SHARP®

ENGLISH

SCIENTIFIC CALCULATOR

MODEL EL-509V EL-509VH EL-531V EL-531VH

OPERATION MANUAL

PRINTED IN CHINA / IMPRIMÉ EN CHINE
00KUP (TINSK0424THZZ)

INTRODUCTION

About operation examples, please refer to the attached sheet. Refer to the number on the right of each title for use.

After reading this manual, store it in a convenient location for future reference.

Note: Some of the models described in this manual may not be available in some countries.

Operational Notes

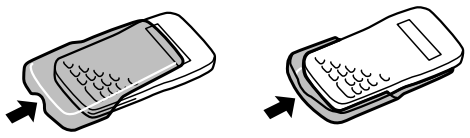
To ensure trouble-free operation, please observe the following points:

1. Do not carry the calculator in the back pocket of slacks or trousers.
2. Do not subject the calculator to extreme temperatures.
3. Do not drop it or apply excessive force.
4. Clean only with a soft, dry cloth.
5. Do not use or store the calculator where fluids can splash onto it.

♦ Press the RESET switch only in the following cases:
- When using for the first time
- After replacing the batteries
- To clear all memory contents
- When an abnormal condition occurs and all keys are inoperative.

If service should be required on this calculator, use only a SHARP servicing dealer, SHARP approved service facility, or SHARP repair service where available.

Hard Case



DISPLAY



(During actual use not all symbols are displayed at the same time.)

If the value of mantissa does not fit within the range ±0.000000001 – ±9999999999, the display changes to scientific notation. The display mode can be changed according to the purpose of the calculation.

←/→ : Appears when the entire equation cannot be displayed. Press [◄]/[►] to see the remaining (hidden) section.

2ndF : Appears when [2ndF] is pressed, indicating that the functions shown in orange are enabled.

HYP : Indicates that [hyp] has been pressed and the hyperbolic functions are enabled. If [2ndF] [arc hyp] are pressed, the symbols "**2ndF HYP**" appear, indicating that inverse hyperbolic functions are enabled.

ALPHA: Indicates that [2ndF] [ALPHA] or [STO] ([RCL]) has been pressed, and entry (recall) of memory contents and recall of statistics can be performed.

FIX/SCI/ENG: Indicates the notation used to display a value and changes each time [2ndF] [FSE] are pressed.

DEG/RAD/GRAD: Indicates angular units and changes each time [DRG] is pressed.

STAT : Appears when statistics mode is selected.

M : Indicates that a numerical value is stored in the independent memory.

BEFORE USING THE CALCULATOR

Key Notation Used in this Manual

In this manual, key operations are described as follows:

[e^x x] [ln]
To specify e^x : [2ndF] [e^x]
To specify ln : [ln]
To specify x : [2ndF] [ALPHA] [X]

Functions that are printed in orange above the key require [2ndF] to be pressed first before the key. When you specify the memory, press [2ndF] [ALPHA] first. Numbers are not shown as keys, but as ordinary numbers.

Power On and Off

Press [ON/C] to turn the calculator on, and [2ndF] [OFF] to turn it off.

Clearing Methods

There are three clearing methods as follows:

Clearing operation	Entry (Display)	M*1	A-D, X,Y*2 STAT, ANS
[ON/C]	○	×	×
[2ndF] [CA]	○	×	○
RESET	○	○	○

○ : Clear × : Retain

*1 Independent memory M.

*2 Temporary memories A-D, X and Y, statistical data, and last answer memory.

Editing the Equation

- Press [◄] or [►] to move the cursor. You can also return to the equation after getting an answer by pressing [►] ([◄]). See below for Multi-line playback function.
- If you need to delete a number, move the cursor to the number you wish to delete then press [DEL]. The number under the cursor will be deleted.
- If you need to insert a number, move the cursor to the place immediately after where you wish to insert the number then enter the number.

Multi-line Playback function (1)

This calculator is equipped with a function to recall previous equations. Equations also include calculation ending instructions such as "=" and a maximum of 142 characters can be stored in memory. When the memory is full, stored equations are deleted in the order of the oldest first. Pressing [▲] will display the previous equation and the answer. Further pressing [▲] will display preceding equations (after returning to the previous equation, press [▼] to view equations in order). In addition, [2ndF] [▲] can be used to jump to the oldest equation.

- The multi-line memory is cleared by the following operations: [2ndF] [CA], [2ndF] [OFF] (including the Automatic Power Off feature), mode change, RESET, [2ndF] [RANDOM], [2ndF] [ANS], constant calculation, angle conversion/change, coordinate conversion, numerical value storage to the temporary memories and independent memory, and input/deletion of statistical data.

Priority Levels in Calculation

This calculator performs operations according to the following priority:

① Functions preceded by their argument (x^{-1}, x^2, n!, etc.) ② Y^x, $\sqrt[x]{\ }$ ③ Implied multiplication of a memory value (2Y, etc.) ④ Functions followed by their argument (sin, cos, etc.) ⑤ Implied multiplication of a function (2sin30, etc.) ⑥ $_nC_r$, $_nP_r$ ⑦ ×, ÷ ⑧ +, – ⑨ =, M+, M–, ⇒M, ▶DEG, ▶RAD, ▶GRAD, DATA, CD, →rθ, →xy and other calculation ending instruction

- If parentheses are used, parenthesized calculations have precedence over any other calculations.

INITIAL SETUP

Mode Selection

Normal mode (NORMAL): [2ndF] [MODE] [0]
Used to perform arithmetic operations and function calculations.

Single-variable statistics mode (STAT *x*): [2ndF] [MODE] [1]
Used to perform 1-variable statistical calculations.

Two-variable statistic mode (STAT *xy*): [2ndF] [MODE] [2]
Used to perform 2-variable statistical calculations.

When executing mode selection, temporary memories, statistical data and last answer memory will be cleared even when reselecting the same mode.

Selecting the Display Notation and Decimal Places

The calculator has four display notation systems for displaying calculation results. When FIX, SCI, or ENG symbol is displayed, the number of decimal places can be set to any value between 0 and 9. Displayed values will be reduced to the corresponding number of digits.

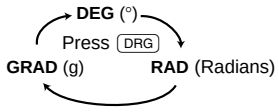
100000÷3=

[Floating point]	[ON/C] 100000 [÷] 3 [=]	33333.33333
→[Fixed decimal point]	[2ndF] [FSE]	33333.33333
[TAB set to 2]	[2ndF] [TAB] 2	33333.33
→[SCIentific notation]	[2ndF] [FSE]	3.33×10^4
→[ENGineering notation]	[2ndF] [FSE]	33.33×10^3
→[Floating point]	[2ndF] [FSE]	33333.33333

- If the value for floating point system does not fit in the following range, the calculator will display the result using scientific notation system:
  $0.000000001 \le |x| \le 9999999999$

Determination of the Angular Unit

In this calculator, the following three angular units can be specified.



SCIENTIFIC CALCULATIONS

- Press [2ndF] [MODE] [0] to select the normal mode.
- In each example, press [ON/C] to clear the display. And if the FIX, SCI, or ENG indicator is displayed, clear the indicator by pressing [2ndF] [FSE].

Arithmetic Operations (2)

- The closing parenthesis [)] just before [=] or [M+] may be omitted.

Constant Calculations (3)

- In the constant calculations, the addend becomes a constant. Subtraction and division are performed in the same manner. For multiplication, the multiplicand becomes a constant.
- When performing calculations using constants, constants will be displayed as K.

Functions (4)

- Refer to the operation examples of each function.
- Before starting calculations, specify the angular unit.
- The results of inverse trigonometric functions are displayed within the following range:

	$\theta = \sin^{-1}x$, $\theta = \tan^{-1}x$	$\theta = \cos^{-1}x$
DEG	$-90 \le \theta \le 90$	$0 \le \theta \le 180$
RAD	$-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$	$0 \le \theta \le \pi$
GRAD	$-100 \le \theta \le 100$	$0 \le \theta \le 200$

Random Numbers

A pseudo-random number with three significant digits can be generated by pressing [2ndF] [RANDOM] [=]. To generate the next random number, press [=]. You can perform this function in the normal and statistics modes.

- Random numbers use memory Y. Each random number is generated on the basis of the value stored in memory Y (pseudo-random number series).

Angular Unit Conversions (5)

Each time [2ndF] [DRG▸] are pressed, the angular unit changes in sequence.

Memory Calculations (6)

This calculator has 6 temporary memories (A-D, X and Y), one independent memory (M) and one last answer memory. Independent memory and temporary memories are only available in the normal mode.

[Temporary memories (A-D, X and Y)]
A stored value can be recalled as a value or variable for the use in equations.

- In case you store an infinite decimal in the memory, recall it as a variable to obtain accurate answers.

Ex.) 1 [÷] 3 [STO] [Y] (0.3333...is stored to Y)
3 [×] [RCL] [Y] [=] ***0.999999999***
3 [×] [2ndF] [ALPHA] [Y] [=] ***1.***

[Independent memory (M)]
In addition to all the features of temporary memories, a value can be added to or subtracted from an existing memory value.

[Last answer memory (ANS)]
The calculation result obtained by pressing [=] or any other calculation ending instruction is automatically stored in the last answer memory.

Note:
Calculation results from the functions indicated below are automatically stored in memories X or Y. For this reason, when using these functions, be careful with the use of memories X and Y.

- Random numbers ..... Y memory
- →rθ, →xy ..... X memory, Y memory

Temporary memories and last answer memory are cleared even when the same mode is reselected.

Chain Calculations (7)

This calculator allows the previous calculation result to be used in the following calculation.
For example, you can calculate by [√] [=] and [sin] [=]. The previous calculation result will not be recalled after entering multiple instructions.

Fraction Calculations (8)

This calculator performs arithmetic operations and memory calculations using a fraction, and conversion between a decimal number and a fraction.

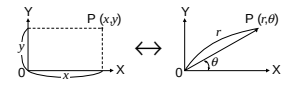
- In all cases, a total of up to 10 digits including integer, numerator, denominator and the symbol (Γ) can be entered.
- If the number of digits to be displayed is greater than 10, the number is converted to and displayed as a decimal number.
- A decimal number, variable, or exponent cannot be used in a fraction.

Time, Decimal and Sexagesimal Calculations (9)

Conversion between decimal and sexagesimal numbers can be performed. In addition, the four basic arithmetic operations and memory calculations can be carried out using the sexagesimal system.

Coordinate Conversions (10)

- Before performing a calculation, select the angular unit.



Rectangular coord. Polar coord.

- The calculation result is automatically stored in memories X and Y.
  Value of *r* or *x*: X memory
  Value of θ or *y*: Y memory

Modify Function (11)

In this calculator, all calculation results are internally obtained in scientific notation with up to 12 digits for the mantissa. However, since calculation results are displayed in the form designated by the display notation and the number of decimal places indicated, the internal calculation result may differ from that shown in the display. By using the modify function, the internal value is converted to match that of the display, so that the displayed value can be used without change in subsequent operations.

STATISTICAL CALCULATIONS

Press [2ndF] [MODE] [1] to select single-variable statistics mode and [2ndF] [MODE] [2] to select two- variable statistics mode. The following statistics can be obtained for each statistical calculation (refer to the table below):

Single-variable statistical calculation (12)

Statistics of ①

Linear regression calculation (13)

Statistics of ① and ② and, in addition, estimate of *y* for a given *x* (estimate *y'*) and estimate of *x* for a given *y* (estimate *x'*)

①	$\bar{x}$	Mean of samples (*x* data)
	sx	Sample standard deviation (*x* data)
	σx	Population standard deviation (*x* data)
	n	Number of samples
	Σx	Sum of samples (*x* data)
	Σx^2	Sum of squares of samples (*x* data)
②	$\bar{y}$	Means of samples (*y* data)
	sy	Sample standard deviation (*y* data)
	σy	Population standard deviation (*y* data)
	Σy	Sum of samples (*y* data)
	Σy^2	Sum of squares of samples (*y* data)
	Σxy	Sum of products of samples (*x*, *y*)
	r	Correlation coefficient
	a	Coefficient of regression equation ($y=a+bx$)
	b	Coefficient of regression equation ($y=a+bx$)

Entered data are kept in memory until [2ndF] [CA] or [2ndF] [MODE] [1] ([2]) are pressed. Before entering new data, clear the memory contents.

[Data Entry]
Single-variable data
Data [DATA]
Data [(x,y)] *frequency* [DATA] (To enter multiples of the same data)
Two-variable data
Data x [(x,y)] *Data y* [DATA]
Data x [(x,y)] *Data y* [(x,y)] *frequency* [DATA] (To enter multiples of the same data *x* and *y*.)

[Data Correction]
Correction prior to pressing [DATA]:
Delete incorrect data with [ON/C].
Correction after pressing [DATA]:
Press [▶] to confirm the latest entry and press [2ndF] [CD] to delete it.

Statistical Calculation Formulas (14)

Refer also to the operation examples sheet.
In the statistical calculation formulas, an error will occur when:

- the absolute value of the intermediate result or calculation result is equal to or greater than 1×10^{100}.
- the denominator is zero.
- an attempt is made to take the square root of a negative number.

ERROR AND CALCULATION RANGES

Errors

An error will occur if an operation exceeds the calculation ranges, or if a mathematically illegal operation is attempted. When an error occurs, pressing [◄] (or [►]) automatically moves the cursor back to the place in the equation where the error occurred. Edit the equation or press [ON/C] to clear the equation.

Error Codes and Error Types

Syntax error (Error 1):
- An attempt was made to perform an invalid operation.
  Ex. 2 [2ndF] [→rθ]

Calculation error (Error 2):
- The absolute value of an intermediate or final calculation result equals or exceeds 10^{100}.
- An attempt was made to divide by 0.
- The calculation ranges were exceeded while performing calculations.

Depth error (Error 3):
- The available number of buffers was exceeded. (There are 8 buffers* for numeric values and 16 buffers for calculation instructions). *4 buffers in STAT mode.

Equation too long (Error 4):
- The equation exceeded its maximum input buffer (142 characters). An equation must be shorter than 142 characters.

Calculation Ranges (15)

Refer also to the operation examples sheet.

- Within the ranges specified, this calculator is accurate to ±1 in the least significant digit of the mantissa. When performing continuous calculations (including chain calculations), errors accumulate leading to reduced accuracy.
- Calculation ranges
  $\pm10^{-99} \sim \pm9.999999999\times10^{99}$ and 0.

If the absolute value of an entry or a final or intermediate result of a calculation is less than 10^{-99}, the value is considered to be 0 in calculations and in the display.

BATTERY REPLACEMENT

Notes on Battery Replacement

Improper handling of batteries can cause electrolyte leakage or explosion. Be sure to observe the following handling rules:

- Replace both batteries at the same time.
- Do not mix new and old batteries.
- Make sure the new batteries are the correct type.
- When installing, orient each battery properly as indicated in the calculator.
- Batteries are factory-installed before shipment, and may be exhausted before they reach the service life stated in the specifications.

When to Replace the Batteries

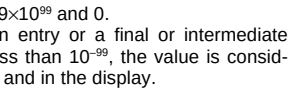
If the display has poor contrast, the batteries require replacement.

Caution

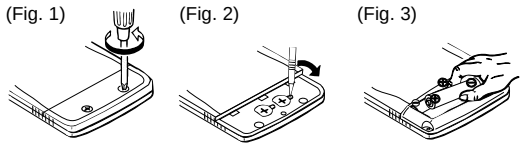
- Keep batteries out of the reach of children.
- Exhausted batteries left in the calculator may leak and damage the calculator.
- Explosion risk may be caused by incorrect handling.
- Batteries must be replaced only with others of the same type.
- Do not throw batteries into a fire as they may explode.

Replacement Procedure

1. Turn the power off by pressing [2ndF] [OFF].
2. Remove two screws. (Fig. 1)
3. Slide the battery cover slightly and lift it to remove.
4. [EL-509V/EL-531V] Remove the used batteries by prying them with a ball-point pen or other similar pointed device. (Fig. 2)
   [EL-509VH/EL-531VH] Remove used batteries.
5. Install two new batteries.
   [EL-509V/EL-531V] Make sure the "+" side facing up.
   [EL-509VH/EL-531VH] First insert the "⊖" side to the spring. (Fig. 3)
6. Replace the back cover and screws.
7. Press the RESET switch (on the back).
- Make sure that the display appears as shown below. If the display does not appear as shown, remove the batteries reinstall them and check the display once again.



(Fig. 1) (Fig. 2) (Fig. 3)



Automatic Power Off Function

This calculator will turn itself off to save battery power if no key is pressed for approximately 10 minutes.

SPECIFICATIONS

Calculations:	Scientific calculations, statistical calculations, etc.
Internal calculations:	Mantissas of up to 12 digits
Pending operations:	16 calculations 8 numeric values (4 numeric values in STAT mode)
Power source:	3V ⎓ (DC): [EL-509V/EL-531V] Alkaline batteries (LR44) × 2 [EL-509VH/EL-531VH] Heavy duty manganese batteries (size AA or R6) × 2
Power consumption:	0.0006 W
Operating time:	[EL-509V/EL-531V] Approx. 2500 hours [EL-509VH/EL-531VH] Approx. 15000 hours when continuously displaying 55555. at 25°C (77°F). Varies according to use and other factors.
Operating temperature:	0°C – 40°C (32°F – 104°F)
External dimensions:	[EL-509V/EL-531V] 78.6 mm (W) × 152 mm (D) × 10.5 mm (H) 3-3/32" (W) × 5-31/32" (D) × 13/32" (H) [EL-509VH/EL-531VH] 78.6 mm (W) × 166 mm (D) × 19.5 mm (H) 3-3/32" (W) × 6-17/32" (D) × 25/32" (H)
Weight:	[EL-509V/EL-531V] Approx. 75 g (0.166 lb) (Including batteries) [EL-509VH/EL-531VH] Approx. 115 g (0.254 lb) (Including batteries)
Accessories:	Batteries × 2 (installed), operation manual, operation examples sheet, quick reference card and hard case

FOR MORE INFORMATION ABOUT THIS CALCULATOR

Visit our Web site.
http://sharp-world.com/calculator/