Key operation	Display (after entry)
1		[INV] [INT/CN]	
2		[PRG] ([3])	
3	PRINCIPAL RM01?	10000 [=]	10000
4	INTEREST(Y) RM02?	9 [=]	9
5	PERIOD RM03?	10 [=]	10
6	MO. PMT. → 126. (Result)		

- Set the integer sub-mode before program execution.

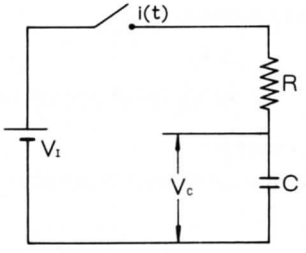
To do the same calculation with an interest rate of 11%, press [PRG] [3] again. Since the principal and the period remain the same, simply press [=] for steps 3 and 5. At step 4, when the prompting "INTEREST (Y) RM02?" appears, change the rate by entering 11 [=] . The result at step 6 will change to 137, indicating the monthly payments required with an annual interest rate of 11%.

Electrical

Calculate the Vc of the circuit on the right after t time has elapsed.

Calculation expression:

$V_C = V_I(1 - e^{-\frac{t}{RC}})$



Preparation of variables and memory

Power source voltage	Vi (V)	RM01
Time	t (ms=10^{-3}s)	RM02
Resistance	R (Ω)	RM03
Condensor	C (μF=10^{-6}F)	RM04

Key operations:

[EDIT] [4]

[ALPH] [0/V] [9/I] [ALPH] [RM] 01 [×] [(] 1 [−] [e^x] [(−)] [(] [ALPH] [+/T] [ALPH] [RM] 02 [×] [INV] [10^x/e^x] [(−)]

3 [÷] [(] [ALPH] [2/R] [ALPH] [RM] 03 [×] [ALPH] [√/C] [ALPH] [RM] 04 [×] [INV] [10^x/e^x] [(−)] 6 [)] [)] [)]

[ALPH] [0/V] [√/C] [PRG/:] [ALPH]

(41 steps)

Execution:

When Vi=100V, t=56ms, R=1.5kΩ, C=50μF

Step	Display (before entry)	Key operation	Display (after entry)
1		PRG (4)	
2	VI RM01?	100 =	100
3	T RM02?	56 =	56
4	R RM03?	1.5 EXP 3	1.5 E 3
5	C RM04?	50 =	50
6	VC: → 52.60562649 (Result)		

Scientific

Calculate the pH of a liquid with a hydrogen ion density of H (moles/liter).

Calculation expression:

$$pH=\log\frac{1}{H}$$

Preparation of variables and memory:

H (moles/liter): RM01

Key operations:

EDIT 5

INV log/ln ALPH 8/H ALPH RM 01 INV x^{-1}/x^2 ALPH ÷/P 8/H PRG/: ALPH (9 steps)

Execution:

With a hydrogen ion density of 4.3×10^{-4} moles/liter, the pH will be:

Step	Display (before entry)	Key operations	Display (after entry)
1		PRG (5)	
2	H RM01?	4.3 EXP (−) 4 =	4.3 E −4
3	PH: → 3.366531545 (Result)		

1) One-Variable Statistical Mode (ST-1)- MODE 4

1 Data Entry, Calculation

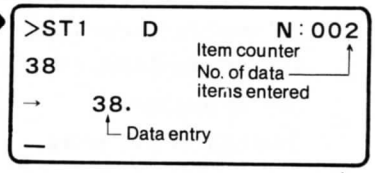
Example: Calculate various statistical values from the table on the right. Key operations are as follows:

	1	2	3	4	5	6	7	8
Class	36	38	40	42	45	47	49	50
Frequency	1	1	5	4	8	2	3	1

(1) Single data:

36 SUM
38 SUM

Press the SUM key after entering each data item. After 38 SUM has been entered, the display will be as shown in <I>.



<I>

(2) Multiple occurrences of the same data:

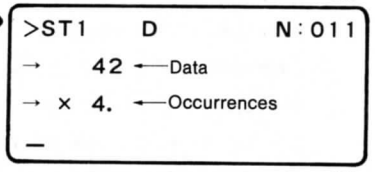
40 × 5 SUM
42 × 4 SUM

To multiply the data by the number of occurrences, press (data) × (frequency) SUM . The display will be as shown in <II>. It is also possible to enter:

42 SUM = SUM = SUM = SUM

Subsequent data are entered in the same way (45 × 8 SUM ····· 50 SUM).

If an optional printer is attached, the data will be printed out as it is entered.

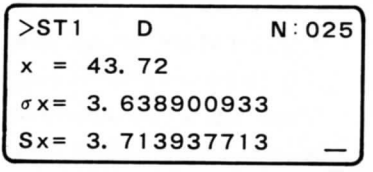


<II>

(3) Calculating statistical quantities:

STAT

The mean ($\bar{x}$), population standard deviation (σx) and sample standard deviation (Sx) are automatically calculated and displayed as shown in <III>. The following keys are used to display individual amounts:



<III>

INV $\frac{\bar{x}}{7}$ x Mean value

INV $\frac{\sigma x}{9}$ x Population standard deviation

INV $\frac{Sx}{8}$ x Sample standard deviation

The basic statistical values are stored in memories 01—03. These can be accessed but not altered using [SM] or [M+].

[RM] 01 Number of data items n

[RM] 02 Sum of data Σx

[RM] 03 Square sum of data Σx^2

(4) Adding new data

New data can be entered after the above operations have been carried out.

(5) Deleting or correcting data

Corrections during entry (before [SUM] is pressed)

Use the edit keys.

Corrections after entry

Delete using [INV] [DLT/SUM] and enter the new data.

Example 1: 48 [INV] [DLT/SUM] Deletes 1 data item of value 48.

Example 2: 53 [×] 2 [INV] [DLT/SUM] Deletes 2 data items of value 53.

Make sure that the item counter on the display reflects the deletion. When a printer is being used, an asterisk is printed in front of the data item to indicate that it has been deleted.

(6) Clearing the ST1 Mode

To execute a new total, press [MODE] [4]. All previous statistical values will be cleared. The calculator cannot be cleared using the [C] key.

2 Calculations in the ST1 Mode

With the exception of the following functions, operations can be carried out in this mode in exactly the same way as in the RDY mode.

- Coordinate conversions (R→P, P→R)
- Programmed calculations
- Calculations which involve storing values in memories 01—03. (The F-300P uses these memories exclusively for statistical calculations.)

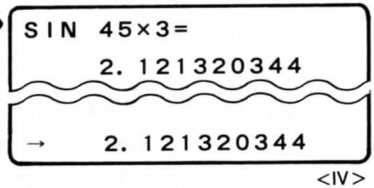
The results of calculations can be used as statistical data and statistical values can be used in other calculations.

(1) Using calculated values as statistical data

Example: Enter sin 45 × 3

[sin] 45 [×] 3 [=]

[SUM] (Display IV)



<IV>

The value that will be entered is always obtained using the [=] key. If the [SUM] key is pressed instead of the [=] key, the F-300P may not function correctly. (This is because [×] is used as a data counter in the ST1 mode.)

(2) Using statistical values in calculations

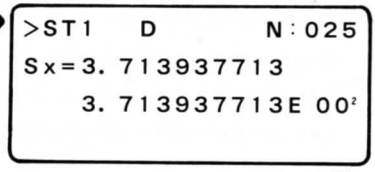
Example: Use the data in the preceding section to calculate the unbiased variance (unbiased variance = $(Sx)^2$).

Following data entry:

[INV] [$\frac{Sx}{8}$] (calls Sx)

[x^2] (Display <V>)

[=] (Result = 13.79333334)



<V>

Remember that general calculations of this type are not printed automatically. To print, use [PRINT] [(−)] , etc.

2) Two-Variable Statistical Mode (ST2)- [MODE] [5]

1 Data Entry, Calculations

	1	2	3	4	5	6	7	8
xi	1.6	1.8	2.5	3.3	3.7	4.1	4.9	5.1
yi	3.2	4.0	4.8	4.9	7.5	7.8	9.7	11.5

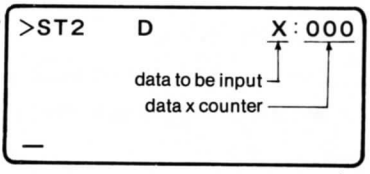
Example: Calculate the gradient and intercept of the regression line and the correlation coefficient of the data shown in the table at right.

(1) Enter data x_1

The initial display is as shown in <I>.

1.6 [SUM]

The display changes as shown in <II> and a prompting appears for the input of the y data.



<I>

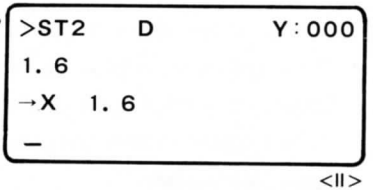
(2) Enter data y_1

3.2 [SUM]

The calculator will display a prompting for the input of another x data. (<III>)

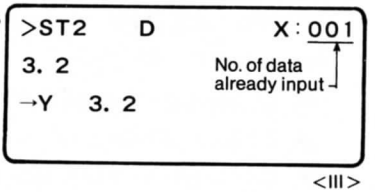
Enter the data in succession —

1.8 [SUM] ····· 11.5 [SUM] as before.



<II>

- The (data) × (frequency) [SUM] format in the ST1 mode cannot be used. For example, the result of 45 [×] 8 [SUM] would be treated as a single data item (answer: 360).

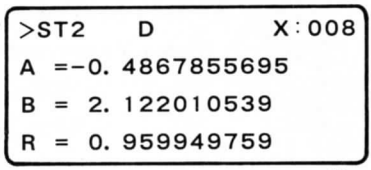


<III>

(3) Calculate the statistical quantity

STAT

The intercept A, gradient B, and correlation coefficient R of the regression line ($y=A+Bx$) will be displayed simultaneously (<IV>). Other statistical quantities can be obtained by the following key operations.



<IV>

INV $\bar{x}$ (7) , INV $\bar{y}$ (4) Mean values for x and y

INV S_x (8) , INV S_y (5) Sample standard deviation for x and y

INV σ_x (9) , INV σ_y (6) Population standard deviation for x and y

INV RR (1) Multiple correlation

INV S^2_{xy} (2) Sample covariance

INV σ^2_{xy} (3) Population covariance

- A, B, and R values can also be obtained for each INV A (0) , INV B (.) , INV R (−) . In this mode, basic statistical values are stored in memories 01 —06.

This mode offers estimation functions for linear regression lines obtained through totaling.

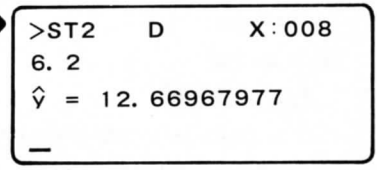
Example: Estimate y from the example in the preceding section when x=6.2.

6.2 INV $\hat{y}$ (1)

The result is displayed as shown in <V>. (The same procedure is used when estimating $\hat{x}$ from the value of y.)

When the printer is used, the value of x (or y) and the estimated value are printed out automatically.

The basic statistical values are stored in memories 01 —06.



<V>

RM 01 Number of data (Xi, Yi = 1 pair)

RM 02 Sum of x data Σx

RM 03 Square sum of x data Σx^2

RM 04 Sum of y data Σy

RM 05 Square sum of y data Σy^2

RM 06 Sum of product of x,y data Σxy

(4) Deleting or correcting data

Corrections during input (before depressing [SUM]):

Use the edit keys.

Corrections after input:

To delete x data immediately after input: [INV] [DLT/SUM] (Reinput of X data is not needed)

To delete y data after input: (x data) [INV] [DLT/SUM] , (y data) [INV] [DLT/SUM]

(Always delete data in x, y pairs.)

Next enter the correct data. Deleted data are displayed with ∗ .

(5) Clearing in the ST2 Mode

The procedure is the same as for ST1. Enter [MODE] [5] again. The calculator cannot be cleared with [C] .

2 Calculations in the ST2 Mode

As in the ST1 mode, it is possible to carry out general calculations. However, memories 01 through 06 are used exclusively by the calculator. For memory calculations, first set up extended memories in the DFM mode. (Refer to the note on page 20.)

Combinations with general calculations permit applied statistical calculations such as those shown on page 48.

3) Other Statistical Calculation Functions

1 Input Ranges and Calculation Precision

The precision of calculations in the ST1 and ST2 modes is determined by the RDY mode. However, since square calculations are carried out internally, the range of input data is: $-1 \times 10^{50} <$ input data $< 1 \times 10^{50}$

(1) When there are data with many digits:

Calculating the data as it is may cause a cumulative calculation error. Greater accuracy can be obtained if appropriate steps (e.g. taking a dummy average) are carried out beforehand.

(2) When errors occur:

Either use [EDIT] [•] to call up the line buffer and correct the erroneous data or clear the data by pressing [C] . Data entered prior to the error are not affected and the calculation can be continued without reinput.

2 Clearing the Statistical Calculation Formula Memory

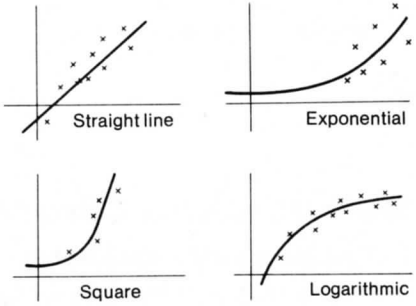
(1) When shifting from another mode into the ST1 or ST2 mode automatically clears memories 01 through 03 (ST1) and 01 through 06 (ST2).

(2) When shifting from ST1 or ST2 into another mode, the contents of all memories are retained, allowing calculations using basic statistics.

	ST1	ST2
RM01	n	n
RM02	Σx	Σx
RM03	Σx^2	Σx^2
RM04		Σy
RM05		Σy^2
RM06		Σxy

3 Calculation of Exponential Regression, Logarithmic Regression, and Power Regression

This calculator performs linear regression calculations for two variables in the ST2 mode. This allows the extent of the proportional relationship between two variables to be found. Depending on the data, it might be that while there is no simple proportional relationship, there is an proportional relationship when taking the logarithms of data (see figures at right).



The ST2 mode can be applied to regression calculations like these.

Taking exponential regression as an example, the formula for a regression curve is:

$$y = ae^{bx}.$$

Taking the logarithms of both sides, we get:

$$\ln y = \ln a + bx.$$

If $\ln y = Y$ and $\ln a = A$, then the formula for the regression line is:

$$Y = A + bx.$$

If the data pair x and ln y are input and calculated in the ST2 mode, it is possible to derive $A = \ln a$, b, and the formula's correlation coefficient r.

x	1.23	2.31	3.51	.....
y	523	492	617	.....

For example, using the data at right, the procedure is:

1.23 [SUM] , [ln] 523 [SUM]

2.31 [SUM] , [ln] 492 [SUM]

⋮

Depressing the [STAT] key causes A, b, and r to be calculated, allowing a to be found using the formula:

$$A = \ln a \ (a = e^A)$$

A is stored temporarily in the memory by using the operation [INV] [A/0] [SM] 07 [=] , which is followed by the operation [e^x] [RM] 07 [=] . (It is not possible to obtain the result directly using [e^x] [INV] [A/0] .)

Calculations of the estimate values are as follows:

- Estimate the value $\hat{y}_i$ from x_i: Obtain $\hat{Y}_i$ by inputting x_i.
  Calculate $\hat{y}_i$ using $\hat{y}_i = e^{\hat{Y}_i}$.
  (In this case, $\hat{Y}_i$ must be stored in the memory temporarily.)
- Estimate the value $\hat{x}_i$ from y_i: Obtain $\hat{x}_i$ by inputting $\ln y_i$.

Other regression calculations are performed in the same way (see table below). The question of which data is closest to which form of regression analysis is determined by comparing the correlation coefficients obtained in each case.

However, since these are all quantitative evaluations, it is advisable to take qualitative factors into consideration, too, when performing actual regression analysis.

Regression type	Regression formula	Model formulas	Input data pairs	a	b	r	Calculation of estimated value
Line	$y=a+bx$	—	(x, y)	a	b	r	Input xi→$\hat{y}$i Input yi→$\hat{x}$i
Exponential	$y=ae^{bx}$	$\ln y=\ln a+bx$ $Y = A + bx$	(x, ln y)	e^A	b	r	Input xi→$e^{\hat{Y}i}$ Input lnyi→$\hat{x}$i
Logarithmic	$y=a+b\ln x$	$y=a+b\ln x$ $y = a + bx$	(ln x, y)	a	b	r	Input lnxi→$\hat{y}$i Input yi→$e^{\hat{x}i}$
Power	$y=ax^b$	$\ln y=\ln a$ $+b\ln x$ $Y = A + bX$	(ln x, ln y)	e^A	b	r	Input lnxi→$e^{\hat{Y}i}$ Inputlnyi→$e^{\hat{x}i}$

7 Appendix

1) Value Stacks and Operator Stacks

The F-300P is capable of executing calculations in response to key operations specified in expressions which may include values, parentheses, and functions. For this reason, a temporary storage area is necessary to hold values and operators that have low priority in expressions. Storage areas of this type are called stacks. The F-300P has value and operator stacks, the functions of which are given in the following table.

Example: Calculate $18-6\div(\cos 60+3\div 2)^2=$ (Specified angle = D)

When the [=] key is pressed this expression is recalled from the line buffer and the calculation proceeds as shown below.

	From LB	* X	Contents of calculation	Value stack						Operator stack					
				Level 1	Level 2	Level 3	Level 4	Level 5	.....	Level 1	Level 2	Level 3	Level 4	Level 5	.....
1	18	18	(LB)												
2	−	18	↓	18						−					
3	6	6	(LB)	18						−					
4	÷	6		6	18					÷	−				
5	(	6		6	18					(	÷	−			
6	cos	6	↓	6	18					cos	(	÷	−		
7	60	60	(LB)	6	18					cos	(	÷	−		
8	+	0.5	cos60°	6	18					+	(	÷	−		
9	3	3	(LB)	0.5	6	18				+	(	÷	−		
10	÷	3	↓	0.5	6	18				÷	+	(	÷	−	
11	2	2	(LB)	3	0.5	6	18			÷	+	(	÷	−	
12	)	1.5	3÷2	0.5	6	18				+	(	÷	−		
13		2	0.5+1.5	6	18					÷	−				
14	2	4	2^2	6	18					÷	−				
15	=	1.5	4÷6	18						−					
16		16.5	18−1.5												
17		(Display)	(END)												

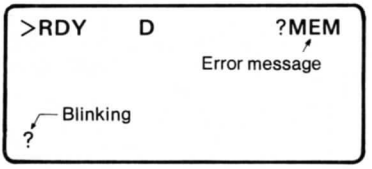
* X: X register — a storage area for calculation expressions.

The F-300P has 8 levels of value stacks and 16 levels of operator registers. In parentheses calculations, for example, this means that up to 16 pairs of parentheses can be entered provided that the number of levels in the value stack doesn't excede 8.

2) Error Messages

1 Display and Processing of Errors

The F-300P responds to illogical operations and other tasks which cannot be processed internally by displaying error messages. All subsequent calculations are halted. The display appears as shown below.



Errors like these are handled as follows:

1) General and statistical calculations
   (1) Clear the memory by pressing the [C] key and reenter the expression.
   or
   (2) Display the contents of the line buffer (the calculation expression which caused the error) using [EDIT] [•]. Use the edit keys to correct the expression
   And then continue the calculation.
2) Programmed calculations
   - Use [EDIT] [1] — [7] to display the program which contains the error. Use the edit key to correct the program and then execute it again using [PRG].

The explanations of the various error messages are given on the following pages.

2 Syntax Errors

Errors relating to the way the calculation formula is written.

Display	Content and Cause	Examples and Possible Solution
?SY−	(−) (sign key) syntax error	1-5 Change to a subtraction sign.
?SYN1	Syntax error relating to value (1) (0−9, .)	π3 Insert a multiplication sign.
?SYN2	Syntax error relating to value (2) (π, RM)	(5+1)π Insert a multiplication sign. (abbreviated multiplication is only permitted with <value (1) or 2>x<value (2) >)
?SY( )	Syntax error relating to parentheses	(9+3(= Change to a close parenthesis.
?SYF1	Syntax error relating to F1 (value-suffix functions)	2SIN30 Insert a multiplication sign before [sin] .
?SYF2	Syntax error relating to F2 (value-prefix functions)	SIN^{2}30 Change to (SIN 30)^2
?SYF3	Syntax error relating to F3 (2-value functions)	2 × + 1 Remove one of the signs or insert a value between signs.
?SYF4	Syntax error relating to =, SM and M+	3+SM01 Remove the + sign or insert a value in front of it

3 Errors Relating to Formula Operations

These errors most commonly occur when the calculator is asked to calculate with values other than those defined in the formula. Be careful when using combined functions.

Display	Contents and Cause
?SCT	Errors relating to trigonometrical, hyperbolic, inverse trigonometric, and inverse hyperbolic functions 1) SIN, COS, TAN outside input ranges 2) x values entered for SIN^{-1}, COS^{-1} result in $\|x\|>1$ 3) When the x value entered for SINH results in $x<-227.9559242$ 4) When the x value entered for $COSH^{-1}$ results in $x<1$ 5) When the x value entered for $TANH^{-1}$ results in $\|x\|>1$
?$\sqrt{\ }$	Errors relating to $\sqrt{\ }$ when $\sqrt{x}$ is attempted for $x<0$
?^$\sqrt{\ }$	Definition range errors relating to a^x and $\sqrt[x]{\ }$ 1) a^x when $a=0$ and $x<0$ 2) a^x or $\sqrt[x]{a}$ when $a<0$ 3) $\sqrt[x]{a}$ when $x=0$
?R	When the radius value R entered for P→R conversion is negative.
? ° ′ ″	When an attempt is made to execute a decimal operation after sexagesimal conversion
?LN	Definition error relating to LN, i.e., when the x value entered for lnx results in $x\leqq 0$
?LG	Definition error relating to LOG i.e. when the x value entered for logx results in $x\leqq 0$
?!	Definition errors relating to n! 1) $n<0$ or $n>69$ 2) n is not a natural number
?÷0	$x\div 0$ Less than two pairs of input data in ST2 mode
?0VF	Results or intermediate results out of the calculation range 1) When the exponent $\geqq 100$ 2) e^x when $x>230.2585093$ 3) a^x or $\sqrt[x]{a}$ when the exponent $\geqq 100$ 4) When TAN θ results in ∞ 5) When SINH and COSH exceed input ranges 6) Statistical input with an exponent $\geqq 50$ (squares executed internally)
?10	10^x When the input value is $\|x\|\geqq 100$

4 Other Errors

Listed below are errors relating to stack utilization and printer operation.

Display	Contents and Cause
?STK	Overflow in the value or operator stack. Causes include an excessive number of parentheses in parentheses calculations. For information on stacks, refer to page 50.
?MEM	Errors relating to the memory. Possible causes include failure to specify a memory number with RM, SM, M+ or the specification of a non-usable memory. 1) Specify a memory using a 2-digit value between 01 and 48. 2) Memories 07 through 48 can only be used after the number of memories has been expanded in the DFM mode. 3) In the statistical modes, memories 01 through 03 (ST1) and 04 through 06 (ST2) are used for internal calculations. These memories can be used with RM but cannot be used with SM or M+ keys.
?OVFN	This error message appears if the number of data input in one of the statistical modes exceeds 1,000. ST1 and ST2 can handle up to 999 data items.
?PRNT	Printer-related errors: Press the [C] key also to clear this error. 1) Errors may occur when the printer's batteries run down. Use after recharging. 2) Errors may occur when the print key ([PRINT] [1] , [PRINT] [(−)] or etc.) is depressed after the printer connection check is performed and then the printer's power switch is turned OFF or the printer cable is disconnected.

3) Connecting the Canon Thermal Printer X-711 (Optional)

1 Connecting the Printer

An optional thermal printer (Canon Thermal Printer X-711) can be connected to the F-300P. This device will print not only calculation expressions and results, but also comments and programs, and can provide hard copies of the contents of the display screen. Attaching this printer greatly extends the F-300P's range of applications.

Before printing

Connecting the printer cable

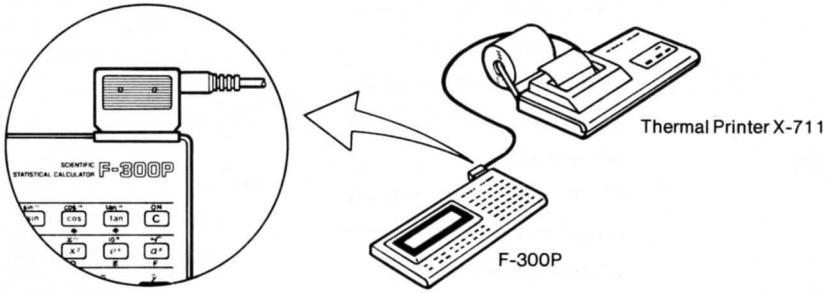
① Make sure that printer's power switch is turned OFF.

② Remove the connector cap attached to the F-300P.

③ Leave the F-300P's power switch ON (green) and connect the cable to the printer connector.

④ Turn the printer's power switch ON.

⑤ Press the [C] key with the display ON.
(When the display is OFF, press the [C] key twice.)



Printer connection check

The F-300P has a function that checks the printer connection.
Press the [C] key as described in step ⑤ above to perform this check. This check should be performed:

1) After the printer cable is connected or reconnected
2) When the print key ([PRINT] [1], [PRINT] [(−)] or etc.) does not produce a printout even though the power switch of both the F-300P and the printer are ON.

(The [MODE] key has the same function as the [C] key.)

- Do not turn the F-300P's power switch ON and OFF when the printer's power switch is ON. This may cause meaningless characters to be printed.

- Do not press the reset key or check key on the printer during printing. This may cause misprinting.

- The calculation results of coordinate conversion, input data and results of programmed calculations, and input data and statistical values in the statistical mode are automatically printed.

Read the instructions included with the printer carefully.

2 Print Commands

The key operations used to control printing fall into 3 categories.

(1) [PRINT] This key is used to print calculation expressions and comments, calculation results, and programs.

- [PRINT] — [0] Prints calculation results. (1)
- [PRINT] — [.] Prints the contents of the line buffer, including calculation expressions, comments, etc. (2)
- [PRINT] — [(−)] Prints the contents of the line buffer and calculation results. (3)
- [PRINT] — [1] — [7] Prints calculation expressions stored in the seven program memories.

(2) [NWS] Sets the size of the print characters. N, W or S is displayed on the message line.

N: Normal (20 characters/line)

W: Wide (10 characters/line)

S: Small (45 characters/line)

Note: ♦♥♠♣ are printed only when N (normal) is set.

(3) [INV] [SCPY PRINT] The entire contents of the display are printed when this key is pressed. The size of characters is slightly smaller even with 20 characters/line.

<Printout>

```
LB
√3-1×6π-LOG 8=          (2)
 9.979706198            (1)   (3)

PRG-1
?(((SIDE ARM01+SIDE
BRM02+SIDE CRM03)÷2)
→SM04×(RM04-RM01)×(R
M04-RM02)×(RM04-RM03
))=AREA

N:LB
12345678901234567890
12345678901234567890
1234567890
W:LB
1234567890
1234567890
1234567890
1234567890
1234567890
S:LB
123456789012345678901234567890123456789012345
678901234567890

>RDY * D
♦ ♦ ♥ ♦♦ ♣ ♦ ♦
♦ ♦ ♥      ♦
♦ ♦ ♥ ♦♦ ♣ ♦ ♦
```

- To stop printing, press the [C] key.
- The minus sign ("small minus") and the subtraction sign are printed in the same way except during screen copy.

8 Specifications

Model: Canon F-300P

Calculation Digits:

Mantissa, sign (1 digit), values (10 digits)

Exponent, sign (1 digit), values (2 digits)

Calculation Range:

$\pm 1.000000000 \times 10^{-99} - \pm 9.999999999 \times 10^{99}$, 0

Calculation System:

Expression-based

Basic Calculation Functions:

Basic calculation: Addition, subtraction, multiplication and division, parenthesis calculations, memory calculations and combinations of the above.

Functions: Trigonometric, inverse trigonometric, logarithms, exponentials (natural and normal), square roots, cube roots, squares, reciprocals, powers, root powers, factorials, hyberbolas, inverse hyperbolas, integer conversion, sexagesimal-decimal conversion, polar-rectangular coordinate conversion, and circle ratio (constant: π).

Statistical calculations: (Common) number of data items, sum, square of sum, average, population standard deviation, sample standard deviation.

(Two-variable) gradient and intercept of regression line, correlation coefficient, multiple correlation coefficient, sum of product of data, sample covariance, population covariance, and estimates.

Program Calculation:

Storage of procedures and algebraic expressions

Capacity: up to 7 memories, 336 steps

Sign and Decimal Display

True value with minus sign

Conversion between exponential and floating decimal point display

Stacks:

Value stack: 8 levels

Operator stack: 16 levels

Memories:

6 fixed, expandable 0—42 (memory area shared with program function)

Memory Protection:

Battery backup (programs and memory contents protected)

Display:

5 × 7 dot matrix, 20 colums, 4 lines liquid crystal

Capable of displaying numbers, functions, operators, and 60 alphabetic and special characters

Editing Functions:

Screen edit method

Cursor left/right shift, line up/down, insert, delete

Elements:

CMOS-LSI

Power Source:

4.5V (DC) alkaline (LR-44) or silver oxide (G13) batteries;

Power consumption: 7mW

Battery Life:

Approx. 100 hours of continuous use ····· LR-44

Approx. 200 hours of continuous use ····· G13

Usable Temperature: 0°C to 40°C (32°F to 104°F)

Size: 194.5mm(W) × 84.5mm(L) × 10mm(T)

(7-21/32″ × 3-5/16″ × 13/2″)

Weight: 151 g (5.32 oz.) with batteries

Batteries included with this calculator may not satisfy the battery life specification given above.

Subject to change without notice.

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