LIMITED WARRANTY:

SHARP ELECTRONICS CORPORATION warrants this product to the original purchaser to be free from defective materials and workmanship. Under this warranty the product will be repaired or replaced, at our option, without charge for parts 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 CONSUMER 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 LIABLE FOR CONSEQUENTIAL ECONOMIC DAMAGE OR CONSEQUENTIAL 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 EXCLUSION 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.

FOR YOUR RECORDS....

For your assistance in reporting this electronic calculator in case of loss or theft, please record below the model number and serial number which are located on the bottom of the unit.

Please retain this information.

Model Number ______________________________ Serial Number ______________________________

Date of Purchase __________________________ Place of Purchase __________________________
OPERATIONAL NOTES

Thank you for your purchase of the SHARP scientific calculator, EL-5100.

Since the liquid crystal display is made of glass material, treat the calculator with care. Do not put the "EL-5100" 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:
1. The calculator should be kept in areas free from extreme temperature changes, moisture and dust.
2. A soft, dry cloth should be used to clean the calculator. Do not use solvents or a wet cloth.
3. If the calculator will not be operated for an extended period of time, remove the batteries to avoid possible damage caused by battery leakage.
4. If service of your calculator is required, use only an authorized SHARP Service Center.
5. Keep this manual for further reference.

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

This manual will introduce you to the Sharp EL-5100 scientific calculator. The EL-5100 is a new and powerful computing instrument. It will provide you with formidable computing power in mathematical, scientific, engineering and business calculations.

The EL-5100 provides direct entry of calculations and formulas as written. You will see as you follow through this manual that the EL-5100 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 and we would appreciate your comments. 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-5100 increases.
MODES

Note the black mode switch on the lower right of your calculator. As you move the black 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 selector to “COMP” position.

1. Addition, Subtraction & Playback

Key in the following:

12 + 45.6 - 32.1 + 789 - 741 + 213

Note that as you key in the “3” in 213, you have exceeded the 24 character capacity of the display. 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 $\Rightarrow$
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 seven 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:

$841 \times 586 \div .12 \Rightarrow$

Answer: 4106883.333
b. Key in the following:

\[
427 + 54 \times 32 \div 7 - 39 \times 2 =
\]

Answer: 595.8571429

Note that multiplication and division have priority to addition and subtraction.

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. \(\pi, \text{ Recall of memory contents}
3. \text{Single-term function preceded by numerals} \quad \left(x^2, x^{-1}, n1, \rightarrow \text{DEG}, \rightarrow \text{D.MS}\right)
4. \text{Two-term function such as } 2AY^X3, \text{ that is directly preceded by multiplication cleared of "X" instruction located just before memory or } \pi. \quad \left(\text{nCr, nPr, } Y^X, \sqrt[n]{\text{, }}, \rightarrow \text{POL}, \rightarrow \text{REC}\right)
(5) Multiplication cleared of "X" instruction located just before memory or π.
(6) Single-term function followed by numerals.
\[ \sqrt{}, e^x, 10^x, \sqrt[n]{x}, \ln, \log, \sin, \cos, \tan, \sin^{-1}, \cos^{-1}, \tan^{-1}, \sinh, \cosh, \tanh, \sinh^{-1}, \cosh^{-1}, \tanh^{-1} \]
(7) Two-term function other than shown in item (4) above.
\[ \binom{n}{r}, \frac{n!}{r!(n-r)!}, y^x, \sqrt[n]{x}, \rightarrow \text{POL}, \rightarrow \text{REC} \]
(8) \[ x^\frac{1}{2}, \sqrt[n]{x} \]
(9) +, −
(10) =, \text{M+}, \text{M−} (2\text{nd F M+}), \Rightarrow \text{M}, \text{STO A} \sim \text{STO J} \]

- Calculations have priority to others, when parenthesized.
- Provided that functions shown in item (5) (6) above are successively designated in an algebraic formula, calculations are performed from the right to the left. The other functions are calculated from the left to the right.

Ex. \[ e^x \sqrt[n]{\sin 60} \rightarrow e^x (\sqrt[n]{\sin 60}) \]
\[ \text{AC bPC} y^x \text{D} \rightarrow ((\text{AC bPC}) y^x \text{D}) \]

Note: • Even in the case of (3), any "X" instruction cannot be omitted if it follows a single-term function that is preceded by any numeric value.

Ex. In case of \(2^2A\), press \[2 \begin{array}{c} x^2 \end{array} \begin{array}{c} A \end{array} = \begin{array}{c} 100 \end{array} (2A)^2\] in this order.

\[5 \text{STO} A \quad 2 \begin{array}{c} x^2 \end{array} \begin{array}{c} A \end{array} = \rightarrow 100 \quad (2A)^2\]
\[2 \begin{array}{c} x^2 \end{array} \begin{array}{c} x \end{array} \begin{array}{c} A \end{array} = \rightarrow 20 \quad 2^2A\]
In case of $\frac{V}{A}$, press $2 \begin{array}{c}x^{-1} X A \end{array} = \frac{1}{2A}$ keys in this order.

\[
\begin{array}{c}
5 \text{ STO A} \\
2 \begin{array}{c}x^{-1} \times A \end{array} = \rightarrow 0.1 \\
2 \begin{array}{c}x^{-1} \times A \end{array} = \rightarrow 2.5 \frac{1}{2A}
\end{array}
\]

- Even in the case of (4), single-term function has priority, if it is directly preceded by two-term function in $2AY^x \sqrt{3}$, for instance.

Ex. \(\sqrt{2AY^x \sqrt{3}} \rightarrow \sqrt{(2 \times (AY^x (\sqrt{3})))}\)

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. 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 and 8-stage data buffer in it. When the calculation exceeds 16-stage in function or 8-stage in data is performed, an error occurs.

Ex. (1) \(2 + 3 \times (\sqrt{10^x (4 - 1.6 \times 2}) = \)

Functional buffer : 8-stage
Data buffer : 4-stage
\[ 4^2 + \log \sqrt[4]{Y^X} 1.2 - 2.1 = \]

- Instructions executable when read out in the course of calculation are not stored in the function buffer.
  \( (x^2, x^{-1}, n!, \rightarrow \text{DEG}, \rightarrow \text{D.MS}, =, \text{M+}, \text{M-}, \text{M\#}, \text{STO}, \text{DATA}, \text{CD}, (x, y), \theta ) \)

Ex. Action of buffer in calculation of
\[ 1.2 + A \times (3.5 + \sin B) Y^X 3 = \]
\[ A = 2.4, B = 30, \text{DEG} \]

<table>
<thead>
<tr>
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<th>X register</th>
<th>Data buffer</th>
<th>Function buffer</th>
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<td>1 stage</td>
<td>2 stage</td>
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<tr>
<td>Instruction</td>
<td>X register</td>
<td>Data buffer</td>
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<td>3.5</td>
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<td>153.6</td>
<td>1.2</td>
<td>(Y^X)</td>
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<td>154.8</td>
<td>1.2</td>
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</table>

**X register:** Calculation register

- Even if multiplication of memory and \(\pi\) is designated as cleared of "X" instruction, "X" instruction is stored in the function buffer in the execution of calculations.
Ex. 2AB =
In case of $A = 7$, $B = 12$

<table>
<thead>
<tr>
<th>Instruction</th>
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</thead>
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<tr>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>A</td>
<td>7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>7, 2</td>
<td></td>
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<tr>
<td>=</td>
<td>84</td>
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</table>

In the above case memory and $\pi$ are treated after once stored in the data buffer. Accordingly, multiplication cannot be continuously performed beyond nine times.

If you want to perform multiplication successively 10 times or more, input "X" instruction.

Ex. $2\pi$ABCDEABC = $\rightarrow$ Error

Ex. $2\pi$ABCDEAB X CDE = $\rightarrow$ Calculation is carried out.

- In calculation as SINH, COSH, TANH, TANH⁻¹, and nCr, a data buffer is used with its capacity increased by one stage for calculative aid.

End of Supplementary 1
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.

a. Trigonometric functions

The angular mode is designated by the \( \text{DRG} \) key. As you press this key the mode "DEG" "RAD" "GRAD" will appear at the top of the display. Put the angular mode at "DEG".

Key in the following:

\[
\text{SIN} 30 \quad \text{COS} 40 \quad =
\]

Answer: 1.266044443

Put the angular mode at "RAD"

Key in:

\[
\text{COS} \ 0.25 \pi \quad =
\]

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 orange 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.

Put the angular mode at “DEG”

Key in: (2nd F) Sin⁻¹ .5  \(=\)

Answer: 30  (Remember to use the second function key to get the inverse)

Put the angular mode at “RAD”

Key in: (2nd F) Cos⁻¹ (-) 1  \(=\)

Answer: 3.141592654  (Value of \(\pi\))
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: \( \text{HYP } \text{SIN} \ 4 \ \boxed{=} \)
Answer: 27.2899172

Key in: (2nd F) \( \text{ARCHYP } \text{SIN} \ 9 \ \boxed{=} \)
Answer: 2.893443986

d. Power Functions

Calculate: \( 20^2 \)
Key in: \( 20 \ X^2 \ \boxed{=} \)
Answer: 400

Calculate \( 3^3 \) and \( 3^4 \)
Key in: \( 3 \ \boxed{\ Y^x \ } \ 3 \ \boxed{=} \)
Answer: 27

Key in: \( 3 \ \boxed{\ Y^x \ } \ 4 \ \boxed{=} \)
Answer: 81
e. Roots
Calculate: \( \sqrt{25} \)
Key in: \( \sqrt{} \) 25 \( = \)
Answer: 5

Calculate: Cube root of 27
Key in: (2nd F) \( \sqrt[3]{ } \) 27 \( = \)
Answer: 3

Calculate fourth root of 81
Key in: 4 (2nd F) \( \sqrt[4]{ } \) 81 \( = \)
Answer: 3
f. Logarithmic Functions
   Natural Logarithms: Key in: LN 21 =
   Answer: 3.044522438
   Common Logarithms: Key in: (2nd F) LOG 173 =
   Answer: 2.238046103

g. Exponential Functions
   Key in: ex 3.0445 =
   Answer: 20.99952881 (21 as in item “f” above)
   Key in: (2nd F) 10x 2.238 =
   Answer: 172.9816359 (173 as in item “f” above)
h. Reciprocals

Calculate: \(\frac{1}{6} + \frac{1}{7}\)

Key in: \(6 \frac{x^{-1}}{+} 7 \frac{x^{-1}}{=}\)

Answer: 0.30952381

i. Factorial

Calculate: 69!

Key in: 69 (2nd F) \(n!\) \(=\)

Answer: \(1.711224524 \times 10^{98}\)

Note that the Error section deals with the calculation limits of the calculator.

j. Permutations

Key in: 5 (2nd F) \(nPr\) 3 \(=\)

Answer: 60
k. Combinations:
Calculate the number of combinations of 5 cards in a deck of 52.
Key in: 52 \(\binom{5}{5}\) \(=\)
Answer: 2598960

l. Scientific Notation
If you wish to place a number into the calculator in scientific notation you must use the “Exp” key. If you wish to convert from floating decimal to scientific notation, you must use the key \(F-E\).
Calculate \(1.2 \times 10^{20} \times 1.5 \times 10^5\)
Key in: 1.2 \(\text{Exp} 20\) \(\times\) 1.5 \(\text{Exp} 5\) \(=\)
Answer: 1.8E25 (1.8 \(\times\) 10\(^{25}\))
Calculate \(1.992 \times 10^{33} \times 6.668 \times 10^{-23}\)
Key in: 1.992 \(\text{Exp} 33\) \(\times\) 6.668 \(\text{Exp} (-) 23\) \(=\)
Answer: 1.3282656E11 (1.3282656 \(\times\) 10\(^{11}\))
If a calculation is displayed in the floating decimal point system, pushing the [F=E] key displays the result in scientific notation. Pushing the key again displays the result in the floating decimal point system.

Key in: 1234567898
Display reads: 1234567898.
Press [F=E] Display reads 1.234567898E 09

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 designation and rounding, but the calculator retains a numerical value whose mantissa is 12 digits. However, the maximum number of effective digits is 10 digits when a calculation result obtained through the [M+] or [M+] key is used in the following calculation.
- 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. 1234567898765 → equal to 1.234567898 x 10^{12}
0.00000000001234 → equal to 1.234 x 10^{-11}

End of supplementary 2
M. Decimal Places

The \textit{TAB} key is used to specify the number of decimal digits in the calculation result. The number of places after the decimal point is specified by the numeral key (0 \sim 9) pressed after the \textit{TAB} key. For free floating calculation press the \textit{•} key after \textit{TAB}. Carry over will be automatically rounded.

First Press \textbf{\textit{TAB} •}

Key in 1.23456789 \(\equiv\)
Display reads 1.23456789
Press \textbf{\textit{TAB} 3}, display reads 1.235
Press \textbf{\textit{TAB} 9}, display reads 1.234567890

Calculate \(1.2 \times 10^{-12} \times 4.5 \times 10^{-10}\)

Key in: \textbf{\textit{TAB} • 1.2E (−) 12 \times 4.5E (−) 10 \equiv}
Answer: 5.4E-22

Note that for results smaller than 0.4 \(\times 10^{-9}\) use \textbf{\textit{TAB} •} only
n. 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

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 (2nd F)

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 \text{ +DEG } + .0238 \text{ +DEG } + .0222 \text{ +DEG } = \\
Answer 1: 0.123611111 (press PB if you wish to check your input)

Key in: \frac{1}{3} = \\
Answer 2: 0.041203704

Key in: (2nd F) \text{-D.MS } = \\
Answer 3: 0.022833333 or the average time is 2 minutes 28 seconds

\text{o. Coordinate Conversion}

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

\[ r = \sqrt{x^2 + y^2} \]

\[ \theta = \tan^{-1} \left( \frac{y}{x} \right) \]

DEG: \quad 0 \leq |\theta| \leq 180

RAD: \quad 0 \leq |\theta| \leq \pi

GRAD: \quad 0 \leq |\theta| \leq 200
Solve for $x = 6$ and $y = 4$ \hspace{1cm} \text{mode = DEG}

Key in: $6 \uparrow POL \ 4 \ \uparrow =$

Answer: $7.211102551 \ (r)$

Key in: $J \ \uparrow =$ \hspace{1cm} Answer: $33.69006753 \ (\theta)$

Note that the values of $y$ and $\theta$ are stored in $J$.

Calculate the magnitude and direction (phase) in a vector $\hat{I} = 12 + j9$

Key in: $12 \uparrow POL \ 9 \ \uparrow =$

Answer: $15 \ (r)$

Key in: $J \ \uparrow =$ \hspace{1cm} Answer: $36.86989765 \ (\theta)$

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

Solve for $P (14, \pi/3)$, $r = 14 \ \theta = \pi/3$

Mode = RAD \hspace{1cm} Key in: $14 \ (2nd \ F) \uparrow REC \ (\ \pi/3 \ ) \ \uparrow =$

Answer: $7 \ (X)$

Key in: $J \ \uparrow =$ \hspace{1cm} Answer: $12.12435565 \ (y)$
4. Memory Calculations

The independently accessible memory is indicated by the three blue keys: RM, \( \Rightarrow \)M, M+. Before starting a calculation clear the memory by pressing CL and \( \Rightarrow \)M.

Key in: 12 + 5   \( \Rightarrow \)M
Answer: 17

To subtract key in: 2 + 5 (2nd F) \( \Rightarrow \)M
Answer to this equation: 7

Key in \( \text{RM} \) to recall memory: 10

Key in: 12 \( \times \) 2 \( \Rightarrow \)M
Answer: 24 (Also takes place of 10 in memory)

Key in: 8 \( \div \) 2 \( \text{M}+ \)
Answer: 4 \( \text{RM} \) : 28

The RM key may be used to place the value in the memory into a formula. The RM key cannot be designated as a variable in a formula.
5. Store Memories

There are 10 store memories labeled A to J. To input a number into a memory press the value followed by STO and the memory letter. Addition or subtraction to a store memory is not possible. To recall a value from a store memory press RCL and the appropriate store memory letter. The capacity of each memory is 12 digits for mantissa and 2 digits for exponent.

Key in: 12 \( \times \) 5 \( \text{STO} \) A
Answer: 60 Content of Memory A

Key in: 1.85E23 \( \div \) RCL A \( \text{STO} \) B
Answer: 3.083333333E21 Content of Memory B

Key in: RCL A \( \div \) RCL B \( \text{STO} \) C (Remember \( \text{TAB} \) •)
Answer: 1.945945946 E-20 Content of Memory C

6. Formula Solution in the COMP MODE

To solve a formula using the store memories as variables in the COMP MODE you must first place your
values in the appropriate memories. Capacity is 80 program steps for playback. (Refer to section 6 of "Direct Formula Entry" for a detailed discussion of steps.)

Key in: 1 \text{STO F}, 2 \text{STO G}, \text{ and } 3 \text{STO H}

Key in: F + G + H =

Answer: 6

Key in: Fx^2 + Gx^2 + Hx^2 =

Answer: 14

Key in: (Mode = DEG) Sin F + Cos G + Tan H =

Answer: 1.069251013

7. Errors

In the case of an error, the display will show \text{Error}. 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 key.
Supplementary 3 – Error Conditions

1. When the absolute value of a calculation result is greater than $9.999999999 \times 10^{99}$.
2. When a number is divided by 0 (zero). ($A \div 0$) 
3. When the absolute value of a result of memory calculation is greater than $9.999999999 \times 10^{99}$.
4. 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**

- The entry and four (4) arithmetic calculations:
  1st, 2nd operand and calculated result: $\pm 1 \times 10^{-99} \sim \pm 9.999999999 \times 10^{99}$ and 0
- Scientific and special functions:

<table>
<thead>
<tr>
<th>Functions</th>
<th>Dynamic range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIN $x$</td>
<td>DEG: $</td>
</tr>
<tr>
<td>COS $x$</td>
<td>RAD: $</td>
</tr>
<tr>
<td>TAN $x$</td>
<td>GRAD: $</td>
</tr>
<tr>
<td>Functions</td>
<td>Dynamic range</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td>$\sin x$</td>
<td>In $\tan x$, however, the following cases are excluded.</td>
</tr>
<tr>
<td>DEG:</td>
<td>$</td>
</tr>
<tr>
<td>RAD:</td>
<td>$</td>
</tr>
<tr>
<td>GRAD:</td>
<td>$</td>
</tr>
<tr>
<td>$\cos x$</td>
<td>$-1 \leq x \leq 1$</td>
</tr>
<tr>
<td>$\tan x$</td>
<td>$</td>
</tr>
<tr>
<td>$\ln x$</td>
<td>$1 \times 10^{-99} \leq x \leq 9.999999999 \times 10^{99}$</td>
</tr>
<tr>
<td>$\log x$</td>
<td>$-9.999999999 \times 10^{99} \leq x \leq 230.2585092$</td>
</tr>
<tr>
<td>$e^x$</td>
<td>$-9.999999999 \times 10^{99} \leq x \leq 230.2585092$</td>
</tr>
<tr>
<td>Functions</td>
<td>Dynamic range</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td>$10^x$</td>
<td>$-9.999999999 	imes 10^{99} \leq x \leq 99.99999999$</td>
</tr>
</tbody>
</table>
| $Y^x$     | $-9.999999999 \times 10^{99} \leq x \log Y \leq 99.99999999$  
  | $Y \geq 0 \quad$ (Here, $Y^X = 0$ at $Y = 0$) |
| $\sqrt{x}$ | $-9.999999999 \times 10^{99} \leq \frac{1}{x} \log y \leq 99.99999999$  
<p>| $y \geq 0, \ x \neq 0$ |
| $\sqrt[3]{x}$ | $|x| \leq 9.999999999 \times 10^{99}$ |
| SINH $x$  |               |
| COSH $x$  | $-227.9559242 \leq x \leq 230.2585092$ |
| TANH $x$  |               |</p>
<table>
<thead>
<tr>
<th>Functions</th>
<th>Dynamic range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{SINH}^{-1}x$</td>
<td>$</td>
</tr>
<tr>
<td>$\text{COSH}^{-1}x$</td>
<td>$1 \leq x \leq 9.999999999 \times 10^{49}$</td>
</tr>
<tr>
<td>$\text{TANH}^{-1}x$</td>
<td>$</td>
</tr>
<tr>
<td>$\sqrt{x}$</td>
<td>$0 \leq x \leq 9.999999999 \times 10^{99}$</td>
</tr>
<tr>
<td>$x^2$</td>
<td>$</td>
</tr>
<tr>
<td>$x^{-1}$</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>$x \neq 0$</td>
</tr>
<tr>
<td>$n!$</td>
<td>$0 \leq n \leq 69$</td>
</tr>
<tr>
<td>$x \cdot y$</td>
<td>$0 \leq y \leq x \leq 69$</td>
</tr>
<tr>
<td>$x \cdot y$</td>
<td>$x, y$: integer</td>
</tr>
<tr>
<td>Functions</td>
<td>Dynamic range</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td>➔ POL</td>
<td>$9.999999999 \times 10^{-49} \leq</td>
</tr>
<tr>
<td>➔ REC</td>
<td>$</td>
</tr>
<tr>
<td>➔ DEG</td>
<td>$</td>
</tr>
<tr>
<td>➔ D.MS</td>
<td></td>
</tr>
<tr>
<td>Functions</td>
<td>Dynamic range</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Data CD</td>
<td></td>
</tr>
<tr>
<td>Statistical calculation</td>
<td></td>
</tr>
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<td>(</td>
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<td></td>
<td>(</td>
</tr>
<tr>
<td>(\bar{x})</td>
<td>(n \neq 0)</td>
</tr>
<tr>
<td>(Sx)</td>
<td>(n \neq 1)</td>
</tr>
<tr>
<td></td>
<td>(0 \leq \frac{\Sigma x^3 - n\bar{x}^2}{n - 1} \leq 9.999999999 \times 10^{99})</td>
</tr>
<tr>
<td>Statistical calculation</td>
<td>Functions</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td></td>
<td>$\sigma x$</td>
</tr>
<tr>
<td></td>
<td>$0 \leq \frac{\sum x^2 - nx^2}{n} \leq 9.999999999 \times 10^{99}$</td>
</tr>
<tr>
<td></td>
<td>$r$</td>
</tr>
<tr>
<td></td>
<td>$0 &lt; \left</td>
</tr>
<tr>
<td></td>
<td>$\left</td>
</tr>
<tr>
<td></td>
<td>$\left</td>
</tr>
<tr>
<td>Functions</td>
<td>Dynamic range</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Statistical calculation</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>$n \neq 0$</td>
</tr>
<tr>
<td></td>
<td>$0 &lt; \left</td>
</tr>
<tr>
<td></td>
<td>$\left</td>
</tr>
<tr>
<td>a</td>
<td>$a$ is the same condition as $b$, and $\left</td>
</tr>
</tbody>
</table>

Note: In the above calculation range, the calculation results or intermediate results are treated or displayed as 0 (zero), when their absolute values are below $1 \times 10^{-99}$.

- As a rule, the error of functional calculations is less than ±1 at the lowest digit of a displayed numerical value (at the lowest digit of mantissa in the case of scientific notation system) within the above calculation range.
  
In the calculation of $\text{SINH } x$ and $\text{TANH } x$, $x$ is a singular point when it is 0 (zero). Near this point the error is accumulated, reducing the accuracy.
8. Grammar

Multiplication of one variable followed by another is automatic. Multiplication of a number before a variable is automatic. The \(\pi\) key may be used as a number.

Key in: \(2 \text{ STO } A, \ 3 \text{ STO } B, \ 2 \pi \text{ AB} \)

Answer: 37.69911184

Multiplication of a numeral or a variable by a scientific function or an expression in parenthesis must include a multiplication sign. If the closing of a parenthesis occurs at the end of an expression, it is not necessary to include the second part of that parenthesis —

\[
\text{Calculate } 4 \sin 30 + \frac{2 \cos 30}{\sqrt{2\pi} + \tan 30}
\]

Key in: \(4 \times \sin 30 + (2 \times \cos 30 ÷ (\sqrt{2} \times \pi + \tan 30) \equiv \)

Answer: 2.345014014
The EL-5100 operators fall into three groupings:

A. Functions for which the numeral or letter (operands) directly follow
B. Operands directly precede the operators
C. Functions where an operand must both directly precede and follow the operator

Supplementary 4 – Grammatical Error Conditions

- The following conditions (1) to (3) are encountered when \( f_1 \), \( f_2 \) and \( f_3 \) are defined as follows.

\( f_1 \): Functions for which function instructions are followed by numerals or memories

\((\sqrt{\cdot}, e^x, 10^x, \frac{\pi}{\cdot}, \ln, \log, \sin, \cos, \tan, \sin^{-1}, \cos^{-1}, \tan^{-1}, \sinh, \cosh, \tanh, \sinh^{-1}, \cosh^{-1}, \tanh^{-1}, [-] \) of mantissa\)

\( f_2 \): Functions for which function instructions preceded by numerals or memories

\((x^2, 1/x, n!, \rightarrow \text{DEG}, \rightarrow \text{D.MS})\)

\( f_3 \): Functions for which function instructions preceded and followed by numerals or memories as well as instructions for four arithmetic calculations

\((\binom{n}{r}, \binom{n}{r}, \sqrt[n]{\cdot}, \rightarrow \text{POL}, \rightarrow \text{REC}, +, -, \times, \div)\)

(1) (, or \( f_1 \) is preceded by a numeral, memory, \( \pi \), or \( f_2 \).

Ex. \( 2(3 + 4), A(1 + 2), 2\sqrt{2}, A \sin 20 \)
(2) $f_2$, $f_3$, ) or calculation execution instruction is preceded by $f_1$, $f_3$ or (.
Ex. $\sin^2, 2y^{x-1}, (+4, \sin), y^x =$

(3) A numeral is preceded by a memory, $\pi, )$ or $f_2$.
Ex. $A2, \pi 3, (2 + 3)4, 2^23$

End of supplementary 4 — Grammatical Errors

9. "Expression" Correction and Editing
The flickering cursor is used to correct and edit expressions.

a. Correction
Key in: $12 \ + \ 3 \ \times \ 2 \ - \ \sin 30 \ \equiv$
Answer: 17.5
Press [PB]

The cursor is flashing over the =. If you wish to change the multiplier from 2 to 4, press the $\leftarrow$ key 5 times until it covers the 2; now press 4; press $\equiv$ (If is not necessary to move the cursor back)
Answer: 23.5
To change SIN 30 to COS 45, move the cursor to over the SIN and press COS 45 and =. 
Answer: 23.29289322

b. Deletion
Key in: 12 + 45 + 78
To change the 45 to 5, press the cursor key 5 times until it covers the 4, press (2nd F) DEL. The 4 will disappear and all remaining material in the display will shift automatically to the left.

c. Insertion
To insert material place the cursor over the item which will follow the insertion. Multiple insertions may be made.
Key in 2 (π + 4) = Display indicates error. A multiplication sign must be placed between the 2 and (. Press PB. Move the cursor to over the (. Press (2nd F) INS. An opening occurs on the display and all material following the insertion automatically shifts to the right.
Press X and =
Answer: 14.28318531
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 80 steps with no limit on characters.

1. Formula Entry I

In Section 6 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 (2nd F) CA (above Red CL Key). Your display will show 1; which means Line 1 (Lines will be discussed in a later section.)

Key in: \( A^2 + B^2 \)

To solve this equation move the black mode switch to COMP.
Put in values: 2 \text{sto} A, 3 \text{sto} B

Press \text{comp} Key (lower right)

Answer: 13

Replace the values: 4 \text{sto} A, 5 \text{sto} B

Press \text{comp} Answer: 41

Solve the equation: 5 \times (X + 8) = 60 \text{ for } X

Mode: AER Key in: (2nd F) \text{CA}

Note that in the AER mode a comma is used to end an equation. The COMP key produces 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 \underline{X} (A + 8), A, A + 1 \text{sto} A

Move the black switch to COMP MODE

Press \text{comp} continuously until Ans. 1 equals 60

Ans. 2 = 4 is the value of A that we are seeking
2. Formula Entry II Dialogic Form

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 \( f(\ ) = \) is above the \( [3 \ 5] \) key. Start with the \( f(\ ) = \) key, follow with the variables, close with the \( f(\ ) = \) key,

Solve 3 equations: \( X^2 + Y^2, \ 23X + 45Y, \ \sqrt{X - \ln Y} \)

Let \( X = A, \ Y = B \)

Key in:  

a. (2nd F) \( CA \)
   (2nd F) \( f0= \) display should read 1; \( f(\ ) = \)

b. \( AB \) (2nd F) \( f0= \) display should read 1; \( f(AB) = \)
   in other words, a function of variables \( A \) and \( B \)

c. \( A^2 \ + \ B^2, \ 23A \ + \ 45B, \ \sqrt{A} \ - \ LN B \)

Note that as you enter the letter \( A \) in the third equation, the 24 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
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 E and H had been used, the calculator would have only asked for these.
Press COMP and get ANS 1 = 13
Press COMP again and get ANS 2 = 181
Press COMP again and get ANS 3 = .315601274
Only three equations were placed in the AER Mode. Note that the maximum number of equations on a Line is 9.
Press \( \text{COMP} \) again and get \( A = ? \) again. New values may now be put in for \( A \) and \( B \).

If you push \( \text{COMP} \) without entering a numeral, the previous value is retained.

3. Law of Cosines
Solve for \( C \) knowing \( A \), \( B \), and \( D \)
The basic equation is

\[
C = \sqrt{A^2 + B^2 - 2AB \cos D}
\]

Note that since the entire equation falls under the square root sign parenthesis must be used.

Key in: \( \text{(2nd F)} \) \( \text{CA} \) \( f(\text{ABD}) = \sqrt{A^2 + B^2 - 2AB \times D} \)
Mode: \( \text{COMP} \) \( \text{Angle Mode: DEG} \)
Press \( \text{COMP} \), put in 3 for \( A \)
Press **COMP**, Put in 4 for B
Press **COMP**, Put in 60 for D
Press **COMP**, value of the third side is 3.605551275
Solve for angle of 45° instead of 60°
Press **COMP** until the display reads $D = \frac{x}{2}$ Key in: 45
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, "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.

4. Business Applications
There are many business applications for which the EL-5100 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)

Key in: \( f(A) = 0.65A \) \( \text{STO} \) B, \( 0.97B \) \( \text{STO} \) C, \( 0.98C \), A + 10 \( \text{STO} \) A

Mode: COMP

Press \( \text{COMP} \), A = \( \frac{105}{164} \)

Key in: 100

Press \( \text{COMP} \), ANS 1 65

Press \( \text{COMP} \), ANS 2 63.05 Make sure you are using \( \text{TAB} 2 \)

Press \( \text{COMP} \), ANS 3 61.79

Press \( \text{COMP} \), ANS 4 110

Answer 4 is the original price of $100 plus the increment of $10. The next time COMP is pressed, A = \( \frac{105}{164} \) 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 \( \text{COMP} \) button 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.
5. Lines

The EL-5100 provides 5 lines in the AER Mode on which formulas can be stored. By placing equations on each line, combined with Safe Guard, you can develop a “Handbook of formulas” for later use. You may use the lines as a number of optional means of solving for a variable in line 1.

Mode = AER (2nd F) [CA]

on Line 1 key in: \( f(AB) = \sqrt{A^2 + B^2} \)  
(Pythagorean Theorem)

The line following the last entry indicates the position of the next entry. This line must be in the display before going to the next formula line. If the cursor is flashing it must be moved to the right until it disappears. To go to the next formula Line:

Key in: (2nd F) ➩ (end mark which appears above the COMP key in the lower right of the calculator). Your display should now read 2;

Key in: \( f(CDE) = CD \times \sin E \)  
(Area of a Parallelogram)

Press (2nd F) ➩ to get 3;

Key in: \( f(FGH) = .5F \times (G + H) \)  
(Area of a Trapezoid)

Press (2nd F) ➩ to get 4;

Key in: \( f(I) = \pi l^2, 4\pi l^2 \)  
(Area of a Circle, Surface Area of a Sphere)
Press (2nd F) to get 5;

Key in: \( f(J) = 1.33\pi J \) (Volume of a Sphere)

Switch the mode to COMP

If you now wish to use the equation on line 4:

Key in: (2nd F) [4] (above the I key)

Note that if you press (2nd F) [CA] in the AER mode all five formula lines will be cleared. Corrections on separate lines may only be made by using the editing functions.

6. Program Steps

The capacity of the EL-5100 for storing algebraic formulas is 80 steps.

If the 80th step is loaded with an instruction, the flickering cursor appears over that instruction. Inputting of further instructions only causes the instruction stored in the 80th step to be replaced by each new instruction. Therefore, an algebraic formula must be composed of and stored within 80 steps. Scientific functions are fully merged and therefore represent only one step each. For instance, \( \text{SIN, COSH, TANH}^{-1}, \text{LOG,} \sqrt{\text{}} \) 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 ~ J) to save steps.

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

End of supplementary — 5 lines and steps
For more advanced mathematical techniques on the EL-5100, we suggest obtaining the book:

Advanced Analysis with the Sharp 5100 Scientific Calculator
by Jon M. Smith
Published by Wiley-Interscience Division
John Wiley & Sons
New York, New York
List Price: $6.95
Set the mode switch to STAT. The black items around the keys RM, ⇒M, and M+ are now in effect. Pressing \textbf{Data} will clear the \textbf{E} \sim \textbf{J} memories so that they can be used for storing statistical results as described below. To clear previous statistical inputs and calculations, press (2nd F) and \textbf{CA}. Intermediate results can be obtained and then additional data may be added. As statistical calculations are performed, the store memories \textbf{E} \sim \textbf{J} are loaded with values, which are retained even if the mode switch is changed to AER or COMP.

1. **One-variable statistical calculation**

   Calculate the following statistics.
   
   (1) \( n \): Number of samples
   (2) \( \Sigma x \): Total of samples
   (3) \( \Sigma x^2 \): Sum of squares of samples
   (4) \( \bar{x} \): Mean value of samples \( \bar{x} = \frac{\Sigma x}{n} \)
(5) Sx: Standard deviation with population parameter taken to be "n—1".

\[ Sx = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n-1}} \]

(Used to estimate the standard deviation of population from the sample data extracted from that population.)

(6) \( \sigma x \): Standard deviation with population parameter taken to be "n".

\[ \sigma x = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n}} \]

(Used when all populations are taken to be sample data or when finding the standard deviation of population with sample taken to be a population.)

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

(1) Data

(2) Data \( \times \) 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 "+", "−", "×" or "÷" instruction.

Ex. \((5 + 4 \times 3)\) Data

\((\text{SINA} + \ln 2) \times 5\) Data

Frequency of data 1

Frequency of data 5
In the above example, if the formula is not parenthesized, 5+ and SINA+ 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 \((S_x)^2\) from the following data:

<table>
<thead>
<tr>
<th>Value</th>
<th>35</th>
<th>45</th>
<th>55</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

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

Key in:  
35 Data  
45 Data  
55 x 5 Data  
65 x 2 Data  

Display:  
1  
2  
7  
9
Key in:  
Display :
Mean: (2nd F) $\bar{x}$ 53.89
Standard Deviation: (2nd F) $S_x$ 9.28
Variance: $x^2$ 86.12
Correct Data (CD): The last entry above is an error and must be changed to $60 \times 2$.

Key in:  
Display :
65 $\times$ 2 7
60 $\times$ 2 9

3. 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 $\Sigma XY$ is added in two-variable 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 in inverse proportion to $X$).

The equation for the straight line is $Y = a + bX$. The point at which the line crosses the $Y$ axis is $a$. The slope is $b$.

\[
\begin{align*}
    r & \text{ Correlation coefficient} \\
    r = \frac{S_{xy}}{\sqrt{S_{xx} \cdot S_{yy}}} \\
    a & = \bar{y} - b\bar{x} \quad \text{Coefficient of linear regression equation } Y = a + bx \\
    b & = \frac{S_{xy}}{S_{xx}} \quad \text{regression equation } Y = a + bX
\end{align*}
\]

\[
\begin{align*}
    S_{xx} & = \Sigma x^2 - \frac{(\Sigma x)^2}{n} \\
    S_{yy} & = \Sigma y^2 - \frac{(\Sigma y)^2}{n} \\
    S_{xy} & = \Sigma xy - \frac{\Sigma x \cdot \Sigma y}{n}
\end{align*}
\]
Example: If we know a student's mark in mathematics, can we predict the mark in English?  
The exam marks for five students chosen at random are given in the following table:

<table>
<thead>
<tr>
<th>Student No.</th>
<th>Mark in Math. (X)</th>
<th>Mark in English (Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>82</td>
<td>79</td>
</tr>
<tr>
<td>2</td>
<td>53</td>
<td>50</td>
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<td>3</td>
<td>61</td>
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<td>74</td>
<td>96</td>
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<td>5</td>
<td>51</td>
<td>73</td>
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<tr>
<td>6</td>
<td>51</td>
<td>73</td>
</tr>
</tbody>
</table>
The value of $r$ of .57 indicates that the correlation is marginal. The equation for the straight line for this data is $Y = 34.62 + .68X$.

If we had a student whose mark in mathematics was 90, based on this analysis, the student would have a mark in English of 95.5.
Supplementary 6 — Detailed Reviews

The Keyboard

- Disp l a y
- 2nd fu nctio n d esig n atio n k e y
- P o w e r o n /p o w e r o ff k e y
- M o d e s e le cto r
- 2nd function designation key
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 5 ~ 8 minutes after the last key operation to save your batteries.

**Power off key**
When this key is depressed, the calculator is turned off.

**Mode selector**

- **AER:** Algebraic Expression Reserve mode
  - This mode is used for placing algebraic formulas into the calculator.
  - In this mode, a calculation cannot 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.
2nd function designation key

Display format exchange key
Example: refer to page 19

Tabulation key
Example: refer to page 20

Degree/Radian/Grad selection key
Used for calculation of trigonometric, inverse trigonometric and coordinate conversion. The $\text{DRG}$ key changes the angular mode.

---

Ex. **DEG** $\rightarrow$ **GRAD**: Depress the $\text{DRG}$ key twice. (DRG DRG)

"**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. ($100^g = 90^\circ = \frac{\pi}{2}$).

Degree/minute second $\leftrightarrow$ Decimal degrees conversions key
Example: refer to page 21.
Rectangular coordinate $\leftrightarrow$ polar coordinate conversion key
Example: refer to page 23.

Combination and permutation key
Example: refer to page 17 and 18.

Pi and factorial key
$\pi$ : Used to enter the constant $\pi \approx 3.141592654$.
$2\text{nd} F \pi!$ : Used to calculate the factorial.
\[ n! = n \cdot (n-1) \cdot (n-2) \cdots 2 \cdot 1 \]

Hyperbolic/arc hyperbolic key
Example: Refer to page 14.

Trigonometric and inverse trigonometric functions keys
Example: Refer to page 12.

Reciprocal and cube root key
Example: Refer to page 15 and 17.
$Y^x$ and $\sqrt[n]{x}$ key

$Y^x$ : Raises a number to a power.

$2\text{nd}F \sqrt[n]{x}$ : Used to obtain $x$th root of a number.

Example: Refer to page 14 and 15.

$10^x$

Natural/common antilogarithm key

Example: Refer to page 16.

$e^x$

Natural/common logarithm key

Example: Refer to page 16.

$x^2$

Square key

Example: Refer to page 14.

$\sqrt{\hspace{1cm}}$

Square root key

Example: Refer to page 15.

$0 \sim 9$

Numeral and statistical calculations keys

$0 \sim 9$ : Used to enter numbers.

$2\text{nd}F n$ : STAT mode (When the calculator is set at the statistical calculation mode.)

Used to obtain the number of samples entered.
: STAT mode
   Used to obtain the sum of the products of data \(x\) and \(y\) in two-variable statistical calculation.

: STAT mode
   Used to obtain the sum of data (Data: \(y\)).

: STAT mode
   Used to obtain the sum of the squares of each data (Data: \(y\)).

: STAT mode
   Used to obtain the mean value of data (Data: \(x\)).

: STAT mode
   Used to obtain the standard deviation (\(Sx\)) of the sample of data (\(x\)).

: STAT mode
   Used to obtain the standard deviation (\(sx\)) of the population of data (\(x\)).

: STAT mode
   Used to obtain the mean value of data (Data: \(y\)).

: STAT mode
   Used to obtain the standard deviation (\(Sy\)) of the sample of data (\(y\)).

: STAT mode
   Used to obtain the standard deviation (\(sy\)) of the population of data (\(y\)).
Decimal point and statistical calculation key

: Positions the decimal point in an entered number.

2ndF $\Sigma x$ : STAT mode:
Used to obtain the sum of data. (Data: $x$)

$\Sigma x^2$ Change sign and statistical calculation key

: Used to designate the negative number.

Ex. $-2.4$ $\text{(–)}$ $2.4$

2ndF $\Sigma x^2$ : STAT mode:
Used to obtain the sum of the squares of each data (Data: $x$)

Parenthesis and statistical calculation keys

: Used to open parenthesis.

: Used to close parenthesis.

2ndF $r$ : STAT mode:
Used to obtain the correlation coefficient between two variables $x$ and $y$ (data).
Arithmetic calculation and statistical calculation keys

\[ \begin{array}{c}
\times & + & \div & - \\
\pm & C & E & \end{array} \]

- Pressed for addition, subtraction multiplication and division.

- COMP mode, STAT mode: Performs the calculation.
- AER mode: Designates the execution instruction of the calculation.

\[ \text{2ndF} \: a \] : Used to obtain the constant \( a \) of the linear regression equation \( y = a + bx \).
\[ \text{2ndF} \: b \] : Used to obtain the coefficient \( b \) of the linear regression equation \( y = a + bx \).

Example: Refer to page 55.

\[ \text{Exp} \]
Enter exponent key
Example: Refer to page 18.

\[ \text{STO} \]
Store key
Example: Refer to page 25.

\[ \text{RCL} \]
Recall key
Example: Refer to page 25.
a) Variables
AER mode only: For use as variables in the direct entry of formulas in the AER mode.

b) Store memory keys
AER mode, COMP mode:
When the keys are depressed following the STO or RCL key, corresponding store memories are designated.

1;
c) Formula keys
: AER mode:
Displays the formulas in each area.
: COMP mode:
Used to perform the calculation according to the algebraic formula stored in each area in the AER mode.

Recall memory and correct data key

Example: Refer to page 24.
Used to correct the mis-entry of data.
Memory-in/two variable data designation key

AER mode:
Instruction to store a result in the independently accessible memory.

COMP mode:
Clear the contents of the independently accessible memory and replaces it with the calculated result. To clear the memory depress the [CL] key followed by the [EM] key.

STAT mode:
Used to distinguish data \(x\) and data \(y\) in the two-variable statistical calculation.
Example: Refer to page 55.

Data memory plus/enter data key

AER mode:
Instruction to add a result to the independently accessible memory.

COMP mode:
Used to add a calculated result to the contents of the independently accessible memory.
2ndF M+: AER mode:
Instruction to subtract a result from the independently accessible memory.
Note: When the 2ndF M+ keys is depressed, the "M−" will be displayed.

COMP mode:
Used to subtract a result from the contents of the independently accessible memory.

Data:

STAT mode:
Used to enter data in one-variable or two-variable statistical calculations.

Clear/clear all key

CA CL:

AER mode:
Places the cursor in the first position in the algebraic expression reserve area.

COMP mode:
Clears the contents of the calculation registers. The contents of the memory and stored algebraic formulas are not affected. Clears the error condition.

STAT mode:
Clears the contents of the calculation registers. The entry data for the statistical calculation is retained. It will also clear an error condition.

2ndF CA:
AER mode:
Clears the algebraic expression reserve area of all contents.
COMP mode:
Clears the contents of the calculation registers. The contents of the memory and stored algebraic formula are not affected.

STAT mode:
Clears the entry data or calculated result of the statistical calculation. The stored algebraic formulas are retained.

Cursor step-down and delete key

- **DEL** : Makes the cursor go left by one step. This key is effective only in the area divided.
- **2ndF DEL** : Deletes the symbol (instruction) stored in the step indicated by the cursor. (The cursor does not move.)

Cursor step-up and insert key

- **INS** : Makes the cursor go right by one step. This key is effective only in the area divided.
- **2ndF INS** : Provides a blank necessary for insertion of an instruction in the step indicated by the cursor.

Pushing the **2ndF** and **INS** keys in this sequence shifts the contents of the display to the right. In the blank step appears the insert mark " ".

Example: Refer to page 38.
Play back and variable designation key

AER mode:
The display will show the equations previously entered when the playback key is pressed. If the equations total more than 22 characters, continued pressing of PB will bring forth each segment in the proper sequence.

COMP and STAT mode:
In the COMP mode pressing the playback key allows the user to check all of the inputs of the most recent calculation. In this mode, the playback feature is in 24-step segments. In the STAT mode the user can check the last data entry.

Example: Refer to page 41.

Compute and comma key

Example: Refer to page 39.

Note: Do not depress 2nd F keys at the end of the 5th area. Otherwise an error will take place.

Example: Refer to page 46.
The EL-5100 has a 24-digit alpha-numeric dot matrix liquid crystal display.

1. Display format
   
   1) Algebraic formulas/contents of the entry

   **AER mode:**
   
   \[
   \text{Cursor (Indicating position of next entry).}
   \]

   **COMP mode:**
   
   \[
   \text{Cursor}
   \]
2) Calculation result
Calculation result obtained by stored algebraic formula.

\[
\begin{array}{c}
\text{DEG} \\
1\div\text{ANS} \quad 1 = -1.234567898E-99
\end{array}
\]

\[
\begin{array}{c}
\text{DEG} \\
-1.234567898E-99
\end{array}
\]

3) Error condition

<table>
<thead>
<tr>
<th>Mantissa</th>
<th>Exponent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 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 divided area where instructions are written by operating the ▶ and ▼ keys.
- Some keys require a maximum of 5 digits for the display of the corresponding instruction. For step, any instruction is counted as one step. (Ex. \(\text{SINH}^{-1}\) ...... 1 step)
- In new key operation causes the display to exceed 24 digits (22 digits in AER mode), the previous display is shifted to the left to provide a space to display the new input and the symbol "←" will appear.
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   DEG: Appears when degree mode is set.
GRAD  RAD: Appears when radian mode is set.
GRAD: Appears when grad mode is set.

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 executing a calculation.
SPECIFICATIONS

Model: EL-5100

Number of internal calculation digits: Mantissa 12 digits, Exponent 2 digits

Calculation system: According to algebraic formula (with priority judging function)

Memory:
- Independently accessible memory: 1
- Store memory: 10

Display:
- Mantissa 10 digits, Exponents 2 digits
- Automatic changeover from floating decimal point display system to exponential display system and vice versa.

Calculations:
- Four arithmetic calculations, trigonometric and inverse trigonometric functions, hyperbolic and inverse hyperbolic functions, Angular conversion, reciprocal, square and cube root, square and power, logarithmic and exponential, Xth root of Y (\(\sqrt[\text{x}]{\text{y}}\)), factorial, permutation, combination, coordinate conversion, memory, and statistical calculations.

General calculation capacity: 80 steps

Algebraic expression reserve: 80 steps

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

Component:
- Dot matrix liquid crystal display.
- LSi etc.
Power supply: 4.5V (DC): Alkaline manganese battery x 3 or Silver oxide battery x 3
Power consumption: 4.5V (DC): 0.0009W
Operating time:
Alkaline manganese battery (LR44)
Approx. 300 hours or
Silver oxide battery (S15 or G-13)
Approx. 1,000 hours
Display 555555555555 at the ambient temperature: 20°C (68°F). The operating time slightly changes depending on the type of battery or the way of use.

Operating temperature: 0°C ~ 40°C (32°F ~ 104°F)
Dimensions: 175(W) x 70(D) x 9.3(H) mm
6-7/8”(W) x 2-3/4”(D) x 3/8”(H)
Weight: Approx. 120g (0.26 lbs.)
Accessories: Carrying case, Alkaline manganese battery x 6 (3: built-in, 3: for spare) and instruction manual

End of supplementary 6
BATTERY REPLACEMENT

Dimming of the display indicates that the batteries should be replaced.

1. Turn off the calculator.
2. Remove the screws from the back cover with a small screwdriver (Fig. 1).
3. Replace the batteries. (Fig. 2) (See Note)
4. Hook the tabs of the back cover into the slits of the calculator proper.
5. Push the back cover in slightly while replacing the screws.
6. Push the reset switch on the back cover to clear the calculator. (Fig. 3)
Use a ball-point pen to press the reset switch. Only a little pressure is needed. Do not use a pencil or other materials that could break in the depressions.

Note • When replacing the batteries, observe the following instructions to prevent the failure of the set due to improper battery.
• Always replace all 3 batteries at the same time.
• Do not use new and once-used batteries together.
• 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

Battery:
Alkaline manganese battery x 3 or
Silver oxide battery x 3
Eveready model S76, Mallory model MS76, and Ray-O-Vac model RS76 or equivalent should be used.

Batteries may be obtained where you purchased your calculator or at most retail outlets for calculators, watches, or cameras.
YOUR OWN APPLICATION
YOUR OWN APPLICATION
SERVICE CENTER ADDRESS

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SHARP CONSUMER FACTORY SERVICE CENTER
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