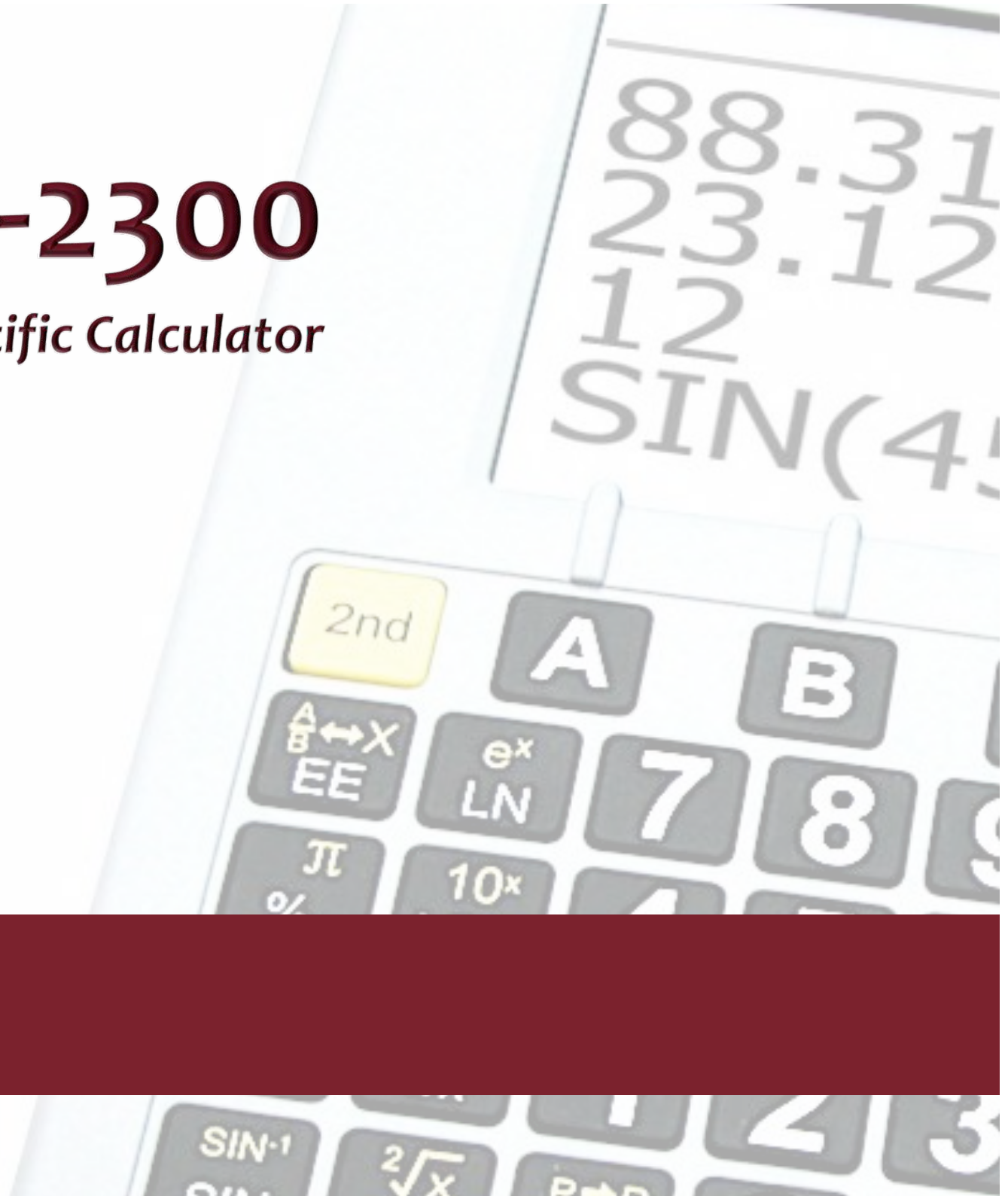
SciPlus-2300

Scientific Calculator



User Guide

sight enhancement systems

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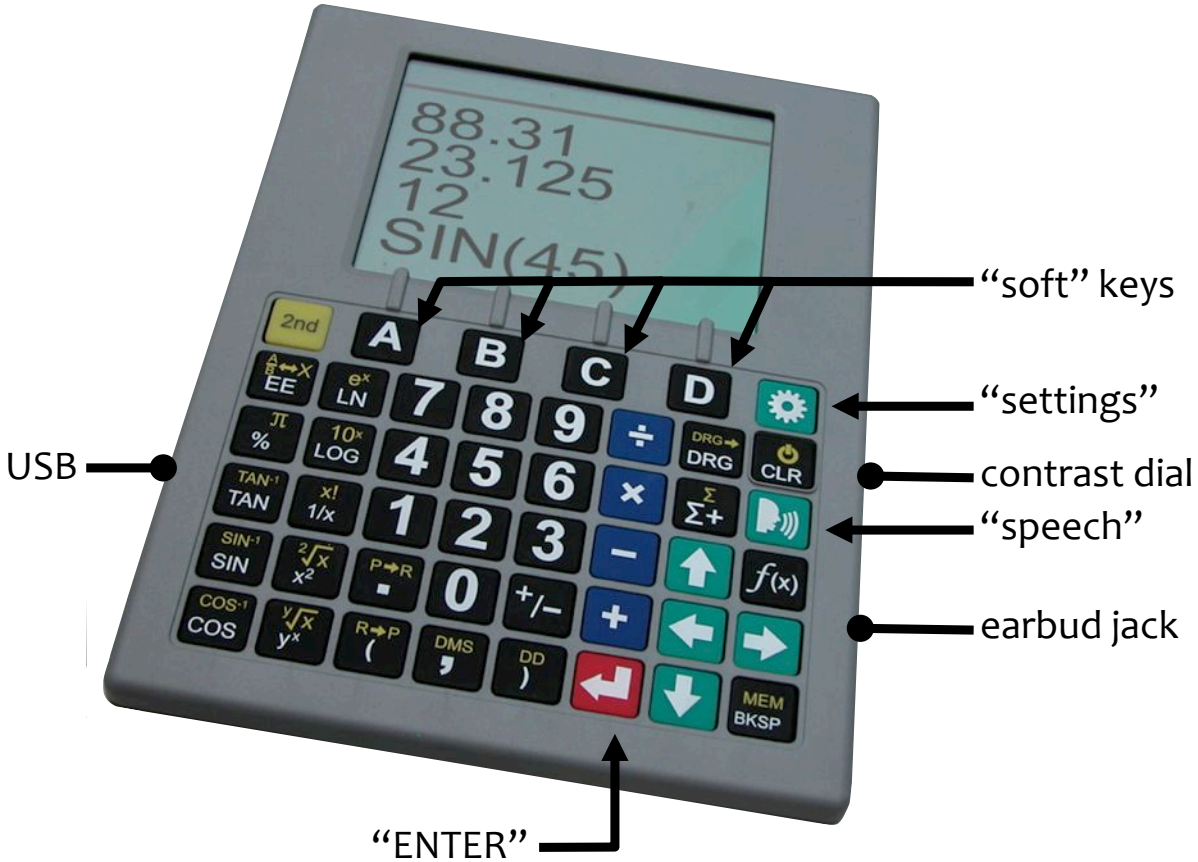
Getting Started

The SciPlus calculator performs a wide variety of mathematical, statistical, and trigonometric calculations. This User Guide will explain how to get the best from your calculator. Let's first get familiar with the SciPlus controls.



Charging your SciPlus-2300

Charging the calculator is easy. Simply plug the USB wall charger into a regular outlet, and plug the USB cable to the SciPlus-2300. The calculator will receive a good charge overnight. The SciPlus-2300 will operate for many weeks between charges. Note that, if you regularly use the backlight, the battery will deplete much more quickly. This is not a problem; just charge it up and you're good to go. Your SciPlus-2300 calculator includes a USB Wall Charger and cord. Please ensure that these items are in the box.

Adjusting the Display Contrast

There is a dial on the right hand side of the SciPlus-2300 that you can use to adjust the contrast of the display. Note that this does NOT adjust the brightness of the backlight; that is done through the settings menu. You may find that adjusting the contrast will help maintain optimal visibility of the display as the battery depletes.

Soft Keys

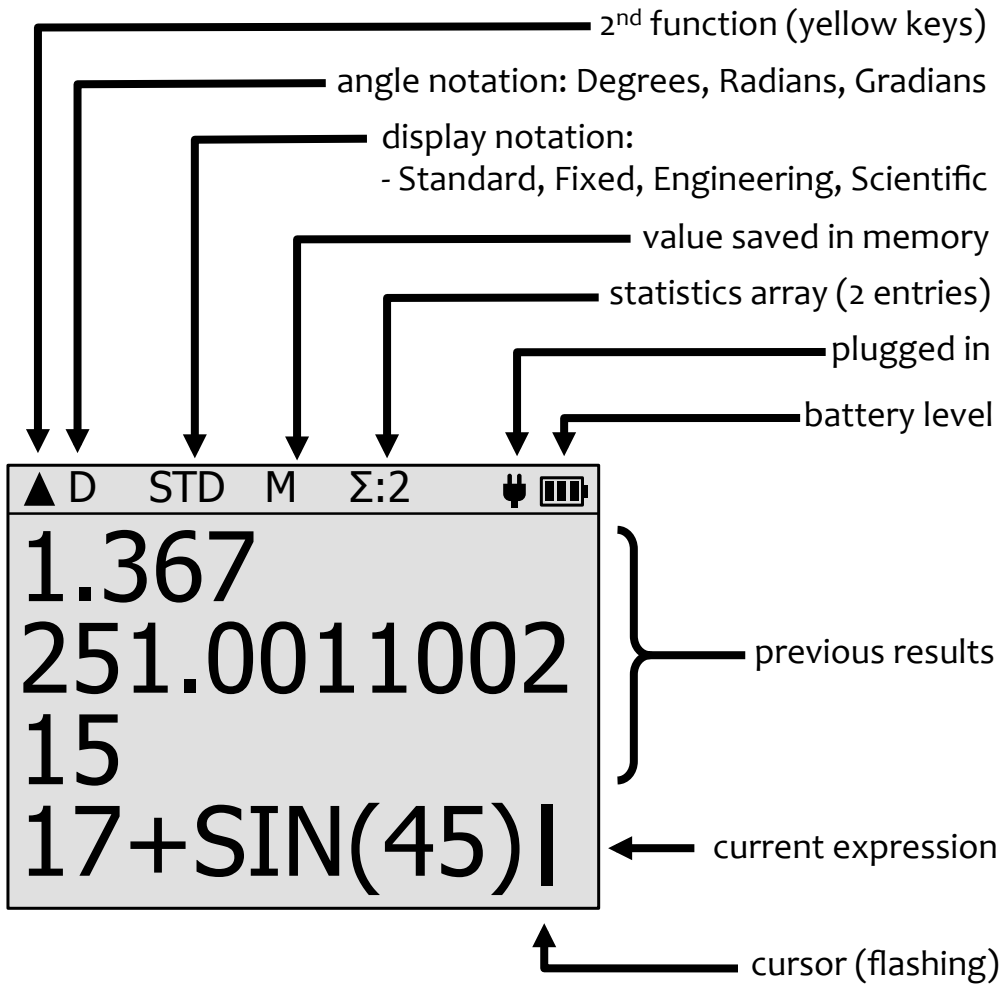
The keys labeled 'A' 'B' 'C' and 'D' do not have a specific function. Instead, labels at the bottom of the display define the function of these keys. If there are no labels, these keys will not do anything. You will use these keys when adjusting the SciPlus-2300's settings, and for memory and statistics operations.

The SciPlus-2300 Display

The SciPlus-2300 screen is shown at right. Note that there are four lines. The bottom line is the one in which you enter expressions. The other three lines show the results of previous operations. Once you hit the ENTER key, an expression is evaluated and it's result is moved up a line, leaving the bottom line empty to enter another expression.

The characters above the horizontal line at the top of the screen show the ***status line*** of the calculator. If the battery symbol is animated, this indicates that the battery is being charged.

Some of the characters in the status line may not appear at all times. For example, if there is no entry in memory, or if the statistics register is currently empty, these items will not appear in the status line.



SciPlus-2300 Operations

The SciPlus-2300 follows the "BEDMAS" rule for order of operations:

Brackets ➔ Exponents ➔ Divide ➔ Multiply ➔ Addition ➔ Subtraction

Most of the SciPlus-2300 keys have two functions. The lower function appears in a white font. The alternate, or **2nd** function, when present, appears in a yellow font. To access this function, the **2nd** key must first be pressed. Throughout the key descriptions below, if a key symbol appears in a yellow background, this indicates that the **2nd** key must be pressed before this key is pressed.

Notes regarding nomenclature:

1. Throughout this manual, a key press is indicated in blue. For example, ↵ indicates the red ENTER key on the keyboard.
2. In the examples below, the key press (in blue) is shown the way it appears in the display, which is not necessarily the way it appears on the key.

Working with Previous Results

When entering expressions in the bottom line, it's very easy to use the results of previous calculations displayed in the lines above it. Using the ← and → arrows, position the cursor at the location in the expression where you wish to insert a previous result. Now, using the ↑ and ↓ arrows, select the previous result that you wish to insert into the current expression, and press ↵.

Auto Shutoff

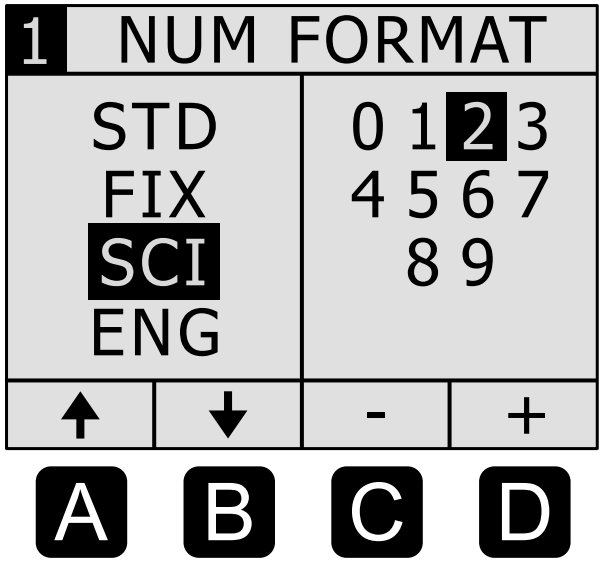
Your SciPlus-2300 calculator will automatically shut off after five minutes of inactivity. Many of the calculator's current settings such as the angle mode, number format, etc., will be saved, so that it will turn on again in the same state. Values stored in memory and the statistics table are also saved.

Note that if the backlight is on when the calculator is turned off, it will be off when the calculator is again turned on.

If the calculator is left off for an extended period (typically many weeks), these settings will be lost.

Settings

There are four settings screens in the SciPlus-2300, accessed by the  key. Cycle through the four settings screens using the ↑ and ↓ arrows, or by entering **1** through **4**. Change settings in any of the three screens using the A-D soft keys.



Number Format: There are four number formats supported by the SciPlus-2300:

Standard: Numbers show up to ten-digit precision.

Examples: 101, 41250.5, 0.33333333

Fixed Notation: Number of decimals is fixed.

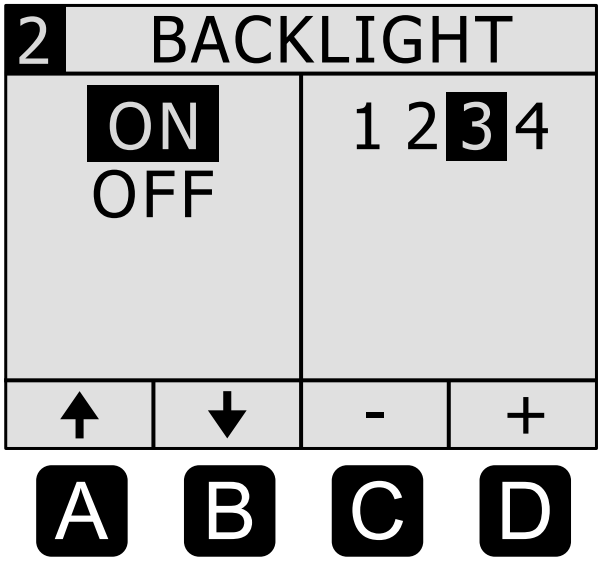
Examples: 101.00, 41250.50, 0.33

Scientific Notation: Numbers are displayed in powers of ten, with a fixed number of decimals.

Examples: 1.01E+02, 4.13E+04, 3.30E-01

Engineering Notation: Numbers displayed in powers of … 10^{-6}, 10^{-3}, 10^{0}, 10^{3}, 10^{6}…, with fixed decimal precision. These steps express values corresponding with "micro, milli, kilo, mega, etc.".

Examples: 101, 41.25E+03, 333E-03

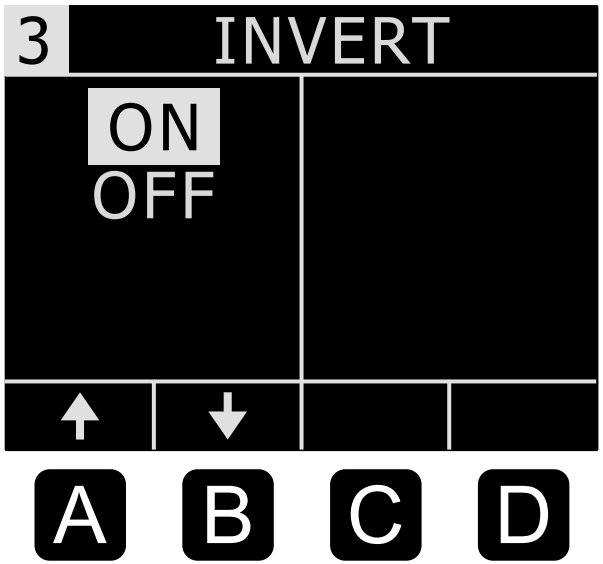


Backlight:

Use the A-B soft keys to turn the backlight on/off.

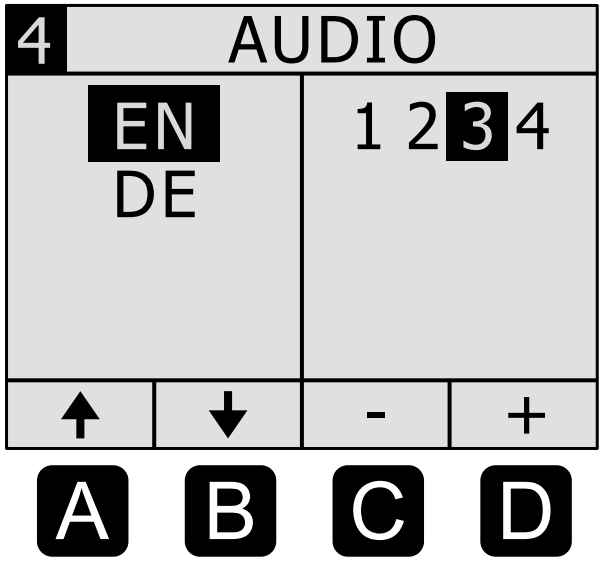
The C-D keys adjust the brightness.

Note that the backlight will significantly shorten the duration of a battery charge from weeks to hours. For this reason, the SciPlus-200 always powers on with the backlight turned off.



Screen Inversion:

Often, people with low vision are able to benefit from an inverted screen. The A-B keys simply invert the display between black/white and white/black.



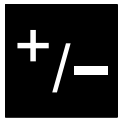
Speech Output:

Use the A-B softkeys to select the language. Normally, your SciPlus-2300 will speak in English (EN) and one additional language as ordered from the factory (German in this example).

The C-D softkeys will adjust the output volume.

Basic Functions

KEY	NAME	DESCRIPTION
2nd	2nd Function	Press this key before any dual-function key to access the upper (yellow) function. You will notice the ▲ symbol appear in the status line.
CLR	ON/Clear	Turn calculator ON. The cursor will appear on the bottom line. Most of the settings from the previous session will remain as they were.
CLR	OFF	Save settings, memory and statistics data, and turn calculator OFF.
MEM BKSP	Backspace	Delete last entry or function.
↵	Enter	Resolves the current expression, displaying the result in the second line. If the expression contains errors, an error message will appear.
↵	2nd Enter	Pressing the 2nd key followed by ↵ clears the current expression and all previous results.
R→P (	Open Parentheses	Open parentheses. Note that some expressions will automatically include the opening parentheses.

KEY	NAME	DESCRIPTION
	Close Parentheses	Close parentheses.
	Change Sign	Change the sign of the operand. After some operands (e.g. × ÷), this operation will insert a negative sign into the expression.
	Scientific Notation	This is equivalent to "×10 raised to the power…"
	Settings	Manage settings (see section on Settings). Toggles on/off.

Mathematical Functions

KEY	NAME	DESCRIPTION
π %	Pi	Enters the symbol π into an expression. If you simply enter **π** ↵, the result 3.141592654 will be displayed.
x! 1/x	Factorial	Calculates the factorial of the value to the left. Enter this *after* you enter the value of 'x'.
π %	Percentage	The behavior of the % function depends upon context. If the expression is simply a number with the % operator, the result of the expression is the number divided by 100. If the % operator is appended to a number which is itself to the right of the + - × or / operator, the percentage is added to, subtracted from, multiplied by, or divided by the number to the left of the operator. e.g.: **3 + 50 %** followed by ↵ yields a result of 4.5. If the % operator is followed by another operator, a Syntax Error results.
$^2\sqrt{x}$ x^2	X^2	Squares the value to the left. Enter 'x' first. e.g: **10 ^2** followed by ↵ yields a result of 10^2, or 100.

KEY	NAME	DESCRIPTION
$\sqrt[y]{x}$ y^x	y^x	Raises the value to the left, to an exponent. Enter 'y' first. Shown as '^'. e.g: **2 ^ 3** followed by ↵ yields a result of 2^3 or 8.
x! 1/x	Reciprocal	Calculates the reciprocal of an expression. e.g: **1/(25 × 4)** followed by ↵ yields 1/100, or 0.01.
$\sqrt[2]{x}$ x^2	Square Root	Calculates the square root of a value. e.g: **2√ 4** followed by ↵ yields √4, or 2.
$\sqrt[y]{x}$ y^x	n^{th} Root	Calculates the n^{th} root of a value. e.g: **3 n√ 8** followed by ↵ yields the $\sqrt[3]{8}$, or 2.
10^x LOG	LOG	Calculates the base10 logarithm of an expression. e.g: **LOG(25 × 4)** followed by ↵ yields $\log_{10}(100)$, or 2.
e^x LN	LN	Calculates the natural logarithm of an expression. e.g: **LN(25 × 4)** followed by ↵ yields ln(100), or 4.605170186.
e^x LN	e^x	Calculates the value of e (2.2.718282) raised to an expression. e.g: **EXP(2+3)** followed by ↵ yields e^5, or 148.4131591.
10^x LOG	10^x	Calculates the value of 10 raised to a value. e.g: **10^ 5** followed by ↵ yields 10^5, or 100000.

Memory Operations

Note that memory operations with the SciPlus-2300 use the soft keys A-D.

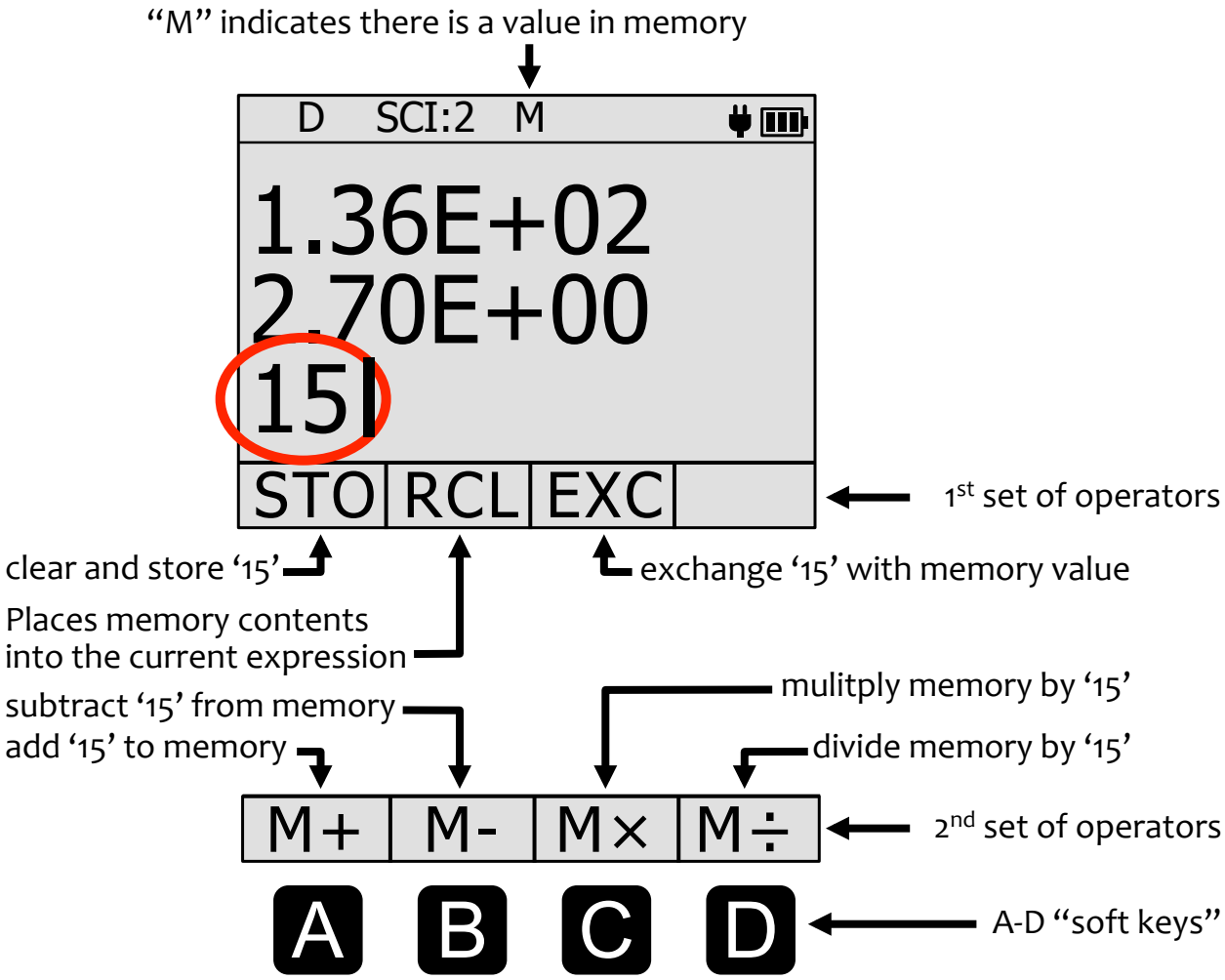
KEY	NAME	DESCRIPTION
MEM BKSP	Display Memory Soft Keys	This key causes the memory soft keys to be displayed. Note that there are two sets. Pressing this **2nd MEM** a second time will bring up the second set of memory soft keys. A third time will disable the soft keys.

Soft keys A-D are used to clear the memory, swap the value in memory with the current line, and perform simple arithmetic operations (+ - × ÷) on the value stored in memory using the current line. Memory soft keys are shown on the opposite page. In this example, the value '15' resides in the current line. Note that storing a value of '0' clears the memory.

Note that the **STO** softkey (A), if pressed at the end of an expression, will solve the expression and store the result. The **EXC M+ M- M×** and **M÷** all work in the same manner.

Pressing the **RCL** softkey (B) will add "RCL" to the current expression. When the expression is evaluated, the value currently stored in memory is used. To display the value currently in memory, simply enter **RCL** by itself, followed by ↵.

Memory Soft Keys:



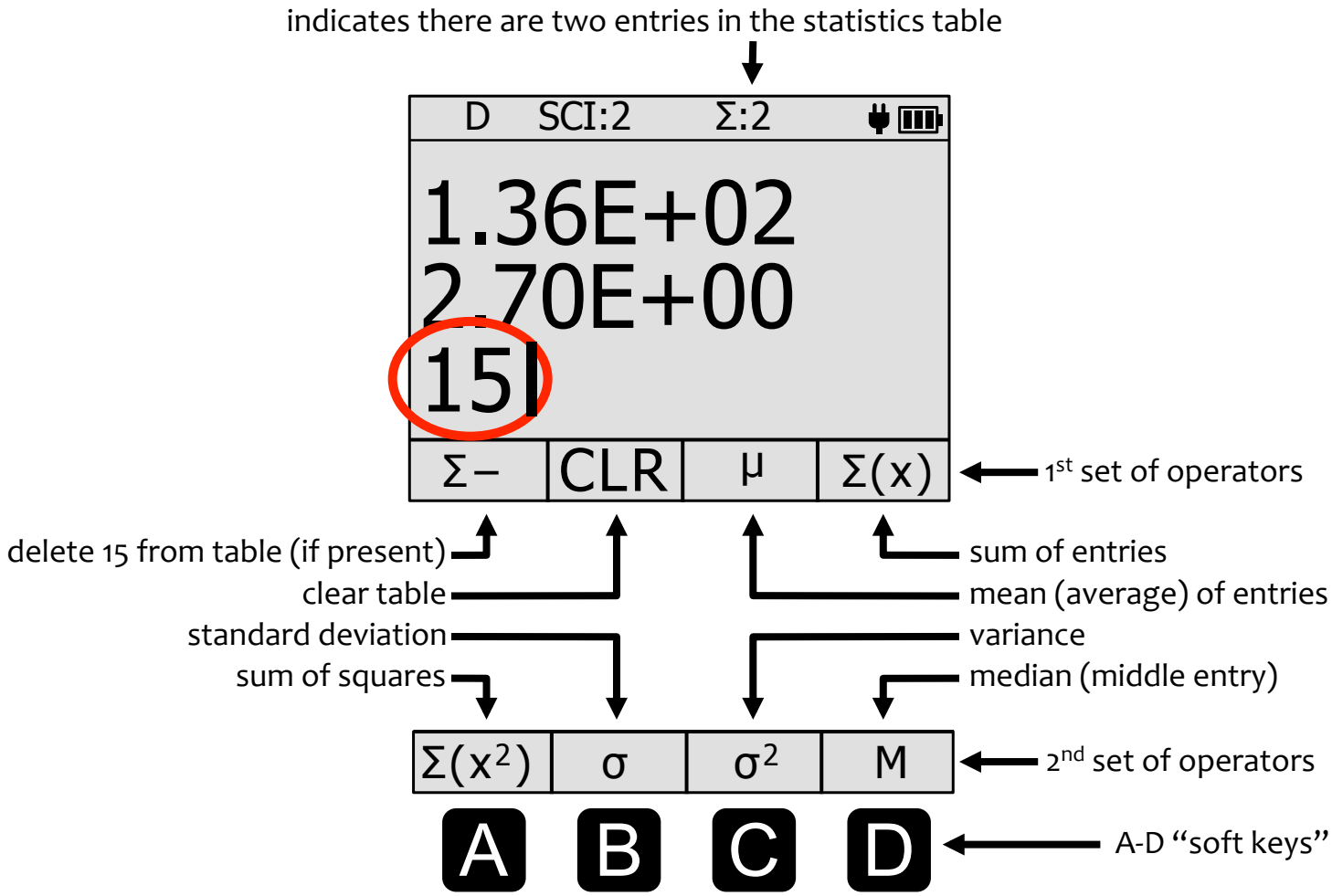
Statistical Operations

The SciPlus-2300 performs statistical operations on a table of up to 99 entries. Note that most statistical operations with the SciPlus-2300 use the soft keys A-D.

KEY	NAME	DESCRIPTION
Σ+	Add Data Point in Stats Register	Adds the current value into the statistics table. If pressed at the end of an expression, the expression is solved, and the result added. Note that if a value already exists in the table, it will be added a second time. e.g.: **2 Σ+ 3 Σ+ 5 Σ+ 3** will create a table (2, 3, 5, 3)
Σ+	Display Statistics Soft Keys	This key causes the statistics soft keys to be displayed. Note that there are two sets. Pressing this **2nd Σ** a second time will bring up the second set of soft keys. A third time will disable the soft keys.

Soft keys A-D are used to perform various statistical operations. Statistics soft keys are shown on the opposite page. Note that μ $\Sigma(x)$ $\Sigma(x^2)$ σ σ^2 and M can all be used in expressions.

Statistics Soft Keys:



Trigonometry

Trigonometry functions are very straightforward with the SciPlus-2300. Note that the values used in trigonometry functions, and the result, are expressed in Degrees, Radians, or Gradians, as indicated by 'D' 'R' or 'G' in the status line.

KEY	NAME	DESCRIPTION
SIN^{-1} SIN	Sine	Calculates the sine of an expression. e.g. (assume degrees): **SIN(30)** followed by ↵ yields 0.5.
SIN^{-1} SIN	Arcsine	Calculates the inverse sine (arcsine) of an expression. e.g. (assume degrees): **ASIN(0.5)** followed by ↵ yields 30.
DRG→ DRG	Set Angle Mode	This simply toggles through Degrees, Radians, Gradians. The current setting is indicated in the status line. After setting this parameter, subsequent input values and the results of expressions are expressed accordingly.
DRG→ DRG	Convert Angle	Converts the current value displayed in the **second line**, and changes the status line parameter.

The Cosine and Tangent functions, and their inversions, work the same way.

Converting Angles

KEY	NAME	DESCRIPTION
DMS ,	Decimal Degrees to DMS	Converts decimal degrees into degrees, minutes, seconds. e.g.: **DMS(45.5)** followed by ↵ yields (45,30,0.00). Note that if the second line is in DD format, entering **DMS(** followed by ↵ converts that value into DMS format.
DD)	DMS to Decimal Degrees	Converts degrees, minutes, seconds into decimal degrees. e.g.: **DD(45,30,0)** followed by ↵ yields (45.5) Note that if the second line is in DMS format, entering **DD(** followed by ↵ converts that value into DD format.

Converting Coordinates between Polar and Rectangular

KEY	NAME	DESCRIPTION
R➔P (	Rectangular to Polar	Converts rectangular (x,y) coordinates into polar (r,θ). Note that angles are expressed in degrees, radians or gradians as indicated on the status line. e.g.: **R➔P(1 , 1)** followed by ↵ yields (1.41,45.00) Note that if the result line is in rectangular (x,y) format, entering **P➔R(** followed by ↵ converts that value into polar (r,θ) format.
P➔R ■	Polar to Rectangular	Converts polar (r,θ) coordinates into rectagualar (x,y). Note that angles are entered as degrees, radians or gradians as indicated on the status line. e.g.: **P➔R(1.41 , 45)** followed by ↵ yields (1.00,1.00) Note that if the second line is in polar (r,θ) format, entering **R➔P(** followed by ↵ converts that value into rectangular (x,y) format.

Working With Fractions

KEY	NAME	DESCRIPTION
A/B ↔ X EE	Enter a Fraction	Use this key to enter a fractional amount into an expression. The result is displayed as a fractional amount ONLY if all the operands in the expression are entered as either fractions or integer numbers. e.g.: **2 + $X^Y/_Z$(4,3/6)** followed by ↵ yields 6 1/2 **2.0 + $X^Y/_Z$(4,3/6)** followed by ↵ yields 6.5 Note that the fraction command always requires the following syntax: an integer number, followed by a comma, then another number followed by the ÷ operator, and finally, a third integer number.
A/B ↔ X EE	Convert Between Fraction and Decimal	Simply press this key followed by ↵ without any arguments, and the result shown in the line above will be converted from fraction to decimal (or vice versa)

Using the SciPlus-2300 to Evaluate Mathematical Functions

When you select the **f(x)** key, the display will look like the picture on the opposite page. Note that, while in functions mode, the following features of the SciPlus-2300 are not accessible:

- Fraction calculations
- (x,y) <-> (r,θ) conversions
- DMS <-> DD conversions
- Memory operations (the value stored in memory is maintained)
- Statistical operations (the statistics table is maintained)

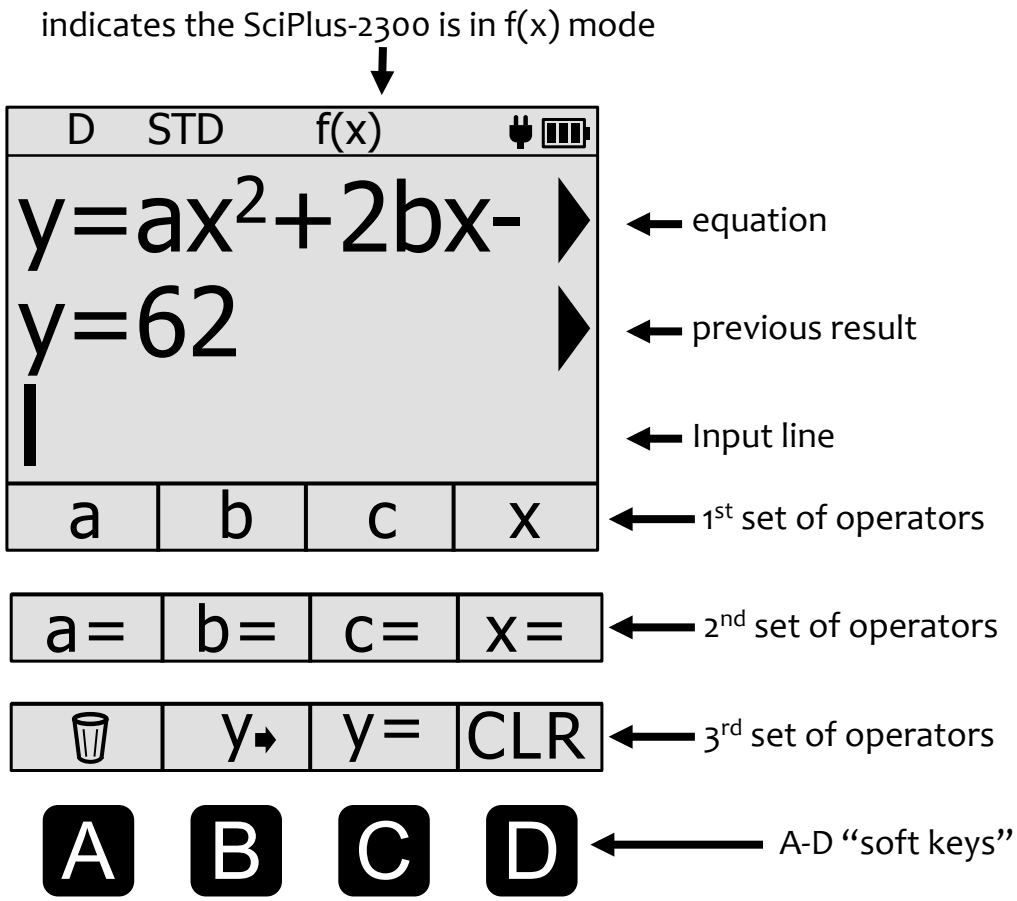
When in f(x) mode, the three lines displayed each have unique meaning:

Equation Line: The top line shows the equation that is being evaluated. Note that equations are in the form y=f(a,b,c,x), and can have up to four variables a, b, c, and x. Of course, convention normally considers a, b, and c, to be "constants", x the "independent variable", and y the "dependent variable".

Results Line: The middle line shows the result of the most recent calculation. This may be the entry (or query) of one of the of the variables a, b, c, x, or the resulting value of the equation for a given set of variables.

Input Line: This is the line in which you enter the equation using the various mathematical functions of the SciPlus-2300. You also enter values a, b, c, and x. Later, we will talk about how to determine one of these values if y is known.

The "soft keys" of the SciPlus-2300 have the following meaning while in functions mode:



First set of operators: Push f(x) once. The four soft keys allow you to use the variables a, c, c, x to define a function in the form y=f(a,b,c,x).

Second set of operators: Push f(x) again. This second set of soft keys allows you to define values for the variables a, b, c, x.

Third set of operators: Push f(x) a third time. This third set of soft keys allows you to enter, edit and clear the equation, find y, and CLR all the stored information related to f(x) mode.

Calculating values of f(x):

Let's investigate how to use the SciPlus-2300 in functions mode by evaluating the expression:

$$y=ax^2+2bcx-c$$

1. **Enter functions mode:** First, use the f(x) key to enter functions mode.
2. **Enter the equation:** Push f(x) two more times to access the "y=" soft key (C), and push it. The bottom line of the display will now show "y=". Now push f(x) again to get back to the variables list a, b, c, x. Enter the expression as follows, using the soft keys A-D (note that 'D' is 'x' in this case), as follows:

   a × x² + 2 × b × c × x - c

   Once you press the ↵ key, the equation will be displayed in the top line. Of course, if the equation contains a syntax error, you will see an error message.

   For now, the middle line will remain blank.
3. **Entering values for the variables:** Push f(x) again so that the soft keys show "a=", "b=", etc. Now let's enter specific values for a, b, c and x as follows:

   a= 3 ↵ b= 2 ↵ c= TAN(45) ↵ x= 3 ↵

   Note from the above example that it's perfectly acceptable to enter a variable as an expression (e.g. TAN(45)). Provided the expression can be resolved, it'll just enter the result as that variable.

   You will notice that, as these values are entered they appear in the middle "results" line.

At any time, you can query a variable by simply selecting the ENTER key without a value or expression after the variable. For example, **a=** ↵ will display 3 in the results line. If you have not yet entered a value for a, then "a=undefined" will be displayed in the results line.

You can clear any variable using the garbage can. E.g.: **a=** 

4. **What's the answer?** Once all four variables have been entered, you can select, **y=** ↵ to display the result of $y = 3x^2 + (2)\,(TAN(45))\,x - TAN(45)$ in the middle line (62 in this example as shown).

   If the equation contains a divide by zero condition, the result Y=DIV0 will be displayed.

   If you see "y=…" in the middle line, it means that not all of the necessary variables have been entered yet. Zero values must be entered as such.

5. **Changing variables:** At any point, you can change one of the values of a, b, c, x by repeating step '3' above. A new value of y will be calculated each time a variable is entered.

   For example, to find the value of $y=ax^2+2bcx-c$ for a new value of x=4, simply enter **x= 4** ↵.

6. **Editing the equation:** To edit the equation, use the enter **y➔** to put the equation into the input line. Move the cursor to the location you wish to edit. Remember BKSP removes operators from the equation. Use the **y➔**  to clear the equation.

7. **Entering a new equation:** You can easily enter a new equation by repeating step 2 above. The values for a, b, c, x will remain unchanged until you change them as explained in step 3.

8. **Clearing everything:** You can use **CLR** to clear all the constants as well as the equation and start fresh.

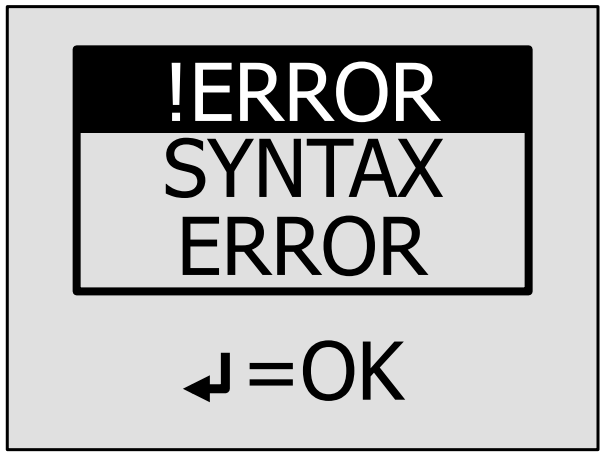
Exiting functions mode:

You can exit function mode by simply pressing the **2nd** key followed by **f(x)**.

Some guidelines while in functions mode:

- Note that you don't need to enter the equation first and the variables second. You can start by entering variables. If you enter variables that are not in the equation, they will be ignored. If you don't enter all the variables required by the equation, you will see "y=…" when you enter **y=** ↵.
- You can also change the equation and keep the same variables.

Errors



Sometimes you'll enter things incorrectly, such as not closing a bracket or dividing by zero. In this case, you'll get a SYNTAX ERROR message like the image at left.

You might see other types of error messages such as "INVALID ARGUMENT" or "INFINITE RESULT".

To correct the error, simply press ↵ which will return you to the entry line. Use the ← → **BKSP** keys to correct the error.

Service

If for any reason you require service or support for your SciPlus-2300, please contact the authorized dealer from whom it was purchased. You may also contact Sight Enhancement Systems directly:

1-613-421-8953 or **service@sightenhancement.com**

Please have the following information available:

- The serial number of the SciPlus-2300 (see the label on the underside of the calculator).
- The authorized manufacturer's representative from whom the SciPlus-2300 was purchased.
- A description of the problem.

The robustness of Sight Enhancement Systems SciPlus calculator is legendary, and you should enjoy years of reliable operation

Warranty

The SciPlus-2300 is covered by a one year limited warranty from the date of purchase. Warranty includes parts, labour and shipping costs. Goods may be returned only upon authorization by SES. Warranty covers "normal wear and tear", and does not cover damage resulting from obvious misuse of the product. Examples of misuse include, but are not limited to, damage due to exposure to moisture or extreme heat, damage due to dropping the device, and physical damage to connectors and plugs.

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