SCIENTIFIC CALCULATOR

MODEL EL-5103

INSTRUCTION MANUAL

(ELECTRONIC CALCULATOR) LIMITED WARRANTY:

SHARP ELECTRONICS CORPORATION warrants this product to the original purchaser to be free from definitive materials and workmanship. Under this warranty the product will be repaired or replaced, at our option, without charge for many or labor, with the exception of batteries, when returned to a SHARP CONSUMER FACTORY SERVICE CENTER listed in the instruction booklet supplied with your unit.

This warranty does not apply to any appearance items nor to any product whose exterior has been damaged or defaced, nor to any product subjected to misuse, abnormal service or handling, nor to any products altered or repaired by other than a SHARP CON-SUMER FACTORY SERVICE CENTER. This warranty does not apply to any product purchased outside the United States, its territories, or possessions.

The period of this warranty covers one (1) year on parts and one (1) year on labor from date of purchase.

This warranty entitles the original purchaser to have the warranted parts and labor rendered at no cost for the period of the warranty described above when the unit is carried or shipped, prepaid, to a SHARP CONSUMER FACTORY SERVICE CENTER together with proof of purchase.

THIS SHALL BE THE EXCLUSIVE WRITTEN WARRANTY OF THE ORIGINAL PURCHASER AND NEITHER THIS WARRANTY NOR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, SHALL EXTEND BEYOND THE PERIOD OF THE TIME LISTED ABOVE. IN NO EVENT SHALL SHARP BE LLABLE FOR CONSEQUENTIAL ECONOMIC DAMAGE OR CON-SEQUENTIAL DAMAGE TO PROPERTY. SOME STATES DO NOT ALLOW A LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS OR AN EXCLUSION OF CONSEQUENTIAL DAMAGE, SO THE ABOVE LIMITATION AND EXCLU-SION MAY NOT APPLY TO YOU. IN ADDITION, THIS WARRANTY GIVES SPECIFIC LEGAL RIGHTS, AND YOU MAY HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

OPERATIONAL NOTES

Thank you for your purchase of the SHARP scientific calculator, EL-5103.

Since the liquid crystal display is made of glass material, treat the calculator with care. Do not put the "EL-5103" in your back pocket as it may be damaged when you sit down.

To insure trouble-free operation of your SHARP calculator, we recommend the following:

- The calculator should be kept in areas free from extreme temperature changes, moisture and dust.
- During summer weather vehicles left in direct sun light are subject to high temperature build up.

Prolonged exposure to high temperature may cause damage to your calculator.

- A soft, dry cloth should be used to clean the calculator. Do not use solvents or a wet cloth.
- If the calculator will not be operated for an extended period of time, remove the batteries to avoid possible damage caused by battery leakage.

5. If service of your calculator is required, use only an authorized SHARP Service Center.

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6. Keep this manual for further reference.

All of the keys may become inoperative during the operation of the calculator due to a strong external noise and so on. In such a case, remove the batteries and install them again. Press the OFF , ON , 2ndF and CA keys in this order and check the display " 0." or "_

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INTRODUCTION

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AER MODE

This manual will introduce you to the Sharp EL-5103 scientific calculator. The EL-5103 is a now and powerful computing instrument. It will provide you with formidable computing power in mathematical, scientific, engineering and business calculations.

The EL-5103 provides direct entry of calculations and formulas as written. You will see as you follow through this manual that the EL-5103 makes it unnecessary to learn a "machine language". After keying in a formula, you will be able to visually edit, correct or test your inputs.

This Instruction Manual uses a new format.

Each section may be divided into basic and advanced material. The advanced material is labeled "supplementary". The supplementary sections may be skipped without hampering your ability to operate the calculator. You may wish to return to the supplementary sections as your skill in operating the EL-5103 increases.

Name label

Write your name on the attached name label and stick it on the back of the calculator.

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AS YOU SAY IN THE ' IN 32.14, YOU WITH DOTH TIME TOTH CHARACTER

MODES

Note the mode switch on the lower right of your calculator. As you move the switch from one mode to another the name of the mode appears in the display. "AER" stands for Algebraic Expression Reserve; "COMP" for COMPutations; and "STAT" for STATistical.

COMPUTATION MODE

Set the mode switch to "COMP". When the symbol "FIX", "SCI" or "ENG" appears at the top of the display, press the CL key. And press the FSE key continuously until the above symbol disappear. (In this case the floating decimal point system is set. (For the FSE key see "Display system and decimal places"))

1. Addition, Subtraction & Playback

Key in the following:

12 + 45.6 - 32.1 + 789 - 741 + 213

As you key in the "1" in 32.1+, you will note that 13th character "+" exceeds the 13 column capacity of the display owing to extra presence of the cursor. At this point, a unique feature called "rolling writer" becomes effective. As each additional step is entered, the display will roll to the left. The data rolled off the screen will be recorded up to 80 steps in the COMP MODE. An arrow \leftarrow will appear on the display indicating information now is stored in that direction.

Now press =

Your answer is 286.5

Now press PB (playback). You will get back in the display a portion of your original input to check and/or edit. Press PB again to obtain the remainder of your inputs. Editing will be explained in detail in a later section.

If you have placed material in the display and have not used the calculator for approximately ten minutes, the calculator will go into (APO) "Automatic Power Off" automatically to conserve battery life. Be simply turning the calculator on all of your last inputs will return to the display.

2. Multiplication, Division

a. Key in the following:

* CL 841 X 586 ÷ .12 = Answer: 4106883.333 (* After play back operation in COMP mode press ≡ or CL key.)

b. Key in the following:

2 + 5 × 3 ÷ 4 - 1 = Answer: 4.75

Note that the EL-5103 follows the priority of mathematics known as algebraic operating system. In other words multiplication and division will occur before addition and sub-

traction. The full order of priorities is described in the supplementary below. The mathematical priorities can be re-ordered by using parenthesis.)

Supplementary -1 priority level

The machine, provided with a function that judges the priority level of individual calculations, permits keys to be operated according to a given algebraic formula. The following shows the priority level of individual calculations.

- (1) (-)
- (2) Single-term function preceded by numerals $(x^2, x^{-1}, n!, \rightarrow \text{DEG}, \rightarrow \text{D.MS})$
- (3) Two-term function preceded and followed by numerals (Y^X, ^X√, →POL, →REC ····)
- (4) Multiplication cleared of "X" instruction located just before memory or π. (Ex. 2π, 4A)
- (5) Single-term function followed by numerals. $(\sqrt{}, e^{\chi}, 10^{\chi}, \sqrt[3]{}, LN, LOG, SIN, COS, TAN, SIN^{-1}, COS^{-1}, TAN^{-1}, SINH, COSH, TANH, SINH^{-1}, COSH^{-1}, TANH^{-1})$
- (6) x, ÷ (7) +, − ₃(8) =, M+, M− (2nd F M+), STO A ~ STO E, STO M, Data, CD

- Calculations have priority to others, when parenthesized.
- Provided that functions shown in item (5) above are successively designated in an algebraic formula, calculations are performed from the right to the left.

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DOU

5 + 2 X SIN 30 + 24 X 5 YX 3, =

Ex. $e^{x} LN \sqrt{120} \rightarrow e^{x} (LN (\sqrt{120}))$

The other functions are calculated from the left to the right. Ex. $A_{X}^{X} - BY^{X}CY^{X}D \rightarrow ((A_{X}^{X} - B)Y^{X}C)Y^{X}D$

Order of calculations in a typical example: Ex. $5 + 2 \times \sin 30 + 24 \times 5^3 =$

(Pending operation)

As this machine is designed to execute an "Expression" according to a given algebraic formula, some of the instructions or numerics included in the "Expression" can't be treated directly.

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Therefore, they are temporarily stored in the built-in buffers and the rest is treated in advance.

This calculator has a 16-stage function buffer (for calculation instruction) and 8-stage data buffer (for numerical data) in it. When the calculation exceeds 16-stage in function or 8-stage in data is performed, an error occurs.

Ex. 1 $1+2x (3-4\div (7\div 5)) (7\times 6) Y^{2} 3 =$ (1) (2) (3) (4) (6) (6) (7) (8) Functional buffer: 11-stage (including parentheses) Data buffer: 8-stage

Ex. 2 $14 - 5 + 4 \times SIN 2 AY^{X} (2 + 3 + LOG 3 B \sqrt[X]{4} 48 = (1) (2) (3) (4) (5) (6) (7) (8)$

When the next "+" command arrives, "14-5" is calculated and the 11-stage (including parentheses) result is retained as "9".

Each memory is regarded as a numerical value.

Functional buffer: 11-stage (including parentheses) Data buffer: 8-stage

 $((2 + 12 \div 4 \times 3)^{x} ((((3 + 2 - 4\sqrt{-LOG}\sqrt[3]{4}A^{2}))^{3})^{3})^{3} A$ Ex. 3 (15) (16) (5)(6)~(9)(10) (11)(12) (13) (14) 1(2)(3) (4) Although "x" is omitted, When "-" comes When "x" comes "3 + 2" is calculated, the calculation is executed "12 ÷ 4" is calculated. resulting in 5-. as if "x" were present. resulting in 3X.

Functional buffer: 16-stage (including parentheses) Data buffer: 7-stage

End of Supplementary 1

When only the symbol " \rightarrow " appears at the top of the display during calculation, do not continue making entries.

3. Scientific Functions

Scientific Calculations are performed in the same manner as basic computations. As you will note, in the following examples, scientific functions are used as you would normally read them.

Note Step: 1 step correspond to 1-digit display. However instructions such as SIN, SIN⁻¹, SINH⁻¹ and LOG are processed as one-step. a. Trigonometric functions DRG

The angular mode is designated by the 2ndF (-) key. As you press these keys the mode "DEG" "RAD" "GRAD" will appear at the top of the display. Put the angular mode at "DEG".

Key in the following: SIN 30 + Cos 40 = Answer: 1.266044443 Put the angular mode at "RAD" Key in: Cos .25 π = Answer: 0.707106781

b. Inverse Trigonometric Functions and Second Function

The yellow key in the upper left of the calculator marked "2nd F" must be used to designate the material appearing in brown above each key. When this key is pressed, the designation "2nd F" will appear in the upper part of the display. If you press this key in error, press it a second time and the "2nd F" designation will disappear.

End of Supplementary 1

Put the angular mode at "DEG" Key in: 2ndF SIN" .5 = Answer: 30 (Remember to use the second function key to get the inverse)

Put the angular mode at "RAD" (To enter a negative number, press the (-)) 2ndF COS" (-) = Key in: key before numerals.) Answer: 3,141592654 (Value of m) In this Manual, we'll always show the key's second functions as follows; 2ndF INS → 2ndF INS c. Hyperbolic and Inverse Hyperbolic functions When using the hyperbolic and arc hyperbolic functions "HYP" will appear in the top of the display. Key in: HYP SIN 4 = Answer: 27.2899172 SIN 9 = Key in: 2ndF ARCHYP 2.893443986 Answer: Power Functions 20^{2} Calculate: 20 12 = Key in: 13

Answer: 400 Calculate 3³ and 3⁴ 3 [Yx] 3 [= 3 Yx 4 = Key in: Key in: 27 81 Answer: Answer: e. Roots Calculate: 25 millionest a year and world average if my hearmand and nit 2ndF 7 25 = Key in: Answer: Calculate: Cube root of 27 HVnerbolic and Inverse Hyperbolic 2ndF 34 27 = Key in: Answer: 3 the top of the display. Calculate fourth root of 81 Key in: 4 2ndF XV 81 = Answer: 3 f. Logarithmic Functions Natural Logarithms: Key in: LN 21 = 3.044522438 Answer: Common Logarithms: Key in: 2ndF LOG 173 = 2.238046103 Answer

g. Exponential Functions Key in: ex 3.0445 = 20.99952881 (21 as in item "f" above) Answer: 10^x 2.238 = Key in: 2nd F 172.9816359 (173 as in item "f" above) Answer: h. Reciprocals 1/6 + 1/7Calculate: Key in: $6 x^{-1} + 7 x^{-1} =$ Answer: 0.30952381 i. Factorial Calculate: 691 69 2ndF n! = ve and the second stress of the second Key in: 1.7112245E 98 (1.7112245 x 1098) Answer: Note that the Error section deals with the calculation limits of the calculator. Permutations Calculate: _sP₃ (5 - 3) Key in: 5 2ndF n! ÷ (n - r)!n!= 60 Answer:

k. Combinations:

Calculate the number of combinations of $nCr = \frac{n!}{r!(n-r)!}$ 5 cards in a deck of 52. Key in: 52 2ndF n! \div (5 2ndF n! (52 - 5) 2ndF n! = Answer: 2598960

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Supplementary 2 - effective digits

- In this calculator, all calculations are performed by using a numerical value whose mantissa is 12 digits or less. Calculation results are displayed after they are subjected to decimal system, but the calculator retains a numerical value whose mantissa is 12 digits. However, when a calculation results is used in the following calculation, the result displayed in accordance with the decimal system is used.
- When a numerical value is inputted as a mantissa, only its upper 10 digits are effective, but the number of inputted digits is retained. A numerical value smaller than 1 (or larger than -1) is also retained within 10 digits as much as possible.
- Ex. 123456789876 0.0000000001234 End of supplementary 2

→ equal to 1.234567898 x 10^{11} 34 → equal to 1.234 x 10^{-11} I. Angle/Time conversions

To convert an angle given as degrees/minutes/seconds to its decimal equivalent, it must be entered as integer and decimal respectively. Convert 12°47'52'' to its decimal equivalent. Key in: 12.4752 -DEG = Answer: 12.79777778

When converting decimal degrees to the equivalent degrees/minutes/seconds, the answer is broken down: integer portion = degrees; 1st and 2nd decimal digits = minutes; 3rd and 4th digits = seconds; and the 5th through end decimal digits are decimal seconds.

Convert 24.7256 to its degree/minute/second equivalent Key in: 24.7256 2ndF = 0.485 = Answer: 24.433216 or 24°43'32''

A horse has track times of 2 minutes 25 seconds, 2 minutes 38 seconds, and 2 minutes 22 seconds. What is the average running time?

Key in: .0225 •DEG + .0238 •DEG + .0222 •DEG = Answer 1: 0.123611111 (press PB if you wish to check your input) Key in: ÷ 3 = Answer 2: 0.041203704

Key in: 2ndF -DMS =

Answer 3: 0.022833333 or the average time is 2 minutes 28 seconds m. Coordinate Conversion

Converting rectangular coordinates to polar $(x, y \rightarrow r, \theta)$

P(r, 0) P(s.p) DEG: $0 \le |\theta| \le 180$ $r = \sqrt{x^2 + v^2}$ RAD: $0 \le |\theta| \le \pi$ $\theta = \tan^{-1}$ GRAD: $0 < |\theta| < 200$ Solve for x = 6 and v = 4mode = DEGKey in: 6 -POL 4 = Answer: 7.211102551 (r) RCL E Answer: 33.69006753 (0) Key in: Note that the values of y and θ are stored in E. Calculate the magnitude and direction (phase) in a vector I = 12 + i912 -POL 9 = Key in: Answer: 15 (r) Key in: RCL E 36.86989765 (0) Answer:

Converting polar coordinates to rectangular $(r, \theta \rightarrow x, y)$ Solve for P (14, $\pi/3$), r = 14 $\theta = \pi/3$ Mode = RAD Key in 14 2ndF -REC (7 ÷ 3) = Answer: 7 (X) Key in: RCL E Answer: 12.12435565 (y) Multiple data memories The EL-5103 has 6 memories (A \sim E, M) for storing variables, constants or results. Independently accessible memory M has memory plus and memory minus (2ndF) M+) function. By Memory Safe Guard, turning the calculator on and off will not affect the material stored in the memory. Memory A ~ E: To input a number into a memory press the value followed by STO and the memory Addition or subtraction to a memory is not possible. To recall a value from a memory press RCL and the appropriate memory letter. To clear a memory press 0 STO and the memory letter. Key in: 12 X 5 STO A Content of Memory A Answer: 60

Key in: 300 ÷ RCL A STO B bet of estembroos valog primewrood Content of Memory B Answer: 5 A ÷ RCL B STO C Key in: RCL Answer: 12 Content of Memory C Accessible memory M: Before starting a calculation clear the memory by pressing CL STO M. Key in: 12 + 5 M+ logs of (M 3 - A) appointin 6 and 50 to Jan T Answer: 17 To subtract key in: 2 + 5 2ndF M+ Answer to this equation: 7 Answer: 24 (Also takes place of 10 in Key in: 12 X 2 STO M memory) Memory A ~ E: Key in: 8 ÷ 2 M+ RCL M : 28 Answer: letter. Addition or subtraction to a memory is no 5. Formula Solution in the COMP MODE To solve a formula using the memories as variables in the COMP MODE you must first place your values in the appropriate memories. Capacity is 80 program steps for

20

playback. (Refer to "Direct Formula Entry" for a detailed discussion of steps.) Key in: 1 STO A 2 STO B, and 3 STO C Key in: 2ndF A + 2ndF B + 2ndF C = Answer: 6 Key in: 2ndF A X² + 2ndF B X² + 2ndF C X² = Answer: 14 (Mode = DEG) SIN 2ndF A + COS 2ndF B + TAN 2ndF C = Key in: Answer: 1.069251013 Use of memories in a formula Each memory of this calculator has a storage capacity of 12 digits for mantissa and of 2 digits for exponent. In the entry of a formula, pushing the 2ndF A ~ 2ndF E , 2ndF M recalls a numerical value stored in a designated memory and uses it when the inputted formula is executed for calculation. (2)In the entry of a formula pushing a RCL A ~ RCL E , RCL M recalls a numerical value stored in the designated memory and writes it into the formula. In this case the numerical value is written into the formula in accordance with

the designation of the decimal system.

Example: 4 ÷ 3 STO A → 1.333333333

Although the calculation result is displayed at 10 digits, the calculator (memory A) retains a numerical value whose mantissa is 12 digits.

(1) When the contents of the memory A is designated as variable with 2ndF A : FIX mode, TAB = 2

When memory A is directly designated, its capacity (mantissa = 12 digits, exponent = 2 digits) is used in full.
(2) When the contents of the memory A is written with RCL A : FIX mode, TAB = 2 2 X RCL A X → 2 × 1.33 × _

3 = → 7.98 A numerical value according to the setting -- FIX mode, TAB = 2 -- is entered into the formula. In the case of an error, the "Er" (Error) and "0." will appear in the display. An error will be caused by a calculation or instruction beyond the capacity of the machine or by an ungrammatical formula. Correct "Grammer" is discussed in the following section. An error can be cleared by the CL or PB key.

Supplementary 3 - Error Conditions

- . When the absolute value of a calculation result is 1×10^{100} or more.
- 2. When a number is divided by 0 (zero). (A \div 0)
- 3. When the absolute value of a result of memory calculation is 1×10^{100} or more.
- When a formula that exceeds the capacity of function (16-stage) or date (8-stage) buffer is used for calculation.
- 5. For scientific functions an error occurs when the calculations exceed the following ranges:

CALCULATION RANGE

Functions	val [89] to [J2] and vo Dynamic range one nA modese
and the second sec	DEG: x < 1 x 10 ¹⁰
	RAD: $1 \times 1 < \frac{\pi}{180} \times 10^{10}$
SIN x	GRAD: $ x < \frac{10}{10} \times 10^{10}$
COS x	 When a number is divided by P (serol: (A + 0)) 3. When the absolute value of a ceptit of memory calculus in
TAN x	In TAN x, however, the following cases are
trendelin and a state of the second second	DEG: $ x = 90 (2n - 1)$
PLX north	RAD: $ x = \frac{\pi}{2} (2n-1)$ n = integer

	Functions and and	Dynamic range	Function
	TAN ⁻¹ x	x < 1 x 10 ¹⁰⁰	SINH
	LN x LOG x	$1 \times 10^{-99} \le x < 1 \times 10^{100}$	COSH1
-	e ^x	$-1 \times 10^{100} < x \le 230.2585092$	
	10 ^{<i>x</i>}	$-1 \times 10^{100} < x < 100$	1.4
	YX	$-1 \times 10^{100} < x \log y < 100$ $y \ge 0$ (Here, Y ^X = 0 at Y = 0)	t+ M
ac :	$\frac{1}{10^{10}}$ $\frac{\sqrt{x}}{\sqrt{y}}$	$-1 \times 10^{100} < \frac{1}{x} \log y < 100$ $y \ge 0, \ x \ne 0$	Ln.
	$\sqrt[3]{x}$ (actor)	$ x < 1 \times 10^{100}$	
	SINH x COSH x TANH x	$-227.9559242 \leq x \leq 230.258509$	2.38-

	Functions	Dynamic rang	ge mai sau a
	SINH ⁻¹ x	$ x < 1 \times 10^{50}$	MINT.
	COSH ⁻¹ x	$1 \le x \le 1 \times 10^{50}$	 KM07
_	TANH ⁻¹ x	x <1	x 005
_	Vx CHOBBER	$0 \le x \le 1 \ge 10^{100}$	-0
	x ²	x <1 × 10 ⁵⁰	2.01
	x ⁻¹ (6 - 7 3. 0	$ x < 1 \times 10^{100}$ $x \neq 0$	×γ
	n1 oor >	$0 \le n \le 69$ (n: integ	er)
	→POL	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	alese
	→REC CORRECTORS	x < 1 x 10 ¹⁰⁰ y is in the same condition as x x: Magnitude y: Direction	c of SIN x. (phase)

Function	ns spress oligie	Dynan	nic range	Euneas
→ DEG → D.MS	and a second	$ x < 1 \times 10^{100}$		
0.000		1-1		
		$ x < 1 \times 10^{50}$	- 1400 M	
Statistical calculation	Data CD	$\begin{aligned} \Sigma x < 1 \times 10^{100} \\ \Sigma x^2 < 1 \times 10^{100} \\ \Sigma y < 1 \times 10^{100} \\ \Sigma y^2 < 1 \times 10^{100} \\ \Sigma y < 1 \times 10^{100} \\ \Sigma x y < 1 \times 10^{100} \\ n < 1 \times 10^{100} \end{aligned}$		les faural national
-101 × 1.3	â	n ≠ 0		

Function	ns sprich birds	Dynamic range anologinu 3
S. MH.	\$ <i>x</i>	$ \begin{array}{l} n \neq 1 \\ 0 \leq \underbrace{\Sigma x^2 - n \bar{x}^2}_{n - 1} < 1 \times 10^{100} \\ \hline \end{array} \begin{array}{l} \hline \hline \end{array} $
	σχ	$ \begin{array}{l} n \neq 0 \\ 0 \leq \frac{\Sigma x^2 - n \bar{x}^2}{n} < 1 \times 10^{100} \end{array} $
Statistical calculation r	r	$ \begin{vmatrix} n \neq 0 \\ 0 < (\Sigma x^{2} - n\bar{x}^{2}) \cdot (\Sigma y^{2} - n\bar{y}^{2}) \\ \Sigma x y - \frac{\Sigma x \cdot \Sigma y}{n} < 1 \times 10^{100} \\ \end{vmatrix} \\ \frac{\Sigma x y - \frac{\Sigma x \cdot \Sigma y}{n}}{ \sqrt{(\Sigma x^{2} - \bar{x}^{2}) - (\Sigma x^{2} - \bar{x}^{2})}} \end{vmatrix} < 1 \times 10^{100} $

Functions parts and		dayd Dyn	amic range	Functio
	\overline{y}	Mary Star St		(addratriat 2
1000	sy	Same as \overline{x} , sx, σx		All the first of the second
inits the wint of	σγ	ised at another lighter and the		
isa to bas art Construction tatistical alculation	ni still an op actionita b b	$n \neq 0$ $0 < \Sigma x^{2} - n\overline{x}^{2} < \Sigma xy - \frac{\Sigma x \cdot \Sigma y}{n} < \Sigma xy - \frac{\Sigma x \cdot \Sigma y}{n} < \Sigma xy - \frac{\Sigma x \cdot \Sigma y}{n} $	1 x 10 ¹⁰⁰ (1 x 10 ¹⁰⁰ < 1 x 10 ¹⁰⁰	e manfavel fic norasion fin the calc (zero) Nee "End of Supple
Nultiplication Founder	Barramotu a be used ed	a is the same condition $ \bar{y} - b\bar{x} < 1 \times 10^{100}$	n as b, and	Multiplication
odei DEG	Angey	$ a+bx < 1 \times 10^{100}$	soft arfr 18 20 N.s CA - Las	Ex. Sot EL ST
	THE CASE	and the second	6511160	B.CE CINWERA

Functions		Dynamic Dynamic	range molecular	If
Statistical calculation	x'	$\left \frac{y-a}{b}\right < 1 \times 10^{100}$		to
Note: As a rule, t a displayed fic notation	he error of fu numerical va	nctional calculations is less tha lue (at the lowest digit of ma	n ±1 at the lowest digit of ntissa in the case of scienti-	n 2 n
In the calc	ulation of SI	NH x and TANH x , x is a peterror is accumulated reduci	singular point when it is 0	Supp
120107. 110	in this point t		C Labitzitara W	Vhen a
End of Supple	mentary 3 -	- Error Conditions	E	xamp
 Grammer Multiplication number before Ex. Set EL-51 	of one variat a variable is a 03 at the floa	ble followed by another is auto automatic. The π key may be ting decimal point system. An	omatic. Multiplication of a sused as a number. ngular mode: DEG	ALG
Key in: 2 S Answer: 37.6	ro A , 3 (9911184	STO B , 2 7 2ndF A 2	ndF B =	End

Ar 30

e closing of a parenthesis occurs at the end of an expression, it is not necessary clude the seconde part of that parenthesis -2 COS 30 4 SIN 30 + alculate $\sqrt{2}\pi$ + TAN 30 4 SIN 30 + (2 COS 30 2ndF 7 2 X T ey in: ÷ + TAN 30 = Answer: 2.345014014 ementary 4 – Grammatical Error Conditions y formula uncapable of being calculated has been solved: A2, π3, (4+5)6 ····· Some calculation command is omitted at the place where it cannot be omitted. SIN2, 10X-1, 5YX! (2)COS+, YX=, x+, (x... The calculation of x^2 needs to be calculated in advance in order to calculate, for example, SIN². However, no numerical value to be used is present. Supplementary 4 – Grammatical Errors

8. "Expression" Correction and Editing

The flickering cursor is used to correct and edit expressions.

a. Correction

Key in: 5 + 3 X 2 - SIN 30 = Angular mode: DEG Answer: 10.5 Press PB

The cursor is flashing over the =. If you wish to change the multiplier from 2 to 4, press the *key* 5 times until it covers the 2; now press 4; press (If is not necessary to move the cursor back).

Answer: 16.5 Enotherio Strice Contribution 16.5

To change SIN 30 to COS 45, move the cursor to over the SIN and press COS 45 and

Answer: 16.29289322

b. Deletion

Key in: 12 + 45 + 78

To change the 45 to 5, press the cursor (
Independent of the second sec

c. Insertion



To insert material place the cursor over the item which will follow the insertion. Multiple insertions may be made.

Key in: (π + 4) 2 = Display indicates error. A multiplication sign must be placed between the) and 2. Press PB key. Move the cursor to over the 2. Press 2ndF INS . An opening occurs on the display and all material following the insertion automatically shifts to the right.

Press X and = Answer: 14.28318531

noive shistequation mover the mode switch to COMP, (Figaning decimal p

DIRECT FORMULA ENTRY (AER)

(ALGEBRAIC EXPRESSION RESERVE)

With AER a formula can be stored as an algebraic expression. The formula, even if complicated is entered as you would read it. The rolling writer dot matrix liquid crystal display makes it possible to enter up to 48 steps with no limit on characters.

1. Formula Entry I

In Section 5 of the discussion on the COMP Mode, entering a formula was demonstrated. However, if it was required to do other calculations in the COMP MODE, the equation would be lost. To retain a formula so that we may use it over and over the AER Mode is used.

Put the calculator in the AER mode. Clear the display by pressing 2ndF CA (above Red CL Key).

Formula: A² + B²

Key in: 2ndF A X² + 2ndF B X²

To solve this equation move the mode switch to COMP. (Floating decimal point system)

Put in values: 2 STO A, 3 STO B Press COMP Key

Answer: 13

ALGEBRAIC EXPRESSION RESERVE) OF HIMPING Vith AER a formula can be dored at an algebraic expression. This formula, even if or distributed in restance as you would read it. This rolling writer dot materix liquid cry tistus moved it possible to enter up to 48 stors with no limit on characteri

Replace the values: 4 STO A, 5 STO B Press COMP Answer: 41 Solve the equation: $5 \times (X + 8) = 60$ for X Key in: 2ndF CA Mode: AER Note that in the AER mode a comma is used to end an equation. The 2ndF ? (above PB keys produce the comma in the AER mode. A series of equations using the same variables may be placed in the AER mode. Key in: (let X = A)5 (2ndF A + 8) 2ndF A 2ndF A + 1 STO A 1_2ndF 9

Move the switch to COMP MODE Press the COMP key. Display: 60 And press the COMP key again. Answer, 4 is the value of A that we are seeking.

Note that is you after the 2 in the second aquation, the 13 character canacity of the display is exceeded. The rolling writer begint and as each auditional entry is made a entry is rolled off to the left and atored. The left pointing arrow manactus informa2. Formula Entry II Dialogic Form 8 018 2 A 012 8 Deablev and analogiR

The second procedure for formula entry involves placing an equation into the calculator as a function of the variables in the formula. The function key [f(0)] is above the $\overline{\text{COMP}}$ key. Start with the f()= key, follow with the variables, close

with the f()= key, Solve 3 equations: $X^2 + Y^2$, 23 X + 45 Y, $\sqrt{X} - LN Y$ Let X = A, Y = B abom R3A ent of beside of your veldshev error and price Mode: AER B + A Hed I & A K rell he yes Key in: a. 2ndF CA display should read f (

- f()=
- b. 2ndF A 2ndF B f()= display should read f (AB) = in other words, a function of variables A and B
- C. 2ndF A X² + 2ndF B X² 2ndF 9 23 2ndF A + 45 2nd F B 2nd F 9 2nd F 1 2nd F A - LN 2nd F B

Note that as you enter the 2 in the second equation, the 13 character capacity of the display is exceeded. The rolling writer begins and as each additional entry is made an entry is rolled off to the left and stored. The left pointing arrow indicates information stored to the left.

Change to the COMP MODE (Floating decimal point system) Press COMP ; the display will read A = ? The flashing ? asks you to place in a number Put in 2 Press COMP and get B = ? Put in 3

Note that in the AER mode two variables were used, therefore, the calculator will not ask for a value of C. If two variables such as C and D had been used, the calculator would have only asked for these.

Solve for analo of 45 matend of 60"

Press COMP and get Answer: 13 Press COMP again and get Answer: 181 Press COMP again and get Answer: 0.315601274 Only three equations were placed in the AER Mode. Press [COMP] again and get A = ? again. New values may now be put in for A and B. If you push comp without entering a numeral, the previous value is retained.

3. Law of Cosines Change to the COMP MODE (Floating decimal point tystem Solve for C knowing A, B, and D The basic equation is ou to place to a nue Neckashing, 2 - aslos $C = \sqrt{A^2 + B^2} - 2AB \cos D$ - E Van hum (400) Mode: AER Note that in the AER mode two variables were used. Note that since the entire equation falls under the square root sign parenthesis must be used. Key in: 2ndF CA f()= 2ndF A 2ndF B 2ndF D f()= 2ndF 1 (2ndF A X2 + 2ndF B X2 -2 2ndF A 2ndF B COS 2ndF D Change to COMP mode Angle Mode: DEG (Floating decimal point system) Press COMP Put in 3 for A law world made to A had brid made mode and Press COMP Put in 4 for B Press COMP Put in 60 for D value of the third side is 3.605551275 Press COMP

Solve for angle of 45° instead of 60°

38

Press COMP until the display reads D = 2 Key in: 45 CO Press COMP , value of the third side is 2.833626167

Turn off the calculator. If you wish to use this equation, at a later date, "Memory Safe Guard" will protect the equation and it will be there at that time for reuse. All equations in the AER Mode and all information in memories in the COMP Mode are retained unless intentionally erased.

Business Applications

There are many business applications for which the EL-5103 is an ideal tool. This example also illustrates that the answer from one equation may be stored and used in another equation.

A series of discounts from the list price are offered. They are 35%, 3%, and 2%. Calculate the final price for a series of prices starting at \$100 and continuing at \$110, \$120. etc. 35% is equivalent to .65; 3% to .97; and 2% to .98. The initial price call (A)

Mode: AER

Key in: 2ndF CA (f()= 2ndF A (f()= .65 2ndF A STO B 2ndF 9 .97 2ndF B STO C 2ndF 9 .98 2ndF C 2ndF 9 2ndF A + 10 STO A Mode: COMP (Floating decimal point system) Press COMP , A = ? Key in: 100 Press COMP , Answer 1: 65 Press COMP , Answer 2: 63.05 Press COMP , Answer 3: 61.789 Press COMP , Answer 4: 110

Answer 4 is the original price of \$100 plus the increment of \$10. The next time COMP is pressed, A = ? is displayed. By-pass placing a value in for A each time as it has been changed automatically by equation 4. Answer 3 will now give the discounted price for a list of 110. Continued pressing of the comp key will give the answer for each increment of 10 of the price. After putting the initial value of A in at 100, it is unnecessary to key in any other values.

C (Bridde ve Bed Mudde C South V State AVIII

Supplementary 5 - Steps

Program Steps

The capacity of the EL-5103 for storing algebraic formulas is 48 steps.

If the 48th step is loaded with an instruction, the flickering cursor appears over that instruction. Inputting of further instructions only causes the instruction stored in the 48th step to be replaced by each new instruction.

Therefore, an algebraic formula must be composed of and stored within 48 steps. Scientific functions are fully merged and therefore represent only one step each. For instance, SIN, COSH, TANH⁻¹, LOG, $\frac{X}{2}$ represent one step each.

Each numeral and the decimal point represent a step. Therefore, if a formula includes a constant with more than one numeral, it may be advisable to use a letter (i.e., $A \sim E$, M) to save steps.

The cursor may be used to count steps, as it will stop only once at a fully merged identific function.

End of Supplementary - 5 steps

STATISTICAL MODE

Set the mode switch to STAT. The black items around the keys STO, RCL and M+ are now in effect. Pressing Data will clear the memories (A \sim E, M) so that they can be used for storing statistical results as described below. To clear previous statistical inputs and calculations, press [2ndF] and [CA] . Intermediate results can be obtained and then additional data may be added.

Memory	Contents
A B C D E M	

(1)

(3)

One-variable statistical calculation Calculate the following statistics. Number of samples n: (2) Σx : Total of samples Σx^2 : Sum of squares of samples (4) \bar{x} : Mean value of samples $\bar{x} = \frac{\Delta x}{\Delta x}$ (5) sx: Standard deviation with population parameter taken to be "n"-1". (Used to estimate the standard deviation of $\Sigma x^2 - n \bar{x}^2$ sx =population from the sample data extracted from that population.) (6) σx : Standard deviation with population parameter taken to be "n". (Used when all populations are taken to be $\Sigma x^2 - n\bar{x}^2$ sample data or when finding the standard devia- $\sigma x =$ tion of population with sample taken to be a

population.) Data for one-variable statistic calculations are inputted by the following operations

(1) Data Data

(2) Data X Frequency Data (when two or more of the same data are inputted)

Data can be specified in the form of algebraic formula, but parenthesize the formula when using "+", "-", "x" or " \div " instruction.

Ex. (5 + 4 x 3) Data Frequency of data 1 (SIN 5 + LN 2) x 5 Data Frequency of data 5

In the above example, if the formula is not parenthesized, 5+ and SIN5+ are neglected, and the same results are experienced as in key operation 4 x 3 Data and LN2 x 5 Data .

2. Single Variable Statistics

Calculate standard deviation, mean, and variance $(sx)^2$ from the following data:

 Value
 35
 45
 55
 65

 Frequency
 1
 1
 5
 2

As each sample is entered the number of that sample will appear on the right hand side of the display.



Note: When you correct the mis-entry before pressing the Data key, use CL key.

, Two-Variable Statistics and Linear Regression.

In addition to the same statistical functions for Y as for X in single-variable statistics, the sum of the products of samples ΣXY is added in two-variable 45

statistics.

In Linear Regression there are three important values; r, a, and b. The correlation coefficient r shows the relationship between two variables for a particular sample. The value of r is between -1 and 1. If r equals -1 or 1, all points on the correlation diagram are on a line. The further the value of r is from -1 and 1, the less the points are massing about the line and the less reliable is the correlation. If r is more than 0, it shows a positive correlation (Y is in proportion to X) and if r is less than 0, it is a negative correlation (Y is inverse proportion to X). The equation for the straight line is Y = a + b X. The point at which the line crosses the Y axis is a. The slope is b.



Estimated value (the value of x is estimated from that of y.)

Estimated value (the value of y is estimated from that of x.)

 Data for two-variable statistic calculations are inputted by the following operations.

Data (x) (x,y) Data (y) Data
 Data (x) (x,y) Data (y) X Frequency Data

 $x' = \frac{y-a}{a}$

y' = a + bx

Example: If we know a student's mark in mathematics, can we predict the mark in English?

The exam marks for six students chosen at random are given in the following table:



The value of r of .57 indicates that the correlation is marginal. The equation for the straight line for this data is Y = 34.26 + .68X.

If we had a student whose mark in mathematics was 90, based on this analysis, what mark would the student have in English?

90 2ndF Y' 95.333333333

If we had a student whose mark in English was 80, based on this analysis, what mark would the student have in mathematics? 80 $2ndF \quad x'$ 67.40350877

DISPLAY SYSTEM AND DECIMAL PLACES

The EL-5103 has four types of dispaly system and these display system can be selected with the FSE (EIX, SCI, ENG mode) key.

As you press the FSE key in the COMP or STAT mode, the mode symbol "FIX", "SCI", "ENG" or "Blank" will appear at the top of the display. Use the FSE key, when an answer is displayed or the calculator is cleared with CL key. $\rightarrow FIX \longrightarrow SCI \longrightarrow ENG \longrightarrow Blank (Reset)$

Fixed decimal places (See "decimal places" later)

Floating decimal place

The designation of decimal system and decimal places is retained even when the calculator is turned off.

- (1) FIX (FIXed decimal point system)
 - Calculation results are displayed after they are subjected to decimal designation and rounding.
 - When a calculation result is used for further calculations or formula the contents displayed will be used.

entere possib	a absolute value ad according to ble a maximum	of the TAB so n of 8 digi	calculation result is less than 1, however, it is that effective values are retained as many as ts.
Ex.	([CL]) [FSE] ·		Push the FSE key continuously until "FIX" is displayed.
virgel h	2nd F TAB 3 ·		Pre-set the number of decimal places.
	5 ÷ 3 =	1.7.48.798.7	1.667
	X	- SO	1.667 X_
+ CL	5 ÷ 9 =	021-450	0.556
n vot 7x	X	->	5.556 E-01 X

SCI (SCIentific notation)

Calculation results are displayed with scientific notation (A $\times 10^{B}$). Since the mantissa of the calculation result is displayed in accordance with a decimal designation, the number of effective digits can be easily designated. The next digit after the specified number of decimal places is automatically rounded off.

- When a calculation result is used for further calculations or formula, the contents displayed will be used.
 - Ex. (CL) FSE Push the FSE key continuously until "SCI" is displayed. 2ndF TAB 2 Decimal: 2

(This means that the number of effective digits has been set at 3.)

4.29 E-02

4.29 E-02+_(The calculation result is of three effective digits and rounded off, being used in the next formula.)

(3)ENG (ENGineering notation)

.3 [+ 7 =

+

Every calculation result is displayed on the basis of scientific notation (A x . 10^B). At this time its mantissa is displayed according to a decimal designation (TAB) and its exponent is automatically set at a multiple of 3 (\cdots -6, -3, 0, 3, 6, · · ·) to be displayed. Therefore, any display can be easily read in the unit of K (kilo- 103) or m (milli- 10-3), etc. that is frequently used in the engineering field.

(The next digit after the spe rounded off.)	cified number of decimal places is automatically
Ex. (CL) FSE	· Push the FSE key continuously until "ENG" is displayed.
2ndF TAB 2	Decimal: 2
.3 ÷ 7 = →	42.86 E-03 (42.86 x 10 ⁻³)
× →	42.86 E-03X_(The calculation result is rounded off and used in the
ating decimal point system	tollowing formula.)
	Control of a strength of the s

When (1) through (3) is being cancelled: (when "FIX", "SCI" or "ENG" is not displayed)

Floating

- Calculation results are displayed in floating decimal point system. Calculation results, if they are out of the range $0.00000001 \le |x| \le$ 9999999999 or are not zeroes, are displayed on the basis of scientific notation. When calculation results, when used in the following formula, are treated in
- such a way as to retain as many effective digits as possible a maximum of 10 digits.

	Ex. (CL) FSE	Turn off "FIX", "SCI", and "ENG".
	1 ÷ 3 = →	0.333333333
	famin Agreenance Asy (see)	10 digits
		3.333333333 E-01 X_ (Press the PB key)
erts	CL 1 ÷ 5 Exp (-) 12 [= → 2.E 11
	Lalamin' grissblint [X → 2.E11,X-article territor primot 1

Decimal Places

The 2ndF TAB keys are used to specify the number of decimal digits in the calculation result when the FIX, SCI or ENG mode is set. The number of places after the decimal point is specified by the numeral key ($0 \sim 9$) pressed after the 2ndF TAB keys. Carry over will be automatically rounded.

Use the 2ndF TAB keys when the calculation result is displayed or the calculator is cleared with the CL key.

FIX mode			
2ndF TAB 9			
5 ÷ 9 =	\rightarrow	0.555555556	
2ndF TAB 8	\rightarrow	0.55555556	
2ndF TAB 7	->	0.5555556	
milcula 2			
2ndF TAB 1	\rightarrow	0.6	
2ndF TAB 0	-	- 1.	

Example:

- A display, when it cannot occur on the basis of any decimal designation, can occur based on a possible system.
 - The designations of decimal places is retained even when the display system is changed.

THE KEYBOARD



OPERATING CONTROLS

Power on key When this key is depressed, the calculator is turned on. Automatic Power-Off function (A.P.O.): This calculator is automatically turned off approximately 10 minutes after the last key operation to save your batteries. Power off key When this key is depressed, the calculator is turned off.

Mode switch

CASH.

DITATI

AER: Algebraic Expression Reserve mode This mode is used for placing algebraic formulas into the calculator. In this mode, a calculation can not be performed.

COMP: Compute mode

This mode permits the calculator to perform (except for statistical calculation) all standard calculations including four arithmetic calculations and scientific calculations and calculations that use algebraic formulas from the AER mode.

STAT: Statistical calculations mode The statistical program will be activated. This mode is operated completely independently of the AER mode.	Indif b : STAT mode of the coefficient b of the linear regression equation $y = a + bx$.
2ndF 2nd function designation key y' x' σy • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • 9 • 0 • • • 0 • •	Indf X : STAT mode Used to obtain the mean value of data (Data: x) Indf Sx : STAT mode
2ndF y' : STAT mode (When the calculator is set at the statistical calcula-	Used to obtain the standard deviation (sx) of the sample of data (x).
tion mode.)	STAT mode
Used to obtain the estimated value of y.	Used to obtain the standard deviation (σx) of the population of data (x).
2ndF : STAT mode	Indif Y : STAT mode
Used to obtain the estimated value of x.	Used to obtain the mean value of data (Data: y)
Used to obtain the correlation coefficient in two-variable statistical calculation.	(Inif) sy : STAT mode Used to obtain the standard deviation (sy) of the sample of data
2ndF a : STAT mode	Example 1 (σ_y) : STAT mode
Used to obtain the constant a of the linear regression equation $y = a + bx$.	Used to obtain the standard deviation (σ_y) of the population of data (y) .

DRG

(-)

Change sign and Degree/Radian/Grad selection key TATE Used to designate the nagative number.

Ex. -2.4 (-) 2.4

2ndF DRG : Used for calculation of trigonometric, inverse trigonometric and coordinate conversion. The 2ndF DRG keys change the angular mode.

 \rightarrow DEG \longrightarrow RAD \longrightarrow GRAD \longrightarrow

nothelycold and to the (Press 2ndF DRG) to out out do of betU

Ex. DEG \rightarrow GRAD: Depress the <u>2ndF</u> DRG keys twice. "DEG" mode – Entries and answers are in decimal degrees. "RAD" mode – Entries and answers are in radians. "GRAD" mode – Entries and answers are in grads. (100^g = 90^o = $\frac{\pi}{2}$). Enter exponent key Example: 1.234 x 10¹⁵ Key in: 1.234 Exp 15

Arithmetic calculation, memory and statistical calculation keys Used to obtain the sum of the products of data a and × + ÷ : Pressed for addition, subtraction, multiplication and division. COMP mode, STAT mode: Performs the calculation. AER mode: Designates the execution instruction of the calculation. Used to designate the memories ($C \sim E$, M To designate the memory after pressing the STO or RCL Note: key, the 2ndF is not needed. STAT mode Used to obtain the sum of data (Data: x)

Exp



Used to obtain the sum of squares of data (Data: x) STAT mode

2ndF (Exy) : STAT n

A([xy) B([xy2)

2ndF A

2ndF B

Used to obtain the sum of the products of data x and y in twovariable statistical calculation.

2ndF (n) : STAT mode

Used to obtain the number of samples entered.

Parenthesis, memory and statistical calculation keys.

- Used to open parenthesis.
- Used to close parenthesis.

: Used to designate the memories (A , B) Note: To designate the memory after pressing the STO or RCL key, the [2ndF] is not needed.

2ndF () : STAT mode Used to obtain the sum of data (Data: y)

2ndF (Ey2) : STAT mode Used to obtain the sum of squares of data (Data: y)

Memory plus/enter data key AER mode: Instruction to add a result to the independently accessible memory (M). COMP mode: Used to add a calculated result to the contents of the independently accessible (M) memory. AER mode: Instruction to subtract a result from the independently accessible (M) memory. Note: When the 2ndF M+ keys is pressed, the "M-" will be displayed. COMP mode: Used to subtract a result from the contents of the independently accessible (M) memory. STAT mode: Used to enter data in one-variable or two-variable statistical calculations. **Recall and statistical calculation key** Recall the contents of the designated memory. To designate each memory, depress A ~ E, M keys following the RCL key, (Ex. RCL A)

STAT mode (x,y)

CD STO

t()=

COMP

1()=

Used to distinguish data x and data y in the two-variable statical calculation. Example: Refer to page 48.

Store and statistical calculation key

- STO The EL-5103 has six memory register. To designate each memory, press the STO key followed by A ~ E , M (Ex. STO A) AER mode:
 - Designates the instruction to store a number into the designated memory. COMP mode:
 - Depression of the STO and A ~ E , M key clear a number in the designated memory and then stores a number being displayed or calculated 2ndF . result in the designated memory.
- STAT mode: CD

Used to correct the mis-entry of data. Compute and variable designation key

- Example: Refer to page 35.
- AER mode:
- Example Refer to page 36.

Playback and comma key PB AER mode: why airl?...nete ano vol trian paramup out en late

PB

The display will show the equations previously entered when the playback key is pressed. If the equations total more than 13 chracters, continued pressing of [PB] will bring forth each segment in the proper sequence. COMP and STAT mode: to avoid their brue teas, and grandauf

Cursor stap-up and base to ward

In the COMP mode pressing the playback key allows the user to check all of the inputs of the most recent calculations. In this mode, the playback features is in 13-step segments. In the STAT mode the user can check the last data entry.

AER mode: in and an and and and

A

DEL

2nd F

Inserts comma between formulas to distinguish them from each other when storing two or more formulas.

Cursor step-down and delete key

Makes the cursor go left by one step. This key is effective only whithin the area where instructions are written.

Deletes the symbol (instruction) stored in the step indicated by the cursor. (The cursor does not move.)





E FSE and tabulation key

2ndF TAB

TAB

Example: Refer to page 49.

DISPLAY

The EL-5103 has a 13-digit alpha-numeric dot matrix liquid crystal display.
1. Display format

Display format
1) Algeblaic formulas/contents of the entry

	54 C	DEG	
1	SIN	30×1	2+42_

69

avent and serve



RAD 1.234567898

Cursor

When a numeral key or a key to specify a calculation instruction is pushed in the AER, COMP or STAT mode, the cursor indicates each time the step in which the instruction of the key to be pushed next will be written. If the step indicated by the cursor is filled with an instruction, a symbol of that step and all of dots contained in one-digit display of that step are alternately displayed as cursor display. The cursor can be freely shifted within the area where instructions are written by operating the ▶ and ◀ keys.

2) Calculation result

DEG 1.2345678E-99 Mantissa Exponent 2. Symbols and indicator 2nd F Second function designation symbol Appears when second function is set. HYP Hyperbolic function symbol Appears when hyperbolic function is set. DEG Angular symbols RAD Appears when degree mode is set. DEG: GRAD RAD: Appears when radian mode is set. GRAD: Appears when grad mode is set. FIX Fixed decimal symbol This symbol indicates that calculation results are displayed on the basis of fixed decimal system.

SCI	Scientific notation symbol This symbol indicates that calculation results are displayed on the basis of			
	scientific notation.			
ENG	Engineering notation symbol			
	This symbol indicates that calculation results are displayed on the basis of			
	engineering notation.			
Er	Error symbol Second forestantiation avenue) of a second forestantiation avenue of the			
	This symbol shows that an error has been detected.			
+	Appears, when there exists anything to be displayed to the left of the displayed contents of an algebraic formula.			
→	Appears, when there exists anything to be displayed to the right of the displayed contents of an algebraic formula.			
	Appears also to indicate that the machine is in operation when it is execut-			
	ing a calculation. The short berg name manorA			
	FTX Fixed decimal symbol			
ad with na	This symbol indicates that calculation results and deployed			
	and the second se			

SPECIFICATIONS

Type: Number of internal calculation digits: Calculation system: Memory: Display (Calculation result):

Calculations:

Pocketable scientific calculator

Mantissa 12 digits, Exponent 2 digits According to algebraic formula (with priority judging function)

6 10 digits full-floating or Mantissa 8 digits (7 digits in negative)/Exponent 2 digits Display system: Fixed decimal system (FIX) Scientific notation (SCI) Engineering notation (ENG) Floating decimal point system Four arithmetic calculations, trigonometric and inverse

Er

General calculation capacity: Algebraic expression reserve:

Display: Component: Power supply:

Power consumption: Operating time: trigonometric functions, hyperbolic and inverse hyperbolic functions, Angular conversion, reciprocal, square and cube root, square and power, logarithmic and exponential, Xth root of Y $\{\frac{X}{y}y\}$, factorial, coordinate conversion, memory, and statistical calculations.

80 steps

Capacity: 48 steps

Functions: Cursor step-up, step-down, insertion, deletion, playback.

13-digit Dot matrix liquid crystal display. LSi etc.

4.5V ... (DC): Alkaline manganese battery x 3 or Silver oxide battery x 3 4.5V ... (DC): 0.0006W Alkaline manganese battery (LR44) Approx. 450 hours or

Silver oxide battery (S15 or G-13) Approx. 1,400 hours Display 555555. at the ambient temperature: (68°F). Operating temperature: Dimensions:

Weight: Accessories:

20°C

The operating time slightly changes depending on the type of battery or the way of use. $0^{\circ}C \sim 40^{\circ}C (32^{\circ}F \sim 104^{\circ}F)$ $69(W) \times 128(D) \times 7.8(H)$ $2\cdot23/32''(W) \times 5\cdot1/32''(D) \times 5/16''(H)$ Approx. 80g (0.18 lbs.) Wallet, Alkaline manganese battery x 3, instruction manual

BATTERY REPLACEMENT

Dimming of the display shows that the batteries should be replaced. 1. Turn off the calculator.

Remove the screws from the back cover with a small screw driver (Fig. 1).
 Replace the batteries. (Fig. 2) (+ side must be up)

4. Hook the tabs of the back cover into the slits of the calculator proper. (Fig. 3)

- 5. Push the back cover in slightly while replacing the screws.
- After the replacement, press the OFF, ON, 2ndF and CA keys in this order to clear the calculator.

When the batteries are correctly installed " 0." or " — " will be displayed. (If the display shows nothing or a meaningless symbol, remove the batteries and install them again. Press the OFF , ON 2ndF and CA keys in this order and check the display again.)



Battery: Alkaline manganese battery (Type LR-44) x 3 or Silver oxide battery (Type S-15 or G13) x 3

Eveready model S76, Mallory model MS76, and Ray-O-Vac model RS76, or equivalent should be used.

- Note: When replacing the batteries, observe the following instructions to prevent the failure of the set due to improper battery replacement.
 - Always replace all 3 batteries at the same time.
 - Do not mix new batteries with used batteries.
 - Do not use different kinds of batteries together.
 - Wipe off the surface of the new batteries with dry cloth and then, install the batteries as shown in Fig. 2.

-YOUR OWN APPLICATION -----

YOUR OWN APPLICATION -

79

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- YOUR OWN APPLICATION

SERVICE CENTER ADDRESS

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