CC41 USER MANUAL

Version 0.42.04 Alpha

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Introduction

Why CC41?

CC41 is a re-creation of many of the functions of Hewlett Packard's HP-41CX calculator in software. Most calculator programs recreate a graphical interface resembling a calculator requiring the user to either use a mouse to enter commands and numbers or use a somewhat non-intuitive keyboard mapping where one key on the PC's keyboard maps to a key on the graphical calculator. With CC41 you can quickly type a function such as "1/x" rather than having to memorize which keyboard key the function is mapped to. CC41 contains 1000 data memory registers (0-999) and 65535 program memory registers as well as 64 flags, numbered 0 to 63. Using PATH to navigate your computer’s filesystem CC41 can read programs using GETP and GETSUB and remove them with PCLPS. CC41 can automatically load a program on launch and optionally begin running it.
The VIEW and AVIEW commands can output results to the command window as the program runs and the TRACE and SST commands enable program debugging. While CC41 can be a touch typist’s calculator the

two best features are that programs can be written in your favorite text editor which then run incredibly fast on your computer compared to the original HP-41CX.

Additional Reference Material

The Hewlett-Packard HP-41 CX Owner's Manual, volumes 1 and 2, is the recommended reference for most of the commands supported by CC41. Differences, if any, between the HP-41CX commands and CC41 will be explained in this manual.

Installation

There is no installer needed for CC41. Download the executable corresponding to your computer's operating system and then copy the program from your download location to where you desire to run the program from.

Starting and Exiting CC41

Pressing the CTRL and C keys simultaneously will exit an interactive CC41 session or, if a program is running, stop the running program. The program can be resumed by entering the RUN command.

Windows

Open a console by pressing the Windows key located to the left of the spacebar and typing (without quotes) "cmd". To leave CC41 type "exit" or "off" and press the return key.

Mac OS

Open the Terminal application by pressing the 'command' and 'space' keys to open Spotlight search, type 'terminal' and hit return. To leave CC41 type "exit" or "off" and press the return key or press the key combination CTRL + d .

Linux

In many linux distributions the key combination CRTL + ALT + T will open the terminal. Otherwise use the graphical menu system. To leave CC41 type "exit" or "off" and press the return key or press the key combination CTRL + d

After Opening a Console Window

Navigate to the location where you copied CC41. In Windows type "cc41" and press the return key.

In MacOS and Linux type "./cc41" and press the return key. CC41 starts by displaying version information and some tips to get started. This is followed by a "Memory Cleared" message and a display of the current stack values, last x value, and the contents of the alpha register.

To see the list of supported commands, enter "cat 3" and press the return key.

Commands are entered in upper or lower case with a space between each comand and number or followed by pressing the return key.

Interactive mode is where you imput commands from the keyboard, press the return key and CC41 outputs the resultant stack and alpha registers. When you type RUN and press the return key, CC41 will begin executing the current program, at the current program step. If you type XEQ followed by a program label, CC41 will begin running that program at the program label location. You can also GTO a program label before typing RUN.

Input is limited to 256 characters at a time. This limit includes commands, number, operations, alpha strings, and filenames. Input continues on the next entry line. Commands that always expect a following parameter, such as SF, can be continued after the return key is pressed. Commands that have optional following parameters, such as CLP and LIST, must be completed before pressing the return key.

Numbers must also be completed before pressing the return key. Numbers can be entered using keyboard keys for '+','-','.','0-9','e', and 'E'. If more than 16 number digits are entered the the 16th digit will be rounded.

Text surrounded by double quotes, such as "Alphabet" will be placed in the Alpha Register. Text following a command that expects text does need to be quoted. For example, GTO MYLABEL does not need double quotes.

Command Line Options

The default mode of operation is interactive mode if no options are provided.

Option	Description
-i or -I	Start CC41 in interactive mode.
-l or -L [filename]	Loads a program into memory.
-x or -X [filename]	Loads a program into memory and begin running it.
-r or -R [filename]	Restores entire memory from a file, equivalent to READA command.

Command Line History

A very nice feature available is the ability to press the up and down arrows to navigate through previous commands issued to CC41. In the Windows version of CC41 this feature works with no additional software installation needed. For Linux and MacOS a utility called “rlwrap” needs to be installed. Once the the utility is installed then launch cc41 as follows: rlwrap ./cc41 .

Differences from HP 41CX commands

CC41 Additonal Commands

CC41	Description
astol	Extended version of ASTO that stores 8 characters from the Alpha register in a memory instead of 6.
arcl	Extended version of ARCL that recalls 8 characters from a memory to the Alpha register instead of 6.
ashfl	Extended version of ASHF that shifts 8 characters instead of 6 in the Alpha register.

CC41	Description
changes	Displays list of CC41 software changes.
clall	Clears all memories and resets CC41 to the initial state. Not programmable.
drop	Deletes current X contents and moves stack contents down. L not affected.
dropl	Deletes current L contents and moves stack down. X contents moved to L.
exit	Exits CC41, similar to turning the HP-41CX off, however memory contents and status are not retained.
fview	Displays the flags register as a hexadecimal number.
gto.	Go to the following program line number. Replaces 'GTO .'
gto..	Go to the end of Program Memory, create an END if the last program does not have one. Replaces 'GTO ..'
run	Begins running the current program at the current step.
path	Sets the filesytem path to the contents of the alpha register.
path?	Displays the current filesystem path, if set.
path+	Appends the contents of the alpha register to the current path. Maximum path characters limited to 233.
pdir	Lists contents of the directory that PATH points to. Defaults to the current directory.
reada	Read calculator status, program and memory contents from PATH + filename In a program ,filename length is limited to 8 characters.
reads filename	Reads calculator status, written by WRTS, from PATH + filename.
usage	Prints how to call the CC41 executable.
user	Toggles flag 27 which enables USER Mode.
wrta	Write calculator status, program and memory contents to PATH + filename. In a program filename length is limited to 8 characters.
wrts filename	Write calculator status to PATH + filename. In a program filename length is limited to 8 characters. Saves registers, x, y, z, t, and l. Saves flags 0-63 and the Alpha register. Saves Statistics registers base register and data memory size allocation.

Different Command Behavior

All memory, registers 0 through 999, may be directly referenced by STO, RCL, and other commands. Indirect access works also. SIZE has no affect as data memory size is fixed to 1000. SIZE? always returns 1000. User Flags number 0-63. Stack indirection, STO IND ST X and STO IND X will both work exactly the same. CC41 will list commands referencing stack registers without ‘ST’. There is no need for ALPHA or PRGM mode with CC41. Alpha text is entered directly between double quotes and programs are edited in your favorite text editor. The functions of the R/S key are replaced by the commands RUN and STOP. There

are no key assignments in CC41. PRSTK prints x, y, z, and t registers as well as the l and Alpha register. Beep prints "BEEP!" which can be suppressed by clearing flag 26. RCLFLAG recalls status of flags 0-63 to x regiater. STOFLAG Saves flag data in x register to flags 0-63. TIME displays current time to millisecond resolution. FIX, SCI and ENG will accept values from 0 to 15. CC41 uses 16 decimal digits internally however only 15 can normally be displayed using FIX, SCI and ENG. Setting flag 60 will display all sixteen digits in the current FIX, SCI or ENG formats regardless of the last FIX, SCI or ENG setting. CLD is present for compatibility but does not clear what has been output to the console.

Labels

CC41 supports global labels up to 8 characters in length while HP-41CX supports 7 characters. Global labels are case sensitive. Valid local alpha labels for CC41 are labels a-z and A-Z except for l,x,y,z,t and L,X,Y,Z,T.

Entry Using Upper and Lower Case

Command entry and command short cuts are case insensitive. File name and paths depend on your operating system settings. Program labels are case sensitive.

Short Cut Commands

s for SST. b for BST.

User Mode

User mode is toggled by the USER command which sets flag 27 when in user mode. When in user mode XEQ is not required to execute a global label, just type in a valid global label and it will be treated as a built-in command.

Text Entry

Text entered between “ and “ will overwrite the contents of the Alpha regiEster. Adding a ‘+’ or ‘|-’ before the first “ will append the text to the contents of the Alpha Register (note 3). Program labels following LBL, GTO, XEQ, READS, and filenames following WRTS, READA, WRTA, and READA do not require quotes. CC41 uses the more easily typed "alpha" version of the HP-41CX command set as opposed to the symbols appearing on the HP-41CX keyboard. Some of the alpha commands contain symbols that do not commonly appear on computer keyboards. The following is a list of those commands and the text equivalent. Either command will be accepted in a program file. Numerous other symbols produced by online RAW file decoders will also be translated or ignored. Notes:

1. "x<>y" is the CC41 command to swap the contents of the X and Y registers.
2. Exponentiation is denoted by the '^' character e.g., x^2, y^x, e^x, 10^x, e^x-1.
3. HP-41CX printed program listings include the append character inside the double quotes. For CC41 these characters will be placed in the Alpha register so editing of these lines is necessary.

HP-41CX	CC41
CLΣ	clsum
ENTER↑	enter, space or return key

HP-41CX	CC41
R↑	rup
Σ+	sum+
Σ-	sum-
ΣREG	sumreg
ΣREG?	sumreg?
X≠0?	x<>0? or x!=0?
X≠Y?	x<>y? or x!=y?

Unimplemented Commands

A number of commands do not make sense in the context of CC41 vs. a handheld calculator. There are also commands that are planned to be implemented in the future and are described as such.

Numeric Functions

Unless noted these commands function as described in [Additional Reference Material Numeric](#additional-reference-material) Because CC41 uses 16 digit decimal math, which is more digits than the HP-41CX calculator uses, the outputs of arithmetic operations may be slightly different.

Name	Description
+	y + x
-	y - x
*	y * x
/	y / x
1/x	Reciprocal
10^x	Common exponential
abs	Absolute value
acos	Arc cosine
asin	Arc sine
atan	Arc tangent
chs	Change sign
cos	Cosine
d-r	Degrees to radians conversion
dec	Octal to decimal converstion
e^x	Natural exponential

Name	Description
e^x-1	Natural exponential for arguments close to zero
fact	Factorial
frc	Fractional part
hms	Decimal hours to hours-minutes-seconds conversion
hms+	Hours-minutes-seconds addition
hms-	Hours-minutes-seconds subtraction
hr	Hours-minutes-seconds to decimal hours conversion
int	Integer part
ln	Natural logarithm
ln1+x	Natural logarithm for arguments close to 1
log	Common logarithm
mean	Means of accumulated x and y values
mod	y mod x
oct	Decimal to octal conversion
p-r	Polar to rectangular conversion
%	x percent of y
%ch	Percent change from y to x
pi	Pi
r-d	Radians to degrees conversion
r-p	Rectangular to polar conversion
rnd	Round
sdev	Standard deviations of accumulated x and y values
sum+	Accumulations for statistics
sum-	Accumulations correction
sin	Sine
sign	Sign of x
sqrt	Square root
tan	Tangent
x^2	Square
y^x	y raised to the x power

Alpha Register

The Alpha register can hold up to 24 alpha-numeric characters.

Text surrounded by double quotes, i.e. "example" will be placed in the Alpha register, overwriting any text previously there. If the text in double quotes is prefixed by '|-' or '+', i.e |-"pangolin" or +”anteater” then it is appended onto the existing text, if any, in the Alpha register. A maximum of 24 characters is allowed between double quotes in interactive mode and 16 characters are allowed between double quotes in a program.

Stack, Data and Alpha Register Functions

Name	Description
adate	Append date in X register to Alpha register.
aleng	Loads x with the number of characters in the Alpha register.
anum	Constructs a number from the first string of number characters in the Alpha register. Sets flag 22 if a number is found.
arcl	Appends 6 characters from memory to Alpha register.
arcll	Appends 8 characters from memory to Alpha register.
arot	Rotaes alpha register contents by X, left if X is positive, right if X is negative.
ashf	Shift Alpha register left 6 characters.
ashfl	Shift Alpha register left 8 characters.
asto	Copies the left 6 characters from the Alpha register to memory.
astol	Copies the left 6 characters from the Alpha register to memory.
atime	Append time in X register to Alpha register.
atime24	Append time in X register to Alpha register in 24 hour format.
atox	The value of the left most character in the Alpha register is placed in X and the Alpha register contents are shifted left one character. A 0 is placed in X if the Alpha register is empty.
cla	Clear the Alpha register.
cld	Clear the display. Has no effect in CC41
clrg	Clear all numbered memory registers
clrgx	Clear registers starting at bbb, through eee incrementing by ii as specified in X by bbb.eeeii.
clsum	Clear statistics registers.
clst	Clear the stack registers x, y, z, and t.
clx	Clear the x register.

Name	Description
date	Loads number for current date into the x register.
date+	Adds days in x register to date in y register.
ddays	Difference in days betweein dates in the y and x registers.
dow	Returns the day of the week.
dse	Decrement the referenced register and skip the next program instruction if the counter and the end value are equal.
isg	Increment the referenced register and skip the next program instruction if the counter is greater than the end value.
lastx	Recall register l to x, lifting the stack.
posa	Finds the position of the character byte code or alpha character string in X, and returns the postion of the first character to the X register. -1 indicates that the target was not found.
psize	Set number of data registers from program. Has no effect in CC41 and there are 0-999 memory registers.
rup	rotate the stack up, bringing t into x.
rcl	Recall a memory value to the x register.
rdn	rotate the stack down, putting x into t.
regmove	The value sss.dddnnn in X specifes copying the contents of nnn registers, starting at register sss to registers beginning with ddd.
regswap	The value sss.dddnnn in X specifes swapping the contents of nnn registers, starting at register sss with registers beginning with ddd.
sumreg	Set the base memory register for the statistics registers.
sumreg?	Recall the base memory register value for the statistics registers to the x register.
size	Sets the number of data memory registers. Has no effect in CC41 and there are 0-999 memory registers.
size?	Always returns 1000. See SIZE.
st+	Add the x register to the referenced memory location.
st-	Subtract the x register from the referenced memory location.
st*	Muliply the referenced memory location by x and store the result there.
st/	Divide the referenced memory location by x and store the result there.
sto	Store x in the referenced memory location.
time	Load the current time into the x register.

Name	Description
xtoa	Appends the character represented by the value in X, or the string of alpha characters in X, to the right end of the contents of the Alpha register.
x<>	Swap the x register with the referenced memory register.
x<>f	Swap the first 8 flags, 0-7 with the x register.
x<>y	Swap the x and y registers.

Display and Information Functions

Name	Description
about	Displays information about CC41 and a short summary to get started.
adv	To be implemented.
aview	View the Alpha register.
cat	CAT 1 lists global lables in memory. CAT 3 lists all CC41 commands. CAT 4 lists the files in the current directory. Cat 6 lists global labels if USER mode is enabled. These are the only CAT commands implemented.
changes	Displays recent software change information.
clk12	12 hour clock display.
clk24	24 hour clock display.
clkt	Only display clock time.
clktd	Set clock to display time and date.
clock	View clock.
deg	Set the angle units to degrees.
dmy	Set Day Month Year date format.
eng	Set the display format to engineering.
exit	Exit CC41
fix	Set the display format to fixed.
grad	Set the angle units to grads.
mdy	Set Month Day Year date format.
prstk	Print the stack, l and Alpha register.
rad	Set the angle units to radians
sci	Set the display format to scientific.
trace	Display program step information as a program runs.

Name	Description
usage	Displays command line parameters for loading and running programs.
view	View the contents of the referenced memory.

Interactive Functions

Name	Description
beep	Prints "BEEP!". Output can be suppressed by clearing flag 26.
exit	Exit CC41 program. Memory and status are not saved.
off	Exit CC41 program. Memory and status are not saved.
prompt	Stops a running program and displays Alpha register prompt. User enters the needed data and types RUN followed by pressing the return key.
pse	Pauses running program for 2 seconds. CC41 does not accept input during a pause.
tone	Not yet implemented.

Program and Flag Operations

Flag test operations will print 'yes' or 'no' when commanded in interactive mode. See 11. Flags for flag definitions.

Name	Description
bst	Step back one program line.
cf	Clear flag.
clp	Clear program.
end	End of program.
fc?	Test if flag is clear.
fc?c	Test if flag is clear. Then clear the flag.
fs?	Test if flag is set.
fs?c	Test if flag is set. Then clear the flag.
gto	Go to a program label.
gto.	Go to a program line number.
gto..	Go to the end of program memory and append and END statement to the last program if none is present.

Name	Description
lbl	Program label. Valid numeric labels are 0-999. Alpha-numeric labels can be up to 8 characters in length. Invalid labels are x, y, z, t, l, X, Y, Z, T, and L. Numeric only and single alpha labels are local in scope to the current program, all other labels are globally accessible from any program in memory.
list	list the program from the current step. If followed by a number N, list N program lines from the current program step.
pclps	Programmable version of CLP. Clears a program with the label as identified in the Alpha register.
rclflag	Recalls status of flags 0-63 to x regiater.
rtn	Directs program to return to the calling program or exit.
run	Start running the program at the current program step.
sst	Execute one step of the program.
stoflag	Saves flag data in x register to flags 0-63.
stop	Command in the running program to stop.
x=0?	Test if x is equal to 0.
x<>0?	Test if x is not equal to 0.
x<0?	Test if x is less than 0.
x<=0?	Test if x is less than or equal to 0.
x>0?	Test if x is greater than 0.
x=y?	Test if x is equal to y.
x<>y?	Test if x is not equal to y.
x<=y?	Test if x is less than or equal to y.
x<y?	Test if x is less than y.
x>y?	Test if x is greater than y.
xeq	Execute a program starting at the given program label.

Progam Development Functions

These features help in devloping and debugging programs. A list of up to 25 registers may be monitored. The contents of the registers will be displayed everytime the statck is displayed. Registers can be added and removed one at a time using WATCH and UNWATCH respectively. WATCH and UNWATCH take the same arguments as VIEW.

Name	Description
clwatch	Clear the list of watch registers.

Name	Description
unwatch (0-999, ind, st)	Unwatch the referenced storage register
watch (0-999, ind, st)	Watch the referenced storage register.

File Operations (Extended Memory)

Data and text file operations are not currently supported in CC41.

Name	Description
pdir	List files in the directory pointed to by PATH.
emdir	List files in the default directory.
getp	Reads a program into memory, replacing the last program in memory. Uses PATH plus the filename stored in the Alpha Register. If getsub is commanded from a running program, execution resumes after the getsub command. If the program has line numbers, every line must have a number, the line numbers do not have to be in any order and can be duplicated. This is useful if you add comments to an existing program with line numbers.BM
getr	Copies registers from the file named in the Alpha register plus PATH into main memory.
getrx	Copies registers from the file named in the Alpha register plus PATH into main memory starting at sss and ending at eee where sss.ee is a number in the x register.
getsub	Reads a program into memory after all other programs. Uses PATH plus the filename stored in the Alpha Register and PATH. If getsub is commanded from a running program, execution resumes after the getsub command.
path	Sets the filesytem path to the contents of the alpha register. Initializes to the current directory.
path?	Displays the current filesystem path.
path+	Appends the contents of the alpha register to the current path. Maximum path length is limited to 233 characters.
reada	Read calculator status, program and memory contents from PATH + filename In a program ,filename length is limited to 8 characters.
reads filename	Reads calculator status, written by WRTS, from PATH plus filename.
saver	Saves all registers in main memory to the file named in the Alpha register plus PATH
saverx	Copies registers to the file named in the Alpha register plus PATH from main memory starting at sss and ending at eee where sss.ee is a number in the x register.
wrta	Write calculator status, program and memory contents to PATH + filename. In a program filename length is limited to 8 characters.

Name	Description
wrts filename	Write calculator status to PATH + filename. In a program filename length is limited to 8 characters. Saves registers, x, y, z, t, and l. Saves flags 0-63 and the Alpha register. Saves Statistics registers base register and data memory size allocation.

Flags

Flags typically follow the HP-41CX conventions with flags 0-29 being user modifiable. System flags are 30-63, where HP-41CX stops at flag 55. Currently all flags are user modifiable, this may change in the future.

Flag Overview

Flag No.	Description
0-10	User Flags
11-29	Control Flags
30-61	System Flags
62-63	Console Output Flags

Control Flags

Flags identified as "Reserved" are not currently implemented but may be used in a future version of CC41. They can currently be set, cleared and tested by the user.

Flag No.	Description
11	Reserved (Automatic Execution)
12-20	Reserved (External Device Control)
21	Reserved (Printer Enable)
22-23	Reserved (Data Input)
24-25	Reserved (Error Ignore)
26	Audio Enable, when set enables output to console from BEEP command.
27	User Mode enabled when set.
28-29	Display Punctuation

System Flags

Flags identified as "Reserved" are not currently implemented but may be used in a future version of CC41. They can currently be set, cleared and tested by the user.

Flag No.	Description
31	Date Format page 242
36-39	Number of displayed digits page 160-161
42-43	Angular Mode page 186
44	Reserved (Continuous On)
24-25	Reserved (Error Ignore)
48	Reserved (Alpha Keyboard active)
49	Reserved (Low Battery)
50	Reserved (Message Displayed)
55	Reserved (Printer present)
56-61	Reserved CC41 additional system Flags

Console Display Flags

Console display flags determine what is displayed as console output as a result of user interaction. These flags can be set, cleared and tested by the user.

Flag No.	Description
60	When set will display the 16th digit in the number regardless of the current FIX, ENG and SCI setting. This flag is clear on startup.
61	When set suppresses "Reading/Writing filename.ext" messages when reading or writing files. This flag is clear on startup.
62	Displays just the X register contents instead of the entire stack when set. This flag is clear on startup.
63	Display stack and alpha register contents when set. This flag is set on startup. Clearing this flag results in no output.