i41CX+ Mini-Manual

The Finest Calculator for the iPhone and iPod touch

i41CX+ is an advanced programmable and expandable RPN scientific calculator with a virtual thermal printer/plotter that goes far beyond a mere replica of the original. In addition to being functionally equivalent to the world-renowned HP-41CX and providing access to its entire library of modules and programs, i41CX+ is enhanced with iPhone OS and hardware features, keyboard overlays, complete color control, rich set of import and export capabilities, traditional and upbeat modern skins, and much more. This is the finest and most powerful scientific/engineering/financial/business calculator for the iPhone and iPod touch bar none.

Calculator Features

- RPN logic with a 4 element deep memory stack
- 319 main and 600 extended memory registers
- Over 400 built-in functions, including nearly 100 functions created specifically for i41CX+
- Time, calendar, alarm, and stopwatch functions
- Four module ports provide access to HP-41 expansion pacs
- Rich set of functions and algorithms: numerical, mathematical, statistical, complex, matrix, numerical integration, curve fitting, solutions to equations, and much more
- Powerful, flexible, and programmable Computer Algebra System (CAS) supporting symbolic, arbitrary precision, scalar, vector and matrix algebra calculations, and much more
- Access to the entire HP-41 library of solutions for science, mathematics, statistics, engineering, business, financial, surveying, medicine, real estate, and many other domains
- Programmable - virtually unlimited number of lines
- User definable keyboard
- Device integration: copy and paste, in-app mail, iPhone keyboard, GPS, accelerometer, digital compass, time and date synchronization, and much more
- Virtually unlimited data and program storage capacity using the iPhone's flash memory for local storage
- Import/export data, programs, overlays, modules, etc. via the web and email
- 40 bundled keyboard overlays and support for user created overlays
- Dynamic keyboard overlay switching
- Sound support including synthetic tones and interface sounds
- Support for calculator skins and optional mini stack display
- Adjustable calculator speed, sound volume, and display colors
- Quick reference guide of all built-in functions
- Beautiful and clean user interface optimized for the iPhone and iPod touch portrait mode screen aspect ratio and to maximize the keypad area while still providing for a full featured scientific keypad

Printer Features

- Support for printing, plotting, graphics, and special characters
- User configurable and programmable print color
- Support for emailing printer output in text format
- Ability to save a JPEG snapshot of the virtual paper roll to the iPhone's photo album where they can then be emailed or transferred to the computer and printed out on a real printer

AL SOFTWARE

ABN 93 701 239 587

i41CX+ Global Settings

i41CX+ is highly customizable. Like many applications, the i41CX+ global settings are accessed by tapping the Settings application icon (), scrolling down to the i41CX+ entry and tapping it to view and edit the options. This is where the calculator skin, the display typeface, sounds, etc. are selected. All the global settings are described in the table below.

Setting	Description	Default
Calculator Settings		
Skin	Select calculator skin	Neo Classic
LCD Display	Select display character style	Classic Normal
Stack Display	Show mini displays of Y, Z, T, and L registers	OFF
Key Press Glow	Show glow effect when pressing keys	OFF
Ignore Mute Switch	Play sounds regardless of iPhone mute switch setting	OFF
Key Click Sound Type	Select key click feedback sound	New
Synchronize Time	Synchronize time and date with the device's system clock	ON
Keep Time	Maintain time and date across application launches. Disabling "Synchronize Time" and enabling this option makes it possible to maintain a different time zone independent from the device system time.	ON
CV Calculator Mode	Function as HP-41CV rather than HP-41CX	OFF
Dynamic Overlay	Display selected overlay when USER mode is on, hide overlay when USER mode is off	OFF
Sleep Enable	Suspend all i41CX+ activity while device is locked/asleep to conserve power. Activities (e.g. program execution) will resume when device is unlocked/awakened. Disabling sleep allows programs to continue running while the device is locked/asleep, at the expense of battery power.	ON
Mail Items To	Default email address to use when emailing data and programs	Enter address here
Quick Start	Reduce launch time. When this option is enabled, "Ignore Mute Switch", "Key Click Sound Type", and printer "Volume Control" are forced to OFF, System, and OFF, respectively.	OFF
Text Editor and CAS Settings		
Line Length Warning	Specify whether to set the text to a warning color when any line exceeds the maximum line character limit.	OFF

Setting	Description	Default
{} <-> [] Conversion	Specify whether to convert curly braces to square brackets when importing/exporting and editing/viewing text files with I41CXED. Enabling this option provides seamless compatibility between the i41CX+ CAS and REDUCE.	OFF
Access Saved Files	If enabled, I41CXED and CAS will look for the specified file in the saved text files directory of your device (i.e. the items that show up in the Load Data picker) if the specified file is not found in extended memory. This is useful if you wish to create a CAS input file that won't fit in extended memory and to view CAS output in a saved text file.	OFF
Printer Settings		
Power At Launch	Specify power state when app is launched	OFF
Printout Size Warning	Display warning when recommended printout size is exceeded. While there is no explicit limit for the number of printed lines, each printed line consumes memory and if you plan to save the printout as a JPEG photo, we recommend that the number of lines be not much more than 200 lines.	ON
Start With New Roll	Printer starts with a new paper roll each time app is launched	OFF
Volume Control	Volume of printer sounds is controlled by the volume slider.	OFF

Introduction and Historical Perspective

This ingenious and fully developed application is functionally equivalent to the venerated, paradigm shifting HP-41CX programmable calculator with extended memory. It includes functionalities beyond the equivalent of a magnetic card read/writer, and tape printer, and with numerous additional features like display control, a rich variety of skins and application specific overlays, i41CX+ specific functions, and the ability to share data and programs with other users and devices, it is a sheer delight to use.

The 41's initial arrival in 1979 on the scientific and engineering, financial, and computational scenes was awe inspiring and was the first HP calculator to offer alphanumeric capabilities which revolutionized the way a calculator could be used. It was a masterpiece of compact, powerful design and it represents an astounding upgrade in the new venue of the iPhone and iPod Touch. These are now serious computational machines with powerful capabilities.

This is one of the most sophisticated and highly developed applications for Apple's iPhone/ iPod touch platform. It is an implementation of the universal Scientific Calculator with a programmable capability that made the "41", in reality, a powerful handheld programmable computer. It was astounding for what could be computed and a large body of work was assembled by the HPPC "personal/portable computer" club under the encouragement and nurturing of Richard Nelson of the Educalc Computer store in California.

This work has continued and been assembled by Warren Furlow, who also created the "V41" emulator for the Windows environment, and is available at HP41.org.

Because i41CX+ is an elaborate extension of the extremely powerful and versatile HP-41CX, we created this mini manual to assist new users learn the enormous scope of the work, and quickly understand the essence of each aspect that is special to i41CX+ so that they can quickly delve more deeply into the workings of these very special computational devices.

A rich and delightful world of computation awaits anyone interested in such necessities.

Memory

Computers depend upon memory to operate and provide answers. The basic element of memory in the HP-41CX is the register. Registers are like pigeon holes or mail slots behind the front desk of a hotel, or like cells in a spreadsheet. They can hold several types of elements such as numbers, alphanumeric text, key assignments, program steps, etc. They can even hold addresses of other registers. Registers can be stored or recalled upon the user's command.

RAM registers can hold numbers, key assignments, alphanumeric data (6 characters per register), or program steps. Programs are lists of steps of data and functions with defined names or labels and end points and may include branching commands based upon Boolean conditions. Developing a program on the HP-41CX is actually a simple process and with i41CX+, the program can be printed out on the built-in printer. This saves having to write them down. i41CX+ contains a total of 925 RAM registers (319 main memory, 600 extended memory, 5 stack, and the Alpha register). The Alpha register actually consists of 4 registers

(one register can only hold 6 characters whereas the Alpha register can hold 24 characters), so the true number is actually 928. This can be further extended with the HEPAX module which provides an additional 1304 registers bringing the total to 2,232 registers. And then there is the additional storage by being able to load/save data and programs from/to the iPhone memory. The two layers of memory provide for virtually unlimited storage.

Modules or Application Pacs contain register elements that are “burned” or locked in so that they cannot be modified. Just like the HP-41CX, i41CX+ contains 4 ports in which one can insert modules that contain programs and functions developed by experts in their various fields. They expand the capabilities of the calculator and are hence also called expansion pacs. There are a number of modules for a wide variety of applications and fields.

Modules can be sizable and contain some fairly complex and sophisticated functions and programs.

Programming

Programming allows the creation of new functions and operations. These can be assigned to keys such that they can be executed at the press of a single key. Programs initiate the sequencing from the starting label through the list of data and functions placed in registers to various stop or end points, ultimately giving the desired answer.

The Chinese word for a computer derives from the word "thread". Metaphorically one starts from one end and work on down the thread until we reach the end.

All of the formulas that we learned in school or college can be placed into such programs and run on i41CX+. Quick answers, no point in being caught in the calculations. It actually is easy to operate them. However, we do have to know how they are set up so that we can run them. It is even possible to create interactive programs that request user input, whose execution continue by pressing the run stop (R/S) key so that interactive operations are simple and clear.

The memory in i41CX+ is more than adequate for most computations. In fact, in the early days of space exploration, the HP-41 was used to offload some of the computing load from the main Space Shuttle computer and served as an emergency backup for the highly accurate re-entry calculations in the event of a main computer failure.

The HPPC club had a member who discovered by accident that with a certain key sequence he could access the internal instructions of the machine that are normally not available to the user. The use of such instructions was called Synthetic Programming. i41CX+ provides access to these as well. These can be convenient to save program steps thereby saving execution time and program storage space as well as doing operations that are normally not possible through normal programming means.

Programs can be thought of as consisting of a sequence of key strokes. Thus, the simplest program consists of simply entering the normal calculation sequence in program mode and being able to execute it repeatedly thereafter. More complex programs can use looping, branching, subroutines, conditional execution, indirection, etc.

The Stack and RPN

The stack memory registers are labeled X, Y, Z , T and LastX and are unique to the HP calculators.

The LastX register always contains the last value of the X register. This can be helpful in spotting entry errors and for making corrections.
The X register is displayed in the main display and is the currently focused data.
The Y register contains the previously entered X value.
The Z register contains the previous Y value.

The T register contains the last Z value. This is the last register that data can be pushed into before running a repetitive calculation and because it is a sticky register, it has the handy property of down feeding the other registers as one progresses through a series of calculations. This makes it quick and easy to make a simple counter or to repeatedly perform calculations such as calculating % change for a number of iterations. The T register value sticks or remains until a new Z value is pushed into it.

Arithmetic operations use the data in the X and Y registers.

The stack makes if possible to quickly perform many operations using what is called RPN or Reverse Polish Notation. Mathematical operations are generally taught in infix notation, with the mathematical operators placed between the data that they operate on. For example, in the expression 2 + 3 = 5, the "+" operator is placed between the 2 and the 3. RPN, invented by the Polish Mathematician Jan Lukasiewicz in 1920, is a way of expressing mathematical operations in postfix notation. Using the previous example, 2 + 3 = 5 would be expressed as 2E 3+ 5, where E denotes the Enter operator. Thus, in RPN all operators follow each data item and hence the term postfix.

In the above example, the number of keystrokes is the same in both cases, four to obtain the answer 5. However, this is not always true. RPN makes it possible to enter data and operations without having to write down the intermediate answers or use parentheses.

For example, the infix notation expression (3 + 4) * 6 = 42 requires 8 keystrokes to obtain the answer. In RPN, this would be 3E 4+ 6* 42. That is a saving of 2 keystrokes for this very simple calculation. For more complex calculations, RPN can save a considerable number of keystrokes. In fact, RPN is never less efficient than infix notation so, in general, it can be said that RPN is more efficient.

Once you fully understand the logic of the Stack you are ready to calculate more efficiently than with algebraic or infix notation. Operators, such as the “+” operator used in the above example, operate on the values in the X and Y registers. Unary or single argument operators such as “SIN” operate on the value in the X register. There are many commands in i41CX+ that provide powerful and flexible ways to manipulate the stack registers , such as rolling the stack up or down, swapping registers, etc.

In addition to the stack registers, there is a special register, the A register, which can hold up to 24 alphanumeric characters for use in prompting, displaying messages, results, etc.

Functions and Commands

There is a rich and comprehensive set of functions included in i41CX+.

The HP-41CX came with 244 functions accessible by the user. i41CX+ contains all the functions and operations that were supported by the HP-41CX and the HP82143A printer and almost 100 new functions specific to i41CX+. These include functions that integrate iPhone and iPod touch hardware and OS features such as access to accelerometer, GPS, and digital compass data, copy and paste support, import/export via the web and email, loading and saving data, programs, text files, etc. from/to the iPhone memory as well as very fast and full 10-digit precision implementations of advanced mathematical functions such as the Gamma function, Lambert W function, prime number functions, Bessel functions, etc.

In total, i41CX+ has over 400 functions built in. All of the functions and commands can be listed using the Catalog (CAT) function that is executed by pressing SHIFT ENTER. Using the printer in TRACE mode, it is possible to get a paper print out of the catalog lists. Moreover, i41CX+ contains a Usage & Examples table with many usage tips and examples ranging from basic to advanced, a Quick Reference Guide with brief descriptions for all built-in functions and commands, as well as a CAS Quick Reference.

Like the HP-41CX, i41CX+ also includes the Timer module which provides a comprehensive set of functions for performing time and date calculations. It also includes a clock, stopwatch, and alarms. These can be used to set alerts and even control programs. It is possible, for example, to run a specified program at preset times using alarms.

Keyboard or Front View

The primary means of interacting with the calculator is via the keyboard. The top 4 buttons are used to switch the calculator on/off, to enter and exit the USER defined keyboard mode, enter and exit program (PRGM) mode, and enter and exit Alphanumeric (ALPHA) entry mode.

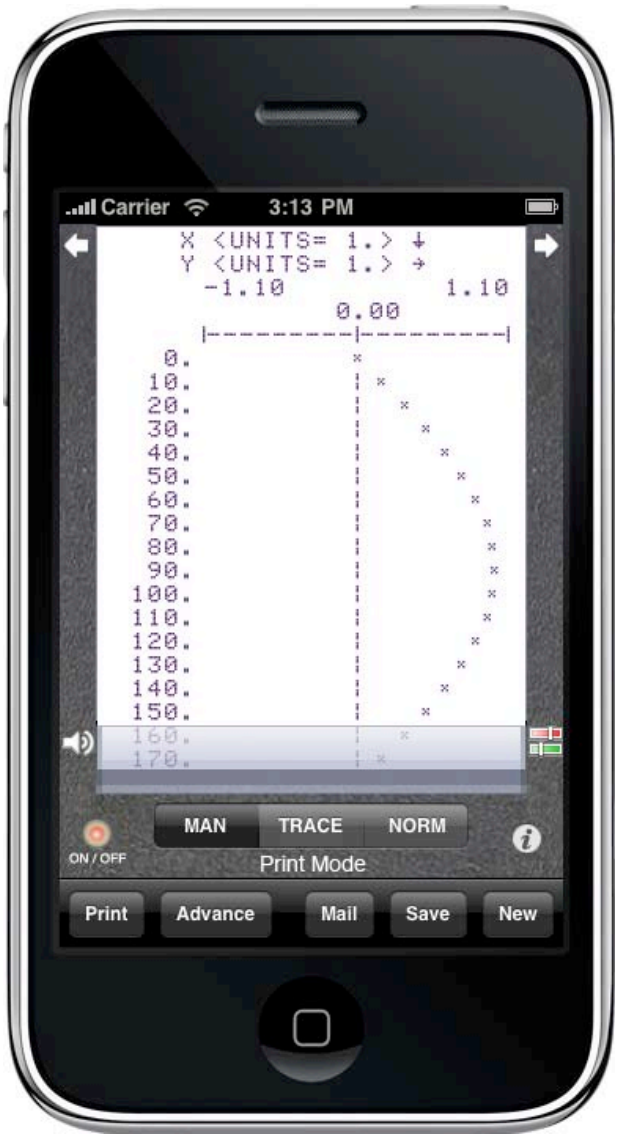
There are a total of 35 keys, including 12 numeric and decimal point keys, 4 arithmetic operator keys, 10 keys for trigonometric and other common math functions, and 9 keys for program execution, register storage, entering values, etc. Furthermore, with the exception of the shift key, all keys have secondary functions (labelled in orange) that are accessed by pressing the shift key. This effectively doubles the total key count. The alphanumeric labels in blue denote the letters that are entered by pressing the keys in ALPHA mode. Taking the shifted alphanumeric characters into account brings the total number of items that can be entered directly from the keyboard to 142. Functions or commands that cannot be directly input by pressing a single key can be invoked either by pressing the execute (XEQ) key and then entering the name of the function or command or by using key assignments. One of the special capabilities of the HP-41 was that the user could customize the keyboard using the assign (ASN) function. This feature essentially allows the user to completely redefine the operations of all keys with the exception of the top row of keys, the shift key, and the number keys (the shifted number key operations can be re-assigned, however). Moreover, the top row of keys can be used to invoke labels 01 through 05 in program mode for quick program execution.

In addition to the HP-41CX keyboard, i41CX+ has special areas that when tapped perform operations such as switching between the various screens, accessing overlays, modules, copy and paste, scrolling, displaying the iPhone OS status bar (when the mini stack display is enabled), etc.

There are 3 primary screens, the Calculator Front, the Calculator Back, the Printer that further contain numerous secondary views to access and configure features and settings. These are initially access through the front calculator and printer screens shown below.

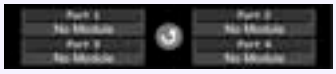
The “i41CX+ Screens” table lists the screens that are used to access various features and to perform adjustments to settings in addition to the aforementioned Global settings.

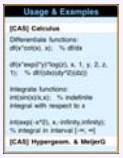
Calculator Front Screen
(La Pomme Mies Skin Shown)



Printer Screen

i41CX+ Screens

Screen	Functions	How To Access
CALCULATOR FRONT	Perform calculations	Tap application icon 
	Access other screens	
	Copy/Paste	
Overlay Picker	Select keyboard overlay	Tap overlay clip button 
	Change display colors	
	Set sounds volume	
	Select alphanumeric keyboard (keypad or iPhone keyboard)	
Display Color Controls	Set display foreground and background colors	Tap Overlays/Colors switch 
PRINTER	View printer output	Tap left or right edge of X register display 
	Print current display contents	
	Create new paper roll	
	Advance paper roll	
	Select printer mode	
	Turn printer sounds on/off	
	Mail printout in text format	
	Save printout to Photos Album as JPG image	
Printer Color Controls	Set print color	Tap color sliders button 
	Enable/disable program control of print color	
Printer Information	View information about printer controls	Tap ***i*** button on bottom right of Printer screen 
CALCULATOR BACK	Load/unload modules	Tap center of X register display 
	Load/Save data	
	View application information	
	Clear calculator memory	
	Set calculator speed	
	Revert calculator speed to default speed	
	Configure frequently used options	
	View and copy flags table	
	View and copy registers table	
	View Usage & Examples	
	View Quick Reference Guide	
	View CAS Quick Reference	
Module Picker	Load/unload modules	Tap port in Back View 
Load Data Picker	Download programs or data from the web	Tap "Load Data" button in Calculator Back View screen 
	Import program or data from the clipboard	
	Load program file	
	Load register data file	
	Load HEPAX RAM file	

Screen	Functions	How To Access
	Load flag data file	
	Load calculator state file	
	Load configuration file	
	Load text file	
	Load data file	
Save Data Picker	Save registers	Tap "Save Data" button inCalculator Back View 
	Save flags	
	Save calculator state	
	Save HEPAX RAM	
	Save configuration	
	Save program	
	Save text file	
	Save data file	
ED Keyboard Map	ED keyboard map	Access Calculator Back
Frequently Used Options	Configure frequently used options	Swipe ED Keyboard Map from right to left 
Flags Table	View and copy flags table	Swipe the Frequently Used Options from right to left 
Registers Table	View and copy registers table	Swipe the Flags Table from right to left 
Usage & Examples	View HP-41 and CAS usage and examples and copy items for use as templates	Swipe the Registers Table from right to left 
Quick Reference Guide	View descriptions of built-in functions and commands	Swipe the Usage & Examples from right to left 

Screen	Functions	How To Access
CAS Quick Reference	View descriptions of CAS functions and optional packages	Swipe the Quick Reference Guide from right to left 
Calculator Information	View information about calculator controls	Tap i button on bottom right of Calculator Back View 
Mail	Send programs, data, printout, etc.	Tap the Mail button on the Save Data Picker or execute any of the MAIL* commands 

Application Pacs

A vast number of application pacs or modules were developed for the HP-41. These were special purpose ROM chips that one could insert into the 4 ports at the top of the HP-41 and contained programs “burned” into the chip. They were expensive back in their day.

With i41CX+, these can be downloaded for free from HP41.org. The library of HP-41 application pacs is huge and there are still new modules being developed to this day. Just from HP alone, there were approximately 70 application pacs available. A list of these is included later in this manual, courtesy of HP41.org. These comprise applications from a wide range of disciplines such as Mechanical Engineering, Structural Engineering, Electrical Engineering, Business, Finance, Securities, Real Estate, Surveying, Physics, Mathematics, Medicine, Fluid Dynamics and the list goes on and on....

The HPPC or Hewlett Packard Personal Computer Club, the first club associated with the 41 and sometimes also referred to as the programmable personal computer club (PPC) also produced a famous module with 122 useful and powerful functions for a wide range of applications.

In the case of the HP-41, some modules were also memory expansion modules. i41CX+ includes the maximum possible memory configuration and thus memory expansion modules are not required and do not take up any ports.

Certain application pacs were for universal use such as the Math and Statistics Pac while some were of a very specialized nature, such as the SGS Redwood Gas Calculator Pac. The Financial Decisions Pac, for example, is a specialized module for financial and business users and effectively turns the HP-41CX into an HP-12C.

Downloading virtually all available HP-41 modules with i41CX+ is as easy as follows.

1. Access the calculator’s back view.
2. Tap one of the module ports.
3. Select the “Download from URL...” picker item.
4. Tap the “Download” button to accept the pre-entered hp41.org/mod URL which points to the i41CX+ module repository kindly hosted by hp41.org.

All modules available at hp41.org are now available for use in i41CX+! Of course, if you have your own modules, it’s a simple matter of placing the modules on a directory accessible via the web and entering the URL into the “Download from URL...” dialog.

Hierarchy of Storage

i41CX+ provides access to three layers of storage via its “Load Data” and “Save Data” features as illustrated below.

Load Data: web/external/clipboard -> iPhone/iPod memory -> HP-41CX memory
Save Data: HP-41CX memory -> iPhone/iPod memory -> web/external (Mail)

This hierarchy provides for virtually unlimited storage of data and programs.

HP-41 Library of Standard Application Pacs, Manuals, and Overlays

Courtesy of HP41.org

Title	Date	Author
Advantage Pac		Hewlett-Packard
Advantage Pac Manual	Jul 1985	Hewlett-Packard
Aviation Pac		Hewlett-Packard
Aviation Pac Manual		Hewlett-Packard
Circuit Analysis Pac		Hewlett-Packard
Circuit Analysis Pac Manual	Aug 1984	Hewlett-Packard
Circuit Analysis Pac Overlay		Hewlett-Packard
Clinical Lab and Nuclear Medicine Pac		Hewlett-Packard
Clinical Lab and Nuclear Medicine Pac Manual		Hewlett-Packard
Clinical Lab and Nuclear Medicine Pac Overlay		Hewlett-Packard
Clinical Lab and Nuclear Medicine Pac Quick Ref	1979	Hewlett-Packard
ELI-41 & Electrical Engineering Solutions 2.21 (Eclipse Logic, Inc.)		Tacit Logic Systems, Inc.
Financial Decisions Pac		Hewlett-Packard
Financial Decisions Pac Manual	Aug 1984	Hewlett-Packard
Financial Decisions Pac Overlays		Hewlett-Packard
Financial Decisions Pac Quick Ref	Jul 1979	Hewlett-Packard
Games Pac		Hewlett-Packard
Games Pac Manual	July 1980	Hewlett-Packard
Games Pac Overlays		Hewlett-Packard
Home Management Pac		Hewlett-Packard
Home Management Pac Manual	Aug 1984	Hewlett-Packard
Home Management Pac Overlays		Hewlett-Packard
Home Management Pac Quick Ref		Hewlett-Packard
HYDRACOMP Module	1982	Paul-Munroe Hydraulics, Inc.
Keys Surveying Module Manual	Sep 1987	Fred McMichael
LINK PLUS for HP-IL 2.06	Jul 1990	Southern Software
Machine Design Pac		Hewlett-Packard
Machine Design Pac Manual		Hewlett-Packard
Math Pac		Hewlett-Packard
Math Pac Manual (Spanish)		Hewlett-Packard
Math Pac Manual	Feb 1984	Hewlett-Packard
Math Pac Overlays		Hewlett-Packard
Math Pac Quick Ref(Spanish)		Hewlett-Packard
Math Pac Quick Ref	Feb 1979	Hewlett-Packard
Math/Stat Pac		Hewlett-Packard
Navigation Pac		Hewlett-Packard

Navigation Pac Manual	Aug 1984	Hewlett-Packard
Petroleum Fluids Pac		Hewlett-Packard
Petroleum Fluids Pac Manual		Hewlett-Packard
Petroleum Fluids Pac Quick Ref	May 1982	Hewlett-Packard
Plot of 2-3 Functions on One Graph		John L. Gilby
Real Estate Pac		Hewlett-Packard
Real Estate Pac Manual	Sep 1983	Hewlett-Packard
Real Estate Pac Overlay		Hewlett-Packard
Real Estate Pac Quick Reference	Aug 1980	Hewlett-Packard
SDK41 ManualR6	Apr 2008	Warren Furlow
Securities Pac		Hewlett-Packard
Securities Pac Manual	Aug 1984	Hewlett-Packard
Securities Pac Overlays		Hewlett-Packard
Securities Pac Quick Ref		Hewlett-Packard
Standard Applications Pac		Hewlett-Packard
Standard Applications Pac Manual	Aug 1980	Hewlett-Packard
Standard Applications Pac Manual(Spanish)	Jul 1979	Hewlett-Packard
Stat Pac		Hewlett-Packard
Stat Pac Manual	Aug 1984	Hewlett-Packard
Stat Pac Manual(Spanish)		Hewlett-Packard
Stat Pac Quick Ref	Jun 1979	Hewlett-Packard
Stat Pac Quick Ref(Spanish)	Apr 1980	Hewlett-Packard
Stress Analysis Pac		Hewlett-Packard
Stress Analysis Pac Manual	Aug 1984	Hewlett-Packard
Stress Analysis Pac Overlays		Hewlett-Packard
Structural Analysis Pac		Hewlett-Packard
Structural Analysis Pac Manual	Aug 1984	Hewlett-Packard
Structural Analysis Pac Overlays		Hewlett-Packard
Surveying Pac		Hewlett-Packard
Surveying Pac Manual	Aug 1984	Hewlett-Packard
Surveying Pac Overlays		Hewlett-Packard
Surveying Pac Quick Ref	May 1979	Hewlett-Packard
Thermal & Transport Science Pac		Hewlett-Packard
Thermal & Transport Science Pac Manual	Aug 1984	Hewlett-Packard

Financial Decisions Pac: Turn i41CX+ into an HP-12C

Need to solve for any of the five standard compound interest variables (N, I, PV, PMT, and FV)? Calculate the internal rate of return of a series of unequal or equal cash flows? Need to solve the internal rate of return using a modified IRR technique? Calculate the net present value? Calculate amortization schedules? Calculate sum of the years' digits depreciation schedule? Calculate before- and after-tax price or yield for semi-annual or annual coupon securities? All of these and more are possible with the Financial Decisions Pac. The HP-12C is essentially dedicated to perform these types of calculations but in two easy steps, i41CX+ can perform all of these tasks and more!

1. Download the Financial Decisions Pac, if you haven't already done so.
2. Tap one of the module ports and select the FINANCE module.

Furthermore, using the configurable USER mode keyboard and keyboard overlays such as the "Financial MONEY" overlay shown below, the user can quite literally convert the i41CX+ keyboard into a keyboard with similar functions as the HP-12C. Best of all, all built-in functions are unaffected by the inserted module and going back to the standard keyboard is a simple matter of either selecting "No Overlay" in the overlay picker or, better yet, use the "Dynamic Overlay" option. When the "Dynamic Overlay" option is enabled, the selected overlay is automatically displayed when in USER mode and hidden when in normal mode. Thus, hiding and showing the overlay is a simple matter of pressing the USER button. In this example, it's almost like having a virtual HP-12C in USER mode!

Advantage Pac: Turn i41CX+ into an HP-15C and HP-16C

Need to perform real or complex matrix operations and functions? Need to find the roots of an equation? Need to solve or evaluate polynomials? Need to perform numerical integration? Need to solve first- or second-order differential equations? Need to perform complex number operations and functions? Need to perform vector operations? Coordinate transformations? Number conversions and Boolean logic? Curve fitting? Solve time value of money problems? These are essentially the problems for which the HP-15C and HP-16C were developed. The Advantage Pac provides these capabilities to the HP-41CX. Thus, by loading the Advantage Pac and creating the appropriate key assignments, you can turn the i41CX+ into a virtual HP-15C or HP-16C!

I41CX-MATH Module: Fast and Full Precision Math Functions and CAS

You can go far beyond the capabilities of these other fine HP calculators, however. i41CX+ contains a custom developed I41CX-MATH module that contains the following advanced mathematic functions that execute much faster than traditional HP-41 modules and with full 10 digit precision (they are internally computed with 15 digits of precision).

- Base 2 powers: 2^x, $\log_2 x$
- Hyperbolic functions: $\cosh,\ \sinh,\ \tanh,\ \cosh^{-1},\ \sinh^{-1},\ \tanh^{-1}$
- Bessel functions: $J_0, J_1, J_n, Y_0, Y_1, Y_n$
- Combinatorics: ${}_nC_r,\ {}_nP_r,\ (x)_n$
- Error functions: $\mathrm{erf},\ \mathrm{erfc}$
- Gamma functions: $\Gamma(x),\ \ln\Gamma(x),\ \Gamma(s,x),\ \gamma(s,x),\ P(s,x),\ Q(s,x)$
- Greatest common divisor (GCD) and least common multiple (LCM)
- Lambert W function: $W_0(x),\ W_{-1}(x)$
- Prime number functions: primality test, next prime, Euler's totient function $\varphi(n)$
- Two argument arctan function $\mathrm{atan}(x,y)$
- Beta functions: $\mathrm{B}(x,y),\ \mathrm{B}(x;a,b),\ I_x(a,b)$
- Digamma function $\psi(x)$
- Exponential integral functions: $E_1(x),\ E_i(x),\ E_n(x)$
- Logarithmic integration function $\mathrm{li}(x)$

In addition to these advanced numerical functions, i41CX+ contains a very powerful and flexible computer algebra system (CAS). The i41CX+ CAS function is based on version 3.8 of REDUCE, a system for doing scalar, vector and matrix algebra, and arbitrary precision numerical calculations. The capabilities of the system include, but are not limited, to the following.

- Expansion and ordering of polynomials and rational functions
- Substitutions and pattern matching in a wide variety of forms
- Automatic and user controlled simplification of expressions
- Calculations with symbolic matrices
- Arbitrary precision integer and real arithmetic
- Facilities for defining new functions
- Analytic differentiation and integration
- Factorization of polynomials
- Solving a variety of algebraic equations
- Facilities for the output of expressions in a variety of formats

Ironically, the embedded CAS is actually more powerful than the HP-41CX and is even programmable! The i41CX+ CAS uses text files as mini notebooks, similar to Mathematica. CAS performs the operations in the input text file whose file name is specified in the Alpha register. Upon completion, the results are appended to the text file. It is also possible to specify separate input and output files by entering the input and output file names separated by a comma into the Alpha register (e.g.`"CASIN,CASOUT"` without the quotes). To ignore the CAS output, an empty output file name can be specified (e.g.`"CASIN,"` without the quotes). This is useful for cases where the CAS operations manipulate and place the result(s) in calculator registers.

By default, the CAS output is converted into uppercase letters to allow it to be viewed in the i41CX+ calculator display (using `ED`, for example). The conversion to uppercase can be disabled by setting flag 13. In either case, the CAS output is best viewed using the `I41CXED` text editor function or emailed using the `MAILTXT` function since the vast majority of cases will involve long output strings and in many cases spanning multiple lines that are difficult to view using the 12 character calculator display. Note that both I41CXED and the MAIL* composition windows support device rotation so the contents can be viewed in landscape.

The i41CX+ CAS environment provides complete access to the calculator registers. They can be accessed within the CAS environment using the following variables.

- Stack Registers: `x_reg, y_reg, z_reg, t_reg`, `l_reg`
- Alpha register: `a_reg`
- Data Register nnn: `data_reg(nnn)`
- Flag n: `flags_reg(n)`

Any changes made to these variables in the CAS environment are reflected in the calculator registers upon completion of the CAS operations. To maintain data typing intact between the calculator internal registers and the CAS environment, strings in the calculator register variables in the CAS environment need to be surrounded with double quotes (e.g. if a register contains the string `ABC` the corresponding variable will contain `"ABC"` instead of just `ABC`) and non-normalized numbers (NNN) are treated as strings (e.g. if a register contains `0xaabbccddeeff`, the corresponding variable will contain `"0xaabbccddeeff"`).

Upon completion, the values of the calculator registers are updated based on the values of the variables in the CAS environment. Therefore, to write a string to a calculator register in the CAS environment, include the surrounding double quotes as part of the string (e.g. to write the string `FOO`, assign the corresponding variable in the CAS environment with `"""FOO"""` so that the CAS variable contains the string `"FOO"`) and if you wish to assign a NNN to a calculator register in the CAS environment, assign it as a string (e.g. to write `0x7766544332211` into a register, assign the corresponding variable in the CAS environment with `"0x7766544332211"`).

The following are just a few simple examples to illustrate the capabilities of the i41CX+ CAS.

- Arbitrary precision, including complex numbers
  Input: `precision 20; 2.3^(5.6i);`
  Output: `-0.048079349091427726016-0.998843519371750555 83*I`

- Solve algebraic equation
  Input: `solve(x^2+8x+15=0,x);`
  Output: `[X=-3,X=-5]`

- Solve simultaneous equations
  Input: `solve([x+3y=7, y-x=1],[x,y]);`
  Output: [[X=1,Y=2]]

- Differentiate a function
  Input: `i=sqrt(-1); u:=(x*exp(i*y)*log(z)); df(u,x,1,y,2,z,1);`
  Output:

```
          i*y
        - e
      ---------
          z
```

- Integrate a function
  Input: `f:=x*exp(x); int(f,x);`
  Output:

```
  x
 e *(x - 1)
```

- Matrix operations
  Input: `m:=mat((a,b),(c,d)); det(m);`
  Output: `a*d - b*c`

- Special functions
  Input: `load specfn; on rounded; zeta(4);`
  Output: `1.08232323371`

For details on the syntax, supported operations, functions, packages, etc. of the i41CX+ CAS please see the online REDUCE User's Manual. Because the HP-41CX character set does not include curly braces ("{" and "}"), these are substituted by square brackets ("[" and "]") in the i41CX+ CAS for both input and output. However, the "{ } <-> [ ] Conversion" global option can be used to automatically make this conversion when importing/exporting and when using the I41CXED text editor. Enabling this option allows seamless compatibility between REDUCE and the i41CX+ CAS.

The Financial Decisions Pac, Advantage Pac, and I41CX-MATH module are just three examples of the powerful capabilities enabled by the use of expansion pacs. And there are over 100 such expansion pacs available! The combination of i41CX+ and expansion modules comprise a very powerful small package. Combined with programmability, there is virtually no calculation application beyond the reach of i41CX+!

Exchanging data and programs

The 41 was so loved by the user community that people were doubling the clock speed and adding all kinds of peripherals and memory. Using the HP-IL interface, the HP-41 could drive any number of peripherals from line printers, to monitors, to tape printers, card readers, barcode wands, tape memory cartridges and other custom devices. There seemed to be no end to the number of riggings and devices associated with the little hand held computer.

Today, with the iPhone/iPod, in an even smaller format much of that capability can still be realized. i41CX+ supports an adjustable calculator speed and has flexible support for exchanging information with other users and devices. It is possible to send and receive emails with data or programs, transfer the printouts to a computer to create actual paper printouts, download data, programs, overlays, modules, etc. from the web and even import data and programs from the iPhone clipboard.

The ability to share data and programs via email would be extremely useful in a classroom setting whereby the teacher could email the students some data and/or programs or vice versa for handing in work. Of course, this could also become a conduit for cheating but that's true of any modern device with communication capabilities... For example, let's suppose that you have a program entered into the calculator and wish to send it to another i41CX+ user. This is very simple with i41CX+. Just go to the back of the calculator and tap the "Save Data" button. Scroll down to the label of the program that you wish to share and tap the "Mail" button. A mail window with the program will pop up. Enter the destination email address and send it.

Receiving data and programs from other users is even simpler. Suppose that you received an email with i41CX+ data or program. Open the email that you received with the iPhone Mail application and scroll down to the bottom and tap the "send to i41CX +" icon (the image with an arrow pointing down to the i41CX+ icon). This will launch i41CX+ and you'll be asked to confirm saving the program. If confirmed, it will show up in the "Load Data" picker from where it can be loaded into the calculator's memory. An alternative way to accomplish this is to email the program or data in an email, copy the program or data in the email on your device, and use the "Import from clipboard..." item in the "Load Data" picker to save the clipboard contents as a program or data file that you can then load into the calculator's memory. This is useful to exchange data or programs with non-i41CX+ users or desktop programs. Overlays can be imported in a similar fashion using the overlay picker.

Of course, i41CX+ also supports copy and paste of stack registers, Alpha register, printer output, flags table, and registers table contents. Double tapping the main display provides access to copy/paste operations from/to the X and Alpha registers depending on the status of Alpha mode. Double tapping the printer paper roll, flags table, or registers table provides the option to copy their contents. Double tapping the mini stack area provides access to copypaste operations from/to the stack registers. Copy and paste operations are also programmatically supported via the `COPYA`, `COPYFLG`, `COPYPRT`, `COPYSTK`, `COPYX`, `PASTEA`, `PASTER`, and `PASTEX` functions.

All in all the i41CX+ elevates the iPhone/iPod Touch into being a serious calculating machine capable of performing a virtually unlimited number of calculation tasks. Imagine going through school and generating programs of each and every formula that is of importance as you travel though your courses. They will always be available to you in the future with a simple download.

Sounds

i41CX+ includes a rich set of interface sounds to provide auditory feedback and provide an immersive experience as close as possible to that of the real HP-41CX and printer. It also supports the HP-41CX sounds (BEEP and TONE) that can be used in programs and for audible alarms. Some HP-41CX users have gone as far as creating programs that play famous musical scores using the available tones (10 normal and a large number of synthetic ones). The standard sounds supported by i41CX+ are listed below.

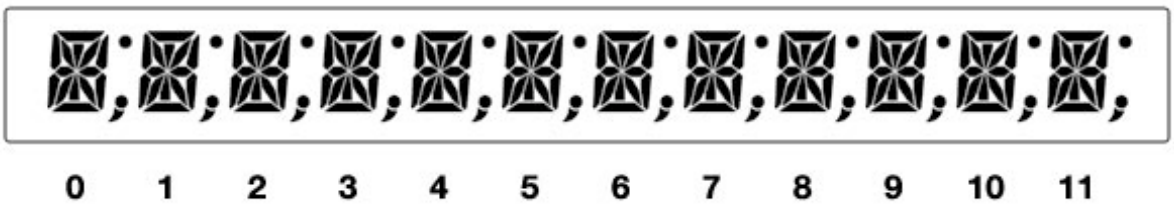
- 11 calculator sounds (TONE 0-9 + BEEP)
- 3 types of key click sounds (New, Old, System)
- scroll click sound
- printer paper advance sound
- printer paper roll tear sound
- printer image save sound (camera capture/shutter sound)

Keyboard Overlay Picker

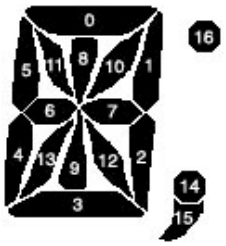
Calculator Back Screen

Graphics Mode

i41CX+ supports a special graphics mode that provides full control over the display (main and stack display if stack display is visible) when running programs. This enables the display of custom characters and shapes that are otherwise not possible with traditional means. In graphics mode, all individual segments of the main display become independently controllable as are the contents of the stack displays. As shown in the diagram below, the i41CX+ main display consists of 12 characters, each containing 17 segments, including the segments used to display the period, comma, and colon. Incidentally, it was not normally possible to display a semicolon on an HP-41 but this is just one of the new possibilities with graphics mode.



Each segment of a character corresponds to a power of 2 with the powers shown in the following diagram.



For example, a capital letter O is displayed by turning on segments 0, 1, 2, 3, 4, and 5 and turning off all other segments. Thus, setting the segments value for a character on the display to 2^0 + 2^1 + 2^2 + 2^3 + 2^4 + 2^5 = 0x3F = 63 would display the capital letter O. As another example, a semicolon could be displayed by setting the segments value of a character to 2^14 + 2^15 + 2^16 = 0x1C000 = 114688.

`GSCRON` enables graphics mode and `GSCROFF` disables graphics mode. The graphics display buffer can be cleared using the `GSCRCLR` function. Graphics mode uses a dedicated main display buffer that is independent from the normal display and its contents are retained until the application is quit. Therefore, clearing the graphics screen has no effect on the contents of the normal mode display. Each character's segments can be set to the desired value using the `GSETSEG` function which takes two arguments. The value in the X register specifies the character location (0-11) and the value in the Y register specifies the segments value for the character. The current value of the segments for a given character can be obtained using the `GGETSEG` function which takes the character position (0-11) argument from the X register. The stack displays (Y, Z, T, and L) can be controlled in a similar fashion. The `GSETST{Y, Z, T, L}` functions set the contents of the corresponding display to the contents of the Alpha register (up to a maximum of 6 characters) and `GGETST{Y, Z, T, L}` copies the contents of the corresponding display into the Alpha register.

Tips and Tricks

As must be obvious from this mini manual which provides only a cursory overview, i41CX+ is a very sophisticated application. There are many features and capabilities that many users may not be aware of. We will briefly mention some of them below.

- Display Status Bar

  To display the iPhone status bar when the mini stack display is enabled, simply tap the mini stack display area (the area that the status bar normally occupies). The status bar will be shown for a few seconds and then it will automatically disappear.

- Display Clock

  Pressing SHIFT ON places the calculator in clock display mode. By default, the displayed clock is a 12-hour h:mm:ss format. This can be changed to display the time and date using the `CLKTD` function which will configure the clock display mode to show the time and date in 12-hour h:mm MM/DD format. To configure the clock to display only the time, use the `CLKT` function. To switch between 12-hour and 24-hour formats, use the `CLK12` and `CLK24` functions. To return to the calculator, press any key. For more details on the Timer module, please see the HP-41CX manual.

- Use the Stopwatch

  Executing the `SW` function places the calculator in stopwatch mode. The stopwatch can be started and stopped using the R/S (Run/Stop) key and cleared using the delete/backspace key. The stopwatch supports splits, storing and recalling times, etc. The included “Stop Watch” keyboard overlay comes in handy when using the stopwatch. To return to the calculator, press SHIFT delete/backspace.

- Copy and Paste Data

  i41CX+ has comprehensive and flexible support for copy and paste operations. Double tapping the main display allows copy and paste operations from/to the X register or A register, depending on the state of ALPHA mode. If the mini stack display is enabled, double tapping the mini stack area (the area that the iPhone status bar normally occupies) allows copy and paste operations from/to the stack registers (X, Y, Z, T, and LastX). Double tapping the paper roll allows copying the printout in text format. Double tapping the Flags or Registers table allows copying the table contents in space delimited format. These operations can also be performed using the `COPYA`, `COPYFLG`, `COPYPRT`, `COPYR`, `COPYSTK`, and `COPYX` functions.

- Turbo Program Execution Mode

  i41CX+ supports a configurable speed that is normally controlled via the “Calculator Speed” slider on the back view of the calculator or programmatically via the `SETCSPD` function and that allows for a maximum speed of 4x the normal HP-41CX operating speed. When running a program, however, the `SETCSPD` function’s 4x limit is raised to 40x. The calculator speed will revert back to the normal valid maximum limit when the program stops running. This allows for faster program execution.

- Navigate the Flags, Registers, Usage & Examples, and Quick Reference Tables

  Tapping the right edge of these tables will jump to the proportionate location in the table (e.g. tapping the middle of the right edge will jump to the middle, tapping the bottom of the right edge will jump to the bottom, etc.), similar to the way that tapping a letter in the built-in address book works. Furthermore, tapping the title area of these tables will jump back to the top of the table, similar to the way that tapping the status bar in Safari jumps back to the top of the web page.

- Quickly Switch Module Port Pickers

  It is not necessary to close a module port picker to access a different one. It is possible to switch between different module port pickers by simply tapping a different port even while the module port picker is visible.

Tips and Tricks (Continued)

- Revert Display Colors, Printer Ink Color, and Calculator Speed and Quickly Remove Active Overlay or Module

  i41CX+ supports the shake gesture to revert display color settings, printer colors, and calculator speed back to default settings as well as to select the “No Overlay” and “No Module” items in the overlay and module pickers. The shake gesture is not only useful for recovering from inadvertently setting psychedelic display colors but can also be used to quickly switch back and forth between different skin display color schemes because the color restore is skin context sensitive. If a traditional skin is active, the display colors will reset to black characters and light green background whereas if a non-traditional skin (e.g. Bauhaus) is active, the display colors will reset to the recommended display settings for that skin. In the case of the overlay and module pickers, the shake gesture saves the need to scroll the picker wheel back to the “No Overlay” and “No Module” items.

  To prevent distracting the user with unnecessary confirmation dialogs due to inadvertent shaking motion, shake gestures are only detected if the display color settings picker, printer color picker, calculator speed slider, overlay picker, or module picker is visible.

- Automatically Display Keyboard Overlay

  The “Dynamic Overlay” option available in the global Settings application or in the calculator back screen can be used to automatically display the selected keyboard overlay only when USER mode is active. This allows for quick and easy switching between the standard keyboard and the selected keyboard overlay without having to manually select and deselect the keyboard overlay using the overlay picker.

- Use the HP-41CX Text Editor

  The HP-41CX came with a built-in text editor for use with extended memory text files. To invoke the text editor, place the name of the extended memory text file in the Alpha register and then execute the `ED` function.

- Use the Mail Composition Window as a General Purpose Editor

  While `ED` is neat and was useful on the HP-41CX, i41CX+ users have a superior alternative to create and edit not just text files but also data and programs. Because i41CX+ supports importing registers, flags, program, and text file data from the clipboard, this can be used in conjunction with the in-app mail composition window as a general purpose editor environment.

  For example, to create a program, execute any of the mail functions (`MAILA` will do) or use any of the GUI based mail features (“Mail” button on the printer, mail icons in the flags and registers tables, or the “Mail” button in the “Save Data” picker) to open a mail composition window. Select all of the text and delete it. Now enter the program. When done entering the program, select all of the text and copy it. Tap the “Cancel” button to return to i41CX+ and select the “Load Data” picker’s “Import from clipboard...” item to save your program to a file in i41CX+ that you can then load into memory. The same process can be used to edit content in i41CX+ by first generating a mail containing the content you wish to edit. After editing it, copy it, return to i41CX+ and save it to a file that you can then load to replace the previous content.

- Expand the available memory and program in MCODE

  As mentioned earlier, i41CX+ is compatible with the HEPAX module. The HEPAX module provides an additional 1304 registers that can be used to store data, text, programs, and even copies of main memory or other module contents. This provides an easy and readily accessible alternative to store large numbers of files in addition to the i41CX+ Load/Save facilities. The HEPAX module also provides facilities for MCODE programming.

Tips and Tricks (Continued)

- Unit conversions

  The Petroleum Fluids and Machine Design Pacs support extremely flexible and powerful unit conversion systems. In both cases, the conversion is performed by entering a unit conversion "equation" into the Alpha register and then using forward and backward conversion functions. Below are some examples using the Machine Design Pac that illustrate the simplicity and flexibility of these unit conversion systems.

  - Convert 212°F to kelvins.
    1. Enter F-K into the Alpha register. This specifies the conversion units and the direction (forward being F to K and backward being K to F).
    2. Enter 212 and execute the FCON (Forward CONversion) function.
    3. The result will be 373.15 (°K).
  - Convert 88 feet per second to kilometers per hour. Convert 100 kilometers per hour back to feet per second.
    1. Enter FT/S-KM/HR into the Alpha register.
    2. Enter 88 and execute the FCON function.
    3. The result will be 96.5606 (KM/HR).
    4. Enter 100 and execute the BCON (Backward CONversion) function.
    5. The result will be 91.1344 (FT/S).
  - Convert 20 (btu · in)/(°F · ft^3 · s) to W/(in^2 · °C).
    1. Enter BTU*IN/F*FT3*S-W/IN2*C into the Alpha register.
    2. Enter 20 and execute the FCON function.
    3. The result will be 21.9803 (W/in^2 · °C).

  The Petroleum Fluids Pac unit conversion system functions similarly but supports a slightly different set of units and the forward and backward functions are named CON (forward CONversion) and INCON (INverse CONversion), respectively.

- Take advantage of i41CX+'s non-modal design

  i41CX+ is designed to be non-modal. That is, there is no need to dismiss picker views, etc. to perform other operations. For example, it is possible to switch between the printer, front, and back views, even if the iPhone keyboard is displayed in the front view. The keyboard will automatically hide itself when switching to the printer or back views and will reappear when returning to the front view. The same applies to picker views. They don't prevent transitions between the front, back, and printer views. As another example, it is possible to switch between keypad and iPhone keyboard ALPHA entry modes without having to first dismiss the iPhone keyboard (e.g. by tapping the ALPHA key). With the iPhone keyboard displayed, tapping the overlay clip button will reveal the ALPHA entry button which can then be toggled to select the keypad for ALPHA input.

- i41CX+ Text Editor (I41CXED)
  - The keyboard can be hidden by tapping the filename being edited that is shown at the top center of the window. This provides access to the font style, font size, color, and mail buttons that are otherwise hidden when the keyboard is visible.
  - Enabling the "Access Saved Files" global option allows I41CXED to edit/view saved text files if the specified file name doesn't exist in extended memory but matches the name of a saved text file.

Tips and Tricks (Continued)

- Quickly Perform CAS operations

  A quick and efficient way to perform CAS operations is to use the new I41CXED to pop up a text editor window, use it to write/edit the CAS input, save the text file, execute the CAS function, and use I41CXED again to view the results. The following is a short program that can be used for this purpose. Note that this program uses separate CAS input and output files.

```
01 LBL "DOCAS"
02 SF 25             ; Set flag 25 in case CASOUT does not exist
03 "CASOUT"          ; CAS output file
04 PURFL             ; Delete CAS output file if it exists
05 CF 25             ; Clear flag 25
06 "CASIN,CASOUT"    ; Specify CAS input and output files
07 I41CXED           ; Open text editor
08 CAS               ; Execute CAS
09 "CASOUT"          ; CAS output file
10 I41CXED           ; View CAS output results with text editor
11 END
```

- Change CAS output line width

  The default CAS output line width is set for optimal viewing with I41CXED based on the set font size. The default output line width can be overridden using the linelength operator. For example, "linelength 72$" sets the output line width to 72 characters.

- Minimize CAS output to the results of interest

  CAS output can be suppressed by using "$" instead of ";" to terminate each operation. Thus, we recommend using "$" to terminate intermediate operations and only use ";" to produce the results of interest.

- Optimal way to view long CAS output

  Open the CAS notebook file with I41CXED or with MAILTXT and turn your device sideways to better view long CAS output in landscape mode.

- Copy sample programs or CAS examples from the Usage & Examples table

  The contents of the Usage & Examples table can be copied by tapping the cell to select it and then tapping the Copy button that appears. The contents can then be pasted into I41CXED or imported as a program or text file using the Load Data picker's "Import from clipboard..." item.

- Have Some Fun ;-)

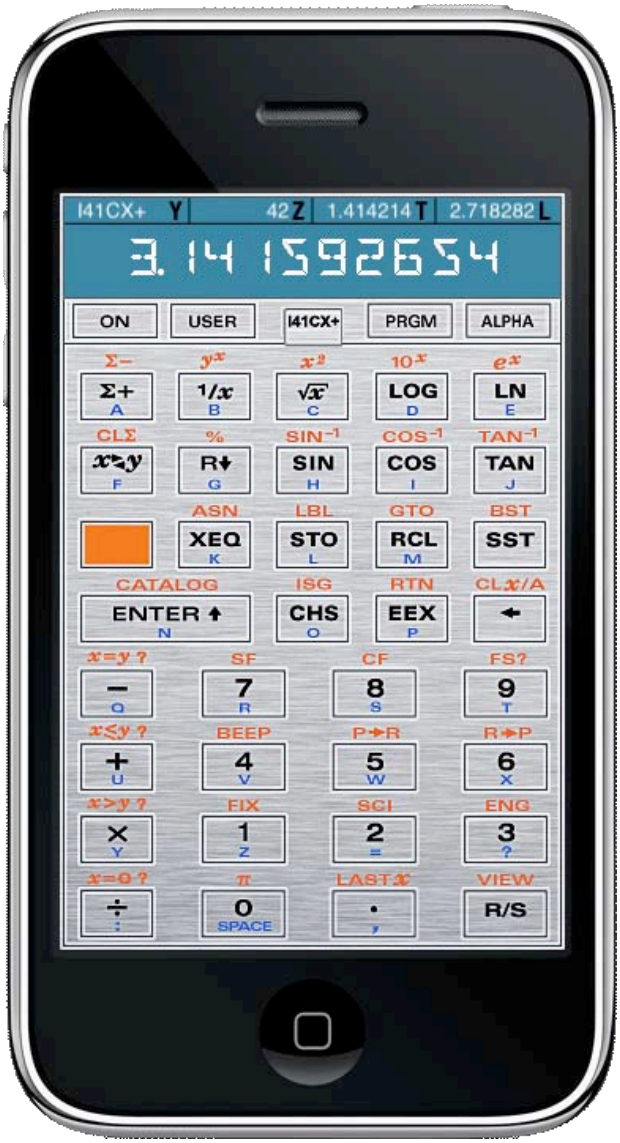
  The printer ink color can be changed while printing is in progress. Varying the printer ink color can make for some funky looking rainbow printouts!

  If you were/are a fan of text based adventure/D&D games, try the DUNGEON-41CX game that can be downloaded from here.

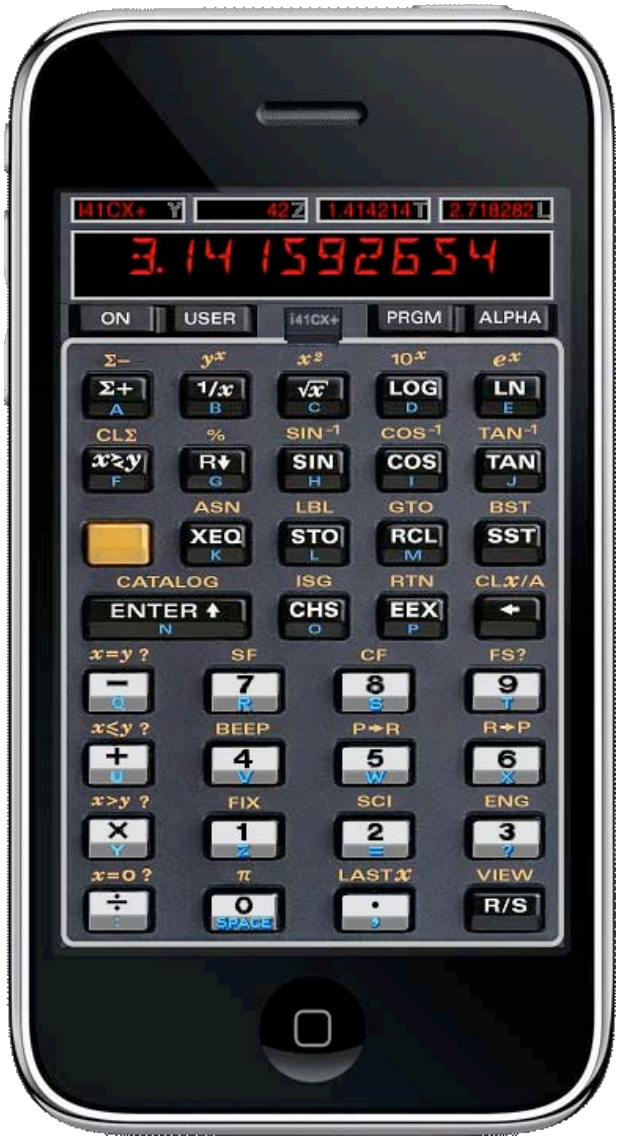
References and Resources

The following are some links to HP-41CX information and resources.
Warren Furlow's comprehensive HP-41 site: http://www.HP-41.org
Online HP-41 Manual: http://www.greendyk.nl/HP-41c-manual/index.html
PDF Versions of the HP-41CX Manuals
i41CX+ FAQ
And, of course, a Google search for HP-41 will reveal many more.

Skins Collection (as of version 4.0)



Aluminum



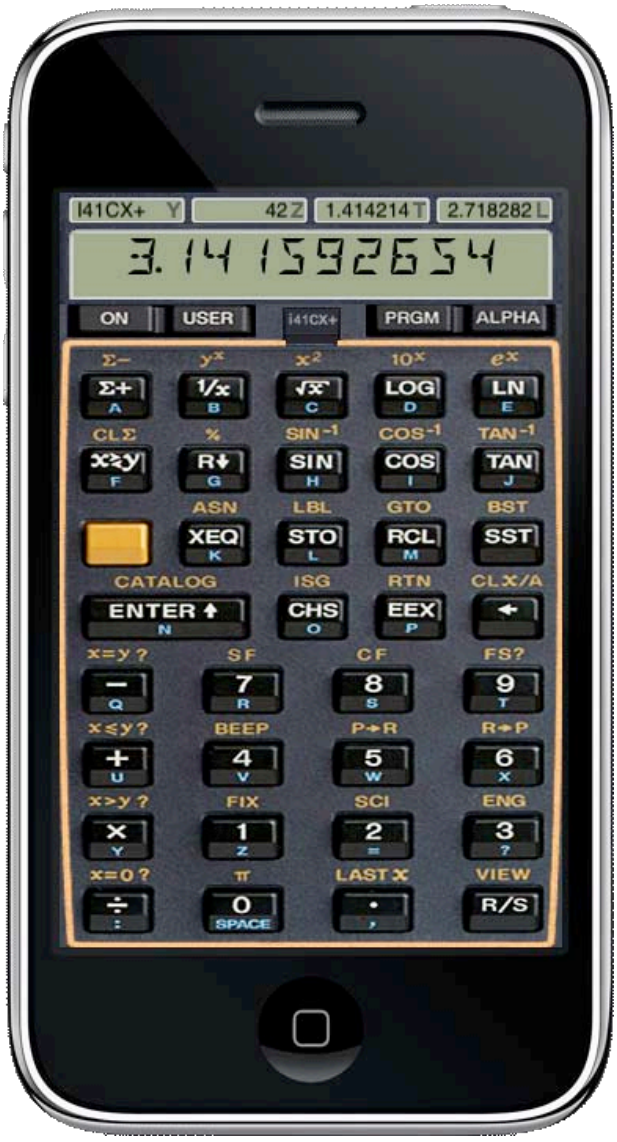
Vintage

Skins Collection (Continued)

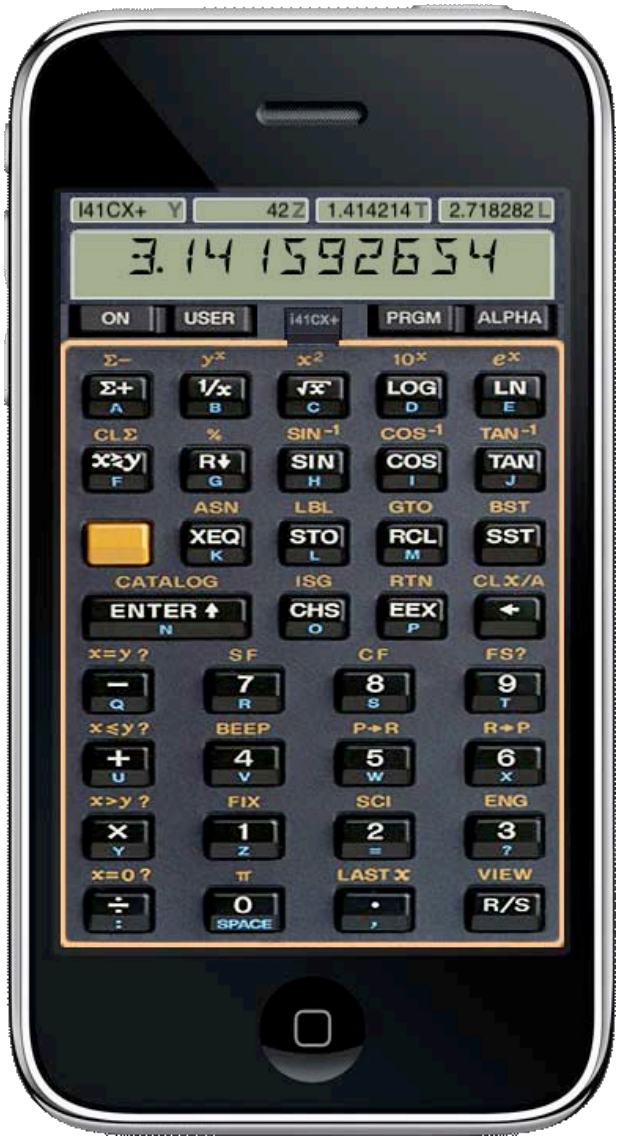
Bauhaus

Bauhaus Mies

Skins Collection (Continued)



Classic



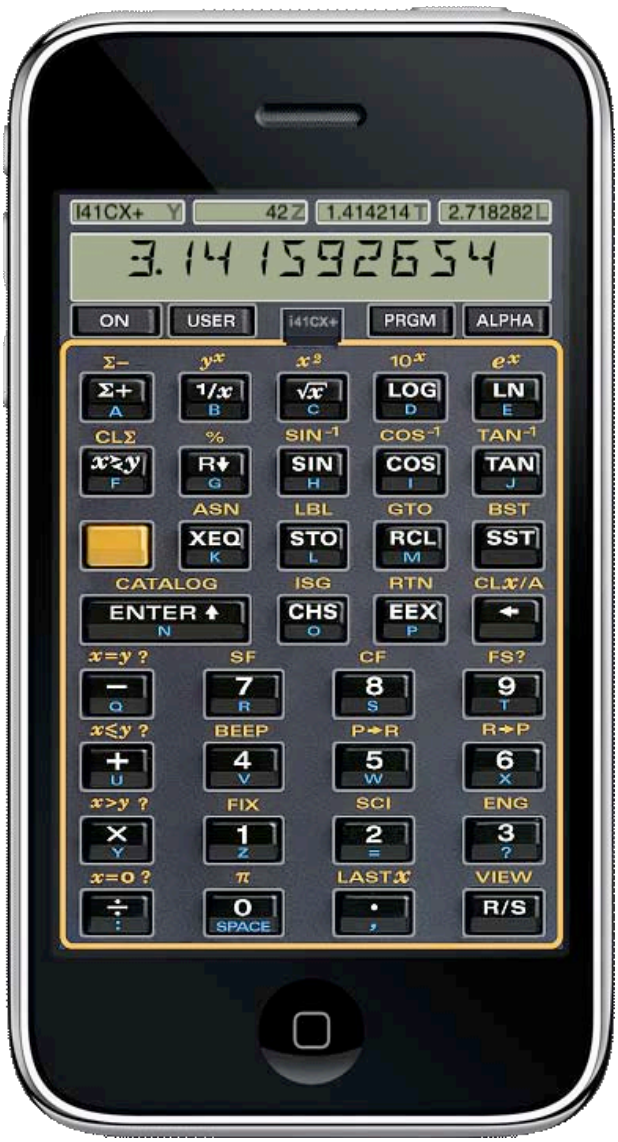
Classic Rectangular

Skins Collection (Continued)

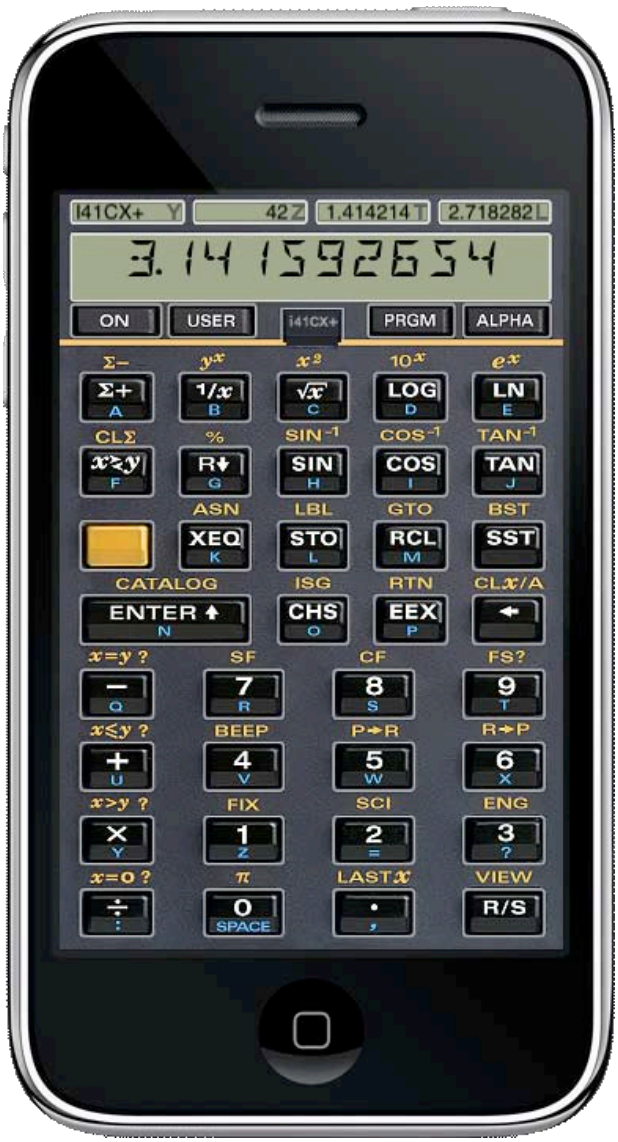
La Pomme

La Pomme Mies

Skins Collection (Continued)



Modern Gris



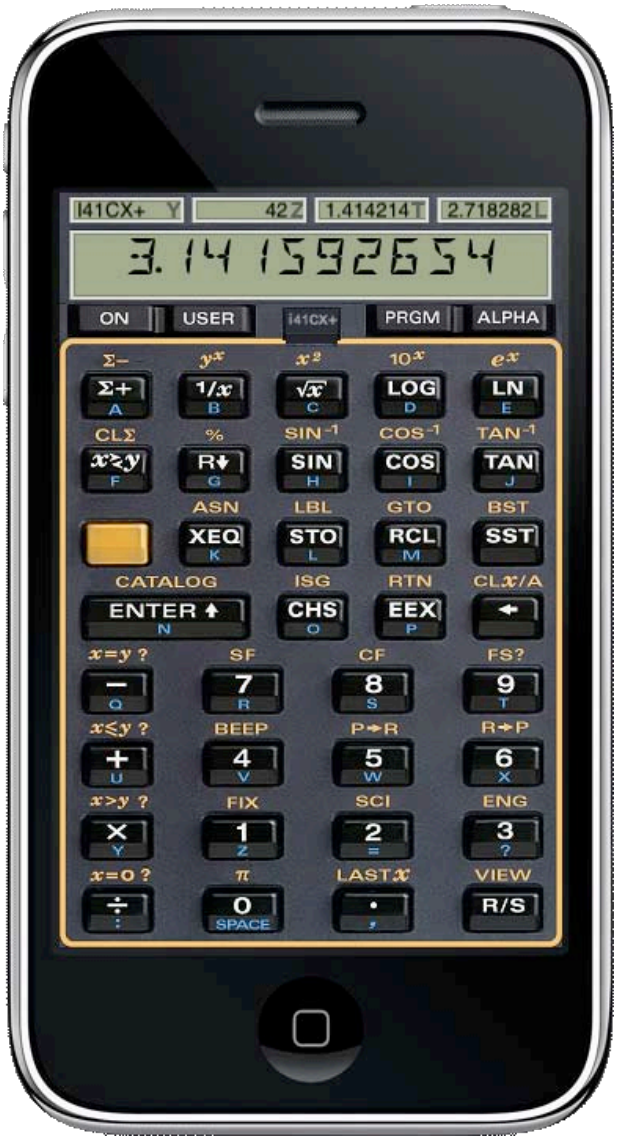
Modern Gris Naked

Skins Collection (Continued)

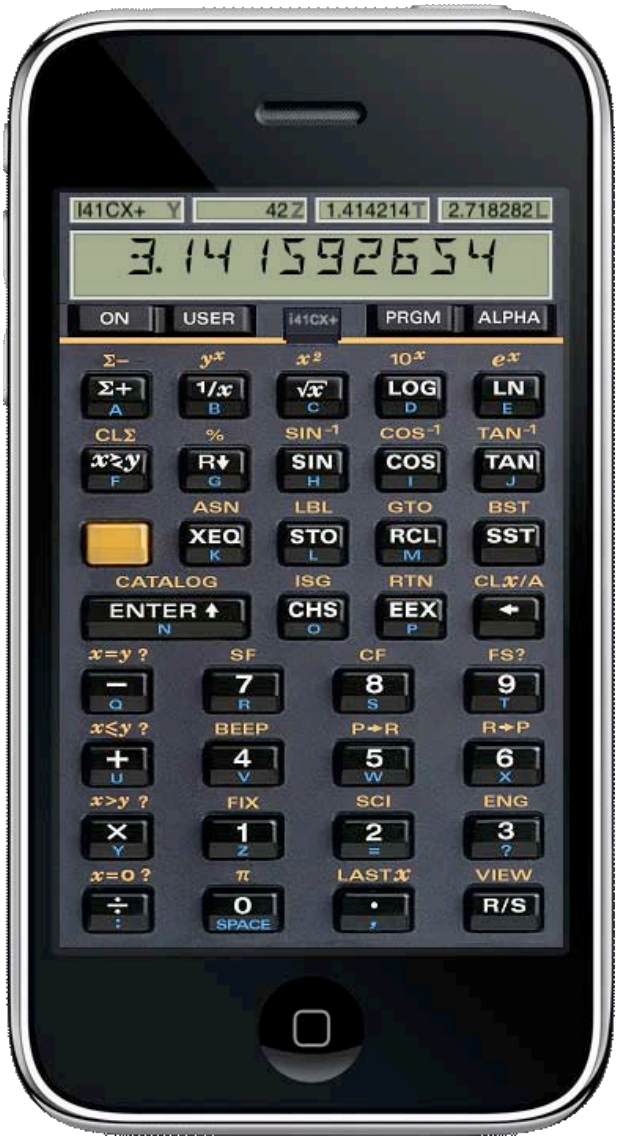
Modern Noir

Modern Noir Naked

Skins Collection (Continued)

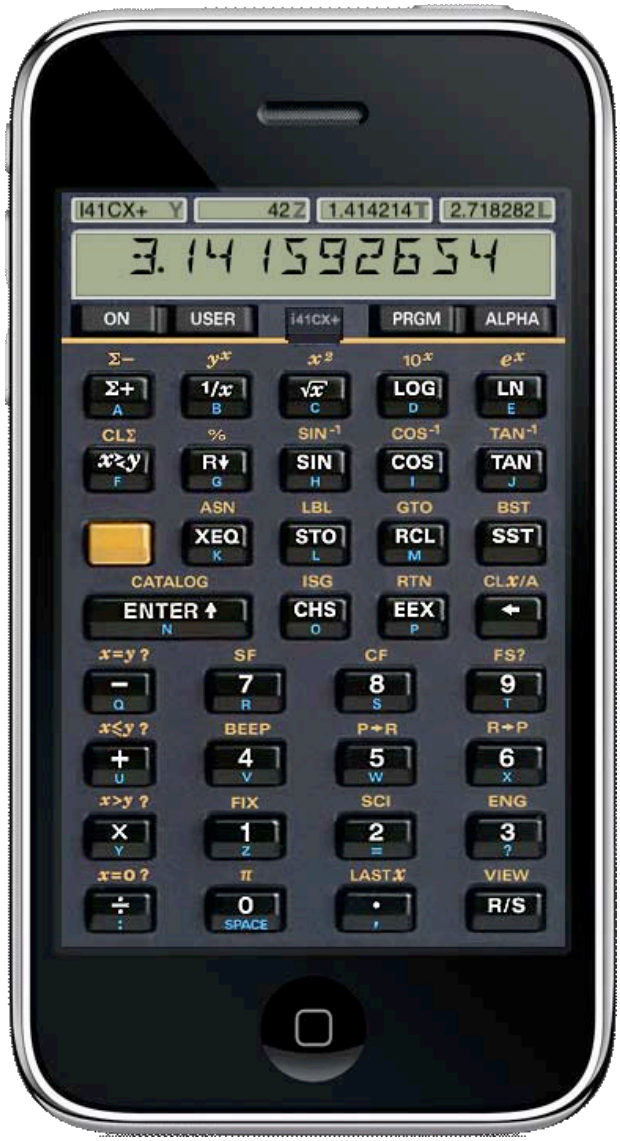


Neo Classic

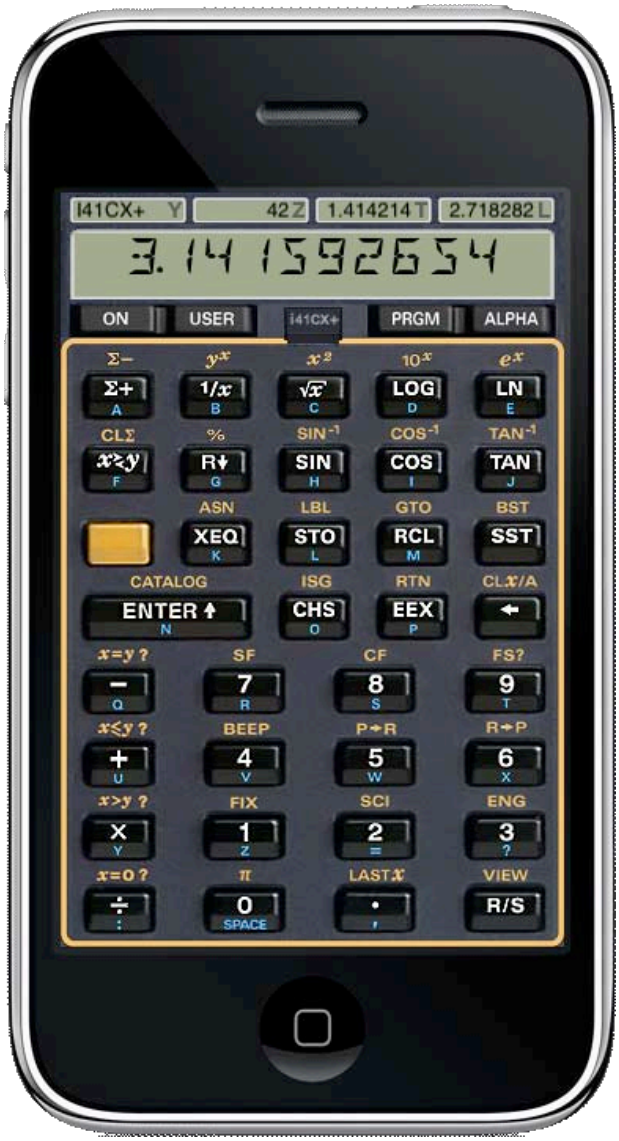


Neo Classic Naked

Skins Collection (Continued)



Skinny Naked



Skinny Rectangular

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