

Model EG-02 Scientific Calculator

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February 1, 1995

This is Version 2.0 of the EG-02 Calculator

The EG-02 Scientific Calculator is a TI-style calculator application that is designed for a variety of scientific, mathematical, and financial functions. It can be easily programmed by saving and editing the keystrokes for repeating. Most of the functions are obvious and perform as they would on any calculator. The advanced functions included in this calculator are financial functions (mortgage & loan payments, savings growth, annuities, etc.), statistics (averages, standard deviations, linear regression, etc.), built-in conversion factors (length, area, temperature, force, pressure, etc.) and physical constants. There are five memory locations and two arrays that can be used to store data. The calculator can be resized for use on a variety of monitor sizes or to fit the users preference. This software is shareware. To get complete use of all of the calculator functions requires that you send in the \$10 shareware fee.

Programming

Programming the calculator can be done in two different ways. The simplest method is to save and "replay" keystrokes. Use the "Save Keystrokes" command under the Program menu (or command-K) to start saving keystrokes and the "Stop Saving Keystrokes" command (command-Z) to stop saving them. Once programs have been saved, they can be edited using the standard Macintosh textediting methods. A program can be executed by using the Execute All (command-E) function to repeat the entire contents of what is saved in the program display, or by using the Execute Selected Text (command-T) function (to rerun only the text that is selected within the program display). The Save Display (command-S) function copies the contents of the calculator display to the program display. Each of the calculator functions (such as sin or log) has a three character code associated with it. When the keystrokes are saved, these codes (enclosed in brackets) are also saved. In creating calculator programs, it is often necessary to use the memory registers to save intermediate data or to store initial data when there is more than one variable.

Programming Examples 1:

Suppose you have an equation such as $y = 3.1 + 2.5*x$, and you want to find the values of y for different values of x . If you were to do this manually to find the result for $x = 5$, you would probably just enter the keystrokes:

3.1+2.5 *5 =

and the answer 15.6 would be displayed. To program this, however, you need to rearrange things so that you can simply enter the value of x that you want, and

then use the "Execute All" (command-E) function to get the answer. To do this, you would need to rearrange the equation to something like: $y = x \cdot 2.5 + 3.1$. You can program the function by entering a sample value of x , and then selecting the "Start Saving Keystrokes" (command-K) function. Then continue on with the keystrokes to continue evaluating the expression. When you are done, the display would read:

*2.5+3.1=

Now use the "Stop Saving Keystrokes" to complete the program and to prevent the new keystrokes from appearing in the program. To execute the program to calculate the value of y for a different value of x , you simply need to first clear the display, then enter the new value of x and use the "Execute All" function to replay the saved keystrokes shown on the display to get a new value of y .

Programming Examples 2:

Calculating interest payments on a mortgage is a little more complicated and requires three input parameters; the principal, the interest rate, and the term. The equation for the monthly payment is:

where P is the principal, i is the monthly interest rate, and n is the total number of monthly payments.

Three memory registers will be used to store the three input parameters, M1 will hold the principal amount, M2 will hold the interest rate (in yearly percent), and M3 will hold the term (in years) of the mortgage. Before creating the program, the input data is entered into memory. For a principal amount of \$100,000, enter 100000 and press the STO1 key to put the amount in register 1. Next press C to clear the 100000, enter 8.5 to hold the 8.5% yearly interest rate and press the STO2 key to put the amount in register 2. Thirdly, press C again and then enter 20 for the mortgage term in years and then press STO3. Before entering the program, clear the command history window by executing "Select All" and "Clear" from under the edit menu.

To create the program, first select "Start Saving Keystrokes" from the Program menu. The actual program consists of the following keystrokes:

RCL3 * 12 = STO4 Recall memory 3, multiply by 12 and store in memory 4. This gives the term in months

RCL2 / 1200 = Recall memory 2 and divide by 1200. This gives monthly interest rate.

+ 1 = Add 1 to the interest rate, (for the $1+i$ term in the denominator.

y^x RCL4 +/- = y^x means the y to the power of x key and +/- is the key to change the sign. This completes calculating the $(1+i)^{-n}$ part of the equation.

+/- + 1 = Change the sign again and add one to complete the denominator.

1/x * RCL2 / 1200 = Now take the inverse of the denominator, multiply by the interest rate (in percent) and divide by 1200 to get the real interest rate.

* RCL1 = Multiply by the Principal amount and you are done.

Execute the "Stop Saving Keystrokes" menu item and the program is done. The result program listing should be as follows.

```
R3*12=  
S4R2/1200=  
+1=  
[POW]R4[CHS]=  
[CHS]+1=  
[INV]*R2/1200=  
*R1=
```

If it isn't, you will have to edit it. Editing is done using standard Macintosh editing techniques. To add something to the program, place the text insertion cursor where it belongs and then enter the keystrokes needed. You MUST be in the saving keystrokes mode for this to work. To delete or replace text, select the desired text and either use the Edit menu functions of keystrokes to replace the text. You can only enter calculator functions such as R1 (recall memory 1) by actually pressing the RCL 1 key on the calculator. Alphabetic characters entered on the keyboard are generally ignored.

The alphabetic codes for for the calculator key functions are as follows:

[CHS]	Change sign of the current display (+/-)
S1	Save the current display in memory location 1
S2	Save the current display in memory location 2
S3	Save the current display in memory location 3
S4	Save the current display in memory location 4
S5	Save the current display in memory location 5
S6	Save the current display in memory location 6
R1	Recall the value stored in memory location 1
R2	Recall the value stored in memory location 2
R3	Recall the value stored in memory location 3
R4	Recall the value stored in memory location 4
R5	Recall the value stored in memory location 5
R6	Recall the value stored in memory location 6
T1	Save the current display into the X array (Xdata) See Statistics.

T2	Save the current display into the Y array (Ydata)	See Statistics.
[sXS]	Sum and display the X array (ΣX)	
[INV]	Inverse ($1/x$)	
[SQU]	Square ($x*x$)	
[SQT]	Square root (\sqrt{x})	
[POW]	Power (y to the power of x)	
[LGN]	Natural logarithm	
[EXP]	Power of e (e to the power of x)	
[LOG]	Logarithm (base 10)	
[10X]	Power of 10 (10 to the power of x)	
[D2R]	Convert from degrees to radians	
[R2D]	Convert from radians to degrees	
[ASI]	Arc sine	
[ACO]	Arc cosine	
[ATA]	Arc tangent	
[ASH]	Arc hyperbolic sine	
[ACH]	Arc hyperbolic cosine	
[ATH]	Arc tangent	
[SIN]	Sine	
[COS]	Cosine	
[TAN]	Tangent	
[SIH]	Hyperbolic sine	
[COH]	Hyperbolic cosine	
[TAH]	Hyperbolic tangent	
[INT]	Round down to nearest integer	
[FAC]	Factorial	
[DEG]	Angles are in degrees	
[RAD]	Angles are in radians	
c	Clear last entry	
C	Clear all entries	

Programs can be saved either to a file, or as Function Keys. Programs that are saved as Function Keys are retained after the program is quit or the computer is turned off. (They are saved as Resources within the EG-02 application). Function Keys are usually set by saving keystrokes in the output window, selecting the desired text in that window that is to be the desired function, and then by selecting the appropriate "Define Function" item under the Program menu. Up to 10 different functions can be defined. To view and edit the functions after they have been defined, you can select "Edit Function Keys" under the Program menu, and a dialog box will open to edit the function keys. The Function keys can be invoked either from the Program menu or by the appropriate Command/Number combination.

Conversions

The unit conversions built into the program will convert virtually any units to and from standard metric units. To convert a non-standard metric units to another non-standard metric unit simply convert from the first unit to the standard unit, and then to the second non-standard unit. For example, to convert from miles to feet,

first convert miles to meters and then from meters to feet. Using this method allows for conversion between any two sets of units with two mouse clicks.

Financial

The financial functions are pretty standard. Loan and mortgage payments can be calculated, as well as compound interest, and annuities. The Regular Savings function will calculate how much money you will end up with if you save a certain amount regularly (weekly, monthly, or yearly) for a period of time and get some interest on it. The Annuity function calculates how much money you would need to start with if you want to withdraw a certain amount regularly and are getting interest payments on the amount remaining.

Statistics

The statistical functions may require some explanation. The keys Xdata and Ydata are used for entering data into memory arrays X and Y. Up to 250 data locations are available in each array. These arrays can be viewed by selecting "Show Statistical Data" under the Statistics menu. This selection will bring up a spreadsheet-type of area in which data can be entered and edited. Select "Hide Statistical Data" to revert back to the programming text area. Note that when the statistics data is shown, that the any keyboard inputs are directed to the statistical data area. It is necessary to use the mouse to select the calculator keys to enter calculator data. The statistical functions available are averages, standard deviations, and linear regression. There are three linear regression functions that can be used when both X and Y data has been entered. A least-squares, straight line data fit is calculated for the data of the form:

$$Y = Y_{int} + \text{slope} * X$$

The function "Lin. Reg - Yint" returns Yint; and the function "Lin. Reg - slope" returns slope. An option where the line can be forced to go through the origin such that the data is fit to the equation:

$$Y = \text{slope} * X$$

is obtained in the function "Lin. Reg thru Orig" which returns the value of "slope".

The Data Menu provides a number of useful and trivial physical constants.

Notes:

The EG-02 Calculator is posted with some of the calculator functions disabled and with an opening dialog reminding users to send in the shareware fee. If you decide to keep the calculator and send in the shareware fee, I will send you a password that will enable all of the calculator functions and will eliminate the opening reminder dialog. I hope that you enjoy using this software. I welcome comments, suggestions and shareware fees.