PPC ROM POCKET GUIDE

KEYBOARD FUNCTIONS (Default Assignments)

BD

				JC
BD	TB	PM	CM	CJ

FI

12 ×	12 ÷	CTS./ DISCRETE	BEGIN/ END	CLEAR FI REG.
n	i	PV	PMT	FV
		CF	PF	STATUS

CA

$X_c \gtrless Y_c$	$Y_c^{X_c}$	POP	LAST Z	e^z
+	−	*	÷	LN(Z)
INITIAL. XEQ 06		SIN(Z)	COS(Z)	PUSH

FR

GN	RN	GCD	DF	NP
+	−	*	÷	REDUCE

CV

Σ−	NO. POINTS IN PLOT	NO. DECIMAL PLACES	NO PLOT	INITIAL.
Σ+	SOLVE TYPE J	$\hat{Y}$	$\hat{X}$	SOLVE BEST TYPE

IG

	IG	SV	FD	

This Pocket Guide is the short form of the 500-page ROM Users Manual. This, the HEX Card and the PPC ROM are available at PPC.

PPC, the Personal Programming Center, publishes a monthly 48-page joint computer/calculator journal. PPC is a California non-profit public benefit corporation dedicated to the advancement and application art of personal programming.

PPC is the oldest, most experienced worldwide users group of personal programmers having printed more than 15 million pages on personal programming calculators and computers.

Each routine has an abbreviated Technical Details box. Abbreviations used in this box are:

S:	SIZE	A:	Alpha Registers
R:	Registers Used	m:	Minimum
F:	Flags Used	A/R:	As Required
SL:	Subroutines Left	N/A:	Not Applicable
C:	Registers to Copy	(R):	All Flags Restored

*Maximum pending RTN's when routine is called.

+K — ADDITIONAL KEY ASSIGNMENT XROM10,03

May be used after MK (which will set flag 20 and clear 07) or after 1K (which will set both flags 20 and 07). The sequence prefix ENTER postfix ENTER keycode, XEQ +K will make the corresponding key assignment. If flag 07 is clear, it will then prompt for subsequent key assignments; otherwise it returns after making only one assignment. Both 1K and +K permit key assignments under program control. Note that the sequence CF 20, SF07, XEQ +K is completely equivalent to XEQ 1K. Do not use data registers 09-11 between uses of +K. Not interruptible. Disrupts I/O Buffer (Timer Alarms), *see warning under* LF.

S: 012 R: 6-11, A F: 7-10, 20, 25 SL: 3 C:61

–B — STORE PART OF LB XROM 10,24

L– must be used for initialization of the byte-loading process. With a decimal code of the byte to be loaded in X, XEQ –B. Will load the corresponding byte into the next available location after LBL "++". CF 09 to terminate byte loading with prompting for clean up operations. CF 08 to switch to manual byte loading.

S: 012 R: 6-11, A F: 8, 9, 29 SL: 4 C: 71

1K — FIRST KEY ASSIGNMENT XROM 10,02

A non-prompting key assignment program. The sequence prefix ENTER postfix ENTER keycode, XEQ 1K, will make one key assignment. For more assignments, see +K. Not interruptible. Disrupts I/O Buffer (Timer Alarms), *see warning under* LF.

S: 012 R: 6-11, A F: 7-10, 20, 25 SL: 3 C: 61

2D — DECODE **2** BYTES TO **D**ECIMAL XROM 10,55

Evaluates the decimal equivalents for the last two bytes in X. Returns the decimal equivalent for the next-to-last byte in X, for the last byte in M. (Use X < > M to view.) Y, Z preserved.

S: 000 R: A F: None SL: 6 C: 60

A? — **A**SSIGNMENT REGISTER FINDER **?** XROM 10,10

Returns the number of assignment registers used. Key assignments by ASN may give a register count 1/2 too high. If timer alarms are present they will be disrupted and file count will be inaccurate. *See alarm warning under* LF.

S: 000 R: A F: 10 SL: 3 C: 59

AD — **A**LPHA **D**ELETE LAST CHARACTER XROM 10,18

Removes the last (rightmost) character from the alpha register. There must be no nulls in the string. L is preserved.

S: 000 R: A F: None SL: 6 C: 64

AL — **AL**PHABETIZE X AND Y XROM 10,37

Sorts two alpha strings in X and Y in alphabetic order (upon return lower value in X). If X and Y are numeric, they are regarded as pointers to two data registers which are to be sorted, the lower value to the register designated by X. Flag 10 is left set or clear to indicate whether an interchange was performed or not.

S: 000 R: A F: 10,25 SL: 4 C: 63

AM — **A**LPHA TO **M**EMORY XROM 20,53

ASTOres then clears all or part of contents of the ALPHA register into data registers using an ISG control number in X of the form bbb.eeeii. Inverse operation is MA. (not synthetic)

S: 004m R: A/R A F: None SL: 5 C: 16

Ab — ALPHA STORE b XROM 10,61

Ab provides an ASTO b with the ROM-mode interpretation, permitting ultra-fast ROM entry as an alternative to XE.

In ROM the mode of interpreting the last two bytes of status register b (which comprise the program pointer) is different than when in RAM. In ROM the first nibble specifies a 4k page of ROM, and the last 3 nibbles specify an address within that page. In RAM the first nibble (mod 8) specifies a byte within a register specified by the last 3 nibbles (mod 1024).

Stack is preserved.

S: 000 R: None F: None SL: 0 C: 60

BA — BARCODE ANALYZER XROM 20,30

Prompts for wand scan of barcode. Prints tabular analysis of barcode including type, with every byte in binary, hex, decimal, and the printer character (< 128). Computes and prints checksum if > 2 bytes.

S: 019 R: 0-18, A F: 7-10, 12, 21 SL 4 C: 49

BC — BLOCK CLEAR XROM 20,43

Stores 0's in defined block using an ISG control number bbb.eeeii in X. Y, Z, and T are preserved.

S: A/R R: A/R F: None SL: 5 C: 61

BD — BASE B TO BASE DECIMAL XROM 20,17

Store base b in RO6 (2 < =b < =25). Input up to 14 digits of base b number in alpha (each digit must be less than b) and XEQ BD. The base 10 result is left in X and alpha is cleared. The inverse routine is TB. Keyboard function A will XEQ BD after positioning to BD, TB, PM, CM, CJ, or JC.

S: 007 R: 6, A F: None SL: 5 C: 53

BE — BLOCK EXCHANGE XROM 20,34

Input two ISG block control numbers bbb.eeeii in X and Y and XEQ BE. For two blocks not of the same size, note that the block control number in Y is tested and controls the loop. Z, L are preserved.

S: A/R   R: A/R   F: None   SL: 5   C: 61

BI — **B**LOCK **I**NCREMENT XROM 20,34

Stores numerical data (as a sequence, constant, or zero) in a block of registers. Input:

Z:	Control word (bbb.eeeii)	bbb.eeeii ENTER
Y:	Starting Data Value	Start value ENTER
X:	Data Increment Value	Increment value
		XEQ BI.

X, T are preserved in L, T.

S: A/R   R: None   F: None   SL: 5   C: 46

BL — **BL**DSPEC INPUTS FOR LB XROM 10,42

Converts seven BLDSPEC numbers into seven decimal byte numbers for a synthetic text line. Key first BLDSPEC number, XEQ BL. See corresponding byte in X (0-255). Key second BLDSPEC number, R/S, see second byte. Continue with R/S until all seven bytes are obtained. To use LB start with 247, followed by seven bytes. To print: Text line, RCL M, ACSPEC, PRBUF. Related routines are FL and XL. These are not intended to be used as subroutines.

S: 000   R: M, N, O   F: None   SL: N/A   C: 46

BM — **B**LOCK **M**OVE XROM 20,39

Moves a block of consecutive registers into another block of consecutive registers. Input:

Z:	1st register number in source block
Y:	1st register number in destination block
X:	Number of registers in block

S: A/R   R: None   F: None   SL: 5   C: 61

BR — **B**LOCK **R**OTATE XROM 20,40

Rotates the content of data in a block of consecutive registers.

Input:

Y: 1st register number of block
X: ±number of registers in block

If X > 0 the block shifts to higher numbered registers
If X < 0 the block shifts to lower numbered registers
Each call to BR shifts by one register.

S: A/R R: A/R F: None SL: 5 C: 61

BV — BLOCK VIEW XROM 20,07

Allows viewing (or printing if able) of non-zero register contents of a block defined using a control word bbb.eeeii in X. Set flag 09 to PSE at each register. Set flag 10 to stop at each register.

S: A/R R: A/R F: 9, 10, 21, 25, 29 SL: 4 C: 40

BX — BLOCK EXTREMA XROM 20,41

Finds the maximum or minimum of a block of registers defined using a control word bbb.eeeii in X. Set flag 10 to use absolute values. Output:

M: INT part is max value register number
N: INT part is min value register number
O: Original block control word
Y: Max value of block
X: Min value of block

S: A/R R: M,N,O F: 10 SL: 5 C: 61

BΣ — BLOCK STATISTICS XROM 20,42

Calculates statistical sums for two register blocks defined by control words bbb.eeeii in X and Y. For two blocks not of the same size the block control word in Y controls the loop. Output in Σ-registers:

Σx Σx^2 Σy Σy^2 Σxy n=#reg. in block

S: A/R R: ΣREG F: none SL: 5 C: 61

© PPC 1981 XROM 10,00

Create this function using LB or MK inputs 162, 128. Use this function to determine if PPC ROM is present. It has no effect if present, gives NON EXISTENT or clears flag 25 if absent.

S: 000 R: none F: 25 SL: 5 C: 61

C? — CURTAIN FINDER ? XROM10,16

Returns the absolute decimal address of R00 (curtain location). X, Y preserved in Y, Z.

S: 000 R: A F: (R) SL: 6 C: 64

CA — COMPLEX ARITHMETIC XROM 20,23

GTO CA and XEQ 06 to initialize the complex stack. The keyboard functions are:

a: X< >Y	b: Y^X	c: Pop	d: Last Z	e: e^z
A: +	B: –	C: ×	D: ÷	E: ln(z)
Initialize (XEQ 06)		H: sin(z)	I: cos(z)	J: Push

Register usage:

R06: function #	R10: Start of Stack
R07: Last Z (IM)	R11: Start of Stack
R08: Last Z (RE)	⋮
R09: Ptr to Stk	Reven = Z (IM)
	Rodd = Z (RE)

RAD mode must be used.

Store call # in R06 and XEQ CA

1: + 2: – 3: × 4: ÷ 5: ln(z) 6: Init. Stack
7: cosh(y), sinh(y) 8: sin(z) 9: cos(z) 10: PUSH
11: X < >Y 12: Y^x 13: POP 14: Last Z 15: e^z
16: POP(save Last Z)

S: 018 m R: 6-17+,M, F: 10 SL: 4 C: 38

CB — COUNT BYTES XROM 10,50

Counts bytes between any two instructions in RAM after placing their program pointers in X and Y. The count includes the first instruction, but not the last. Obtain program pointer with RCL b when positioned at the instruction in RUN mode. Also, the decimal address of the first pointer returns in Y, the last pointer's returns in L. Note that an END adds 3 to the byte count. A program byte count divided by 112 and rounded up to the nearest integer yields the number of tracks required to record the segment on magnetic cards. (RCL b = 144, 124, key)

S: 000 R: A F: None SL: 4 C: 60

CD — CHARACTER TO DECIMAL XROM 10,35

Decodes last byte of alpha register (rightmost character displayed) into a decimal number returned in X. Up to 14 characters (the rightmost 14) will be preserved in the alpha register, **including** the decoded character **if flag 10 is set.** Otherwise the decoded character is deleted. X, Y, Z preserved in Y, Z, T.

S: 000 R: A F: 10 SL: 6 C: 60

CJ — CALENDAR DATE TO JULIAN DAY NUMBER XROM 20,21

Clear flag 10 for Gregorian (modern) calendar. Set flag 10 for Julian calendar. The keyboard function E will XEQ CJ after positioning to BD, TB, PM, CM, CJ, or JC. Valid from March 1, 0 AD (1BC). Input date in format:

Z: year The JDN is returned in X.
Y: month DOW = (JDN + 1) MOD 7 (SUN = 0)
X: day The inverse routine is JC.

S: 000 R: None F: 10 SL: 5 C: 53

CK — CLEAR KEY ASSIGNMENTS XROM 10,06

All USER mode assignments revert to the standard keyboard. Assignment registers become free registers. Global label assignments are dormant until the next program or status card is read in. X is preserved. *Clears I/O buffers (Timer Alarms).*

S: 000 R: A F: (R) SL: 4 C: 59

CM — COMBINATIONS XROM 20,20

To compute C(n,k): n ENTER k XEQ CM. The number of combinations of n objects taken k at a time is left in X. The keyboard function D will XEQ CM after positioning to BD, TB, PM, CM, CJ, or JC.

S: 000 R: None F: None SL: 5 C: 53

CP — COLUMN PRINT FORMATTING XROM 20,27

Aligns numeric values for printing columns of data. A skip index keeps decimal points in place and is calculated as (Max # digits left of dec. pt.) −1 for F29 clear, and (Max # digits . . .) −1 + (No. commas in largest number in the column) for F29 set. Set display mode, status of F29, place skip index in R06, place the number in X and XEQ **CP**. The number will then be added to the buffer in the correct column position.

S: 007 R: 6 F: None SL: 5 C: 29

CU — CURTAIN UP XROM 10,34

Adds the signed integer value of the contents of X to the R00 pointer (in status register c). The sequence 10, XEQ **CU** raises the curtain 10 registers. Then the sequence −10, XEQ **CU** lowers it to its previous position. Y, Z preserved in X, Y; Σ-reg absolute location is unchanged. Not interruptible with printer. *See important warnings under* **CX**.

S: 000 R: A F: (R) SL: 6 C: 60

CV — CURVE FIT XROM 20,08

GTO **CV** and the keyboard functions are:

a: Σ−				e: Initialize
A: Σ+	B: Solve Type j	C: $\hat{Y}$	D: $\hat{X}$	E: Solve Best

Curve Types:	1. Linear	$y = bx + a$
	2. Exponential	$y = ae^{bx}$ $(a > 0)$
	3. Logarithmic	$y = b\mathrm{LN}(x) + a$
	4. Power	$y = ax^{b}$ $(a > 0)$

Key x ENTER y and press A for each data pair.

Key B returns: . X: b Y: a Z: r

Key E returns: X: j Y: b Z: a T: r

R06: fct. #	R13: Σx	R20: $\Sigma \ln(x)^2$
R07: cv type	R14: Σx^2	R21: Σln(y)
R08: b, x	R15: Σy	R22: $\Sigma \ln(y)^2$
R09: a, y	R16: Σy^2	R23: Σln(x)ln(y)
R10: r	R17: Σxy	R24: n
R11: Σxln(y)	R18: Σn	R25: best r
R12: Σyln(x)	R19: Σln(x)	R26: best cv type

Store call # in R06 and XEQ **CV**
0:clear/init. 1: Σ+ 2: solve type j 3: $\hat{Y}$ 4: $\hat{X}$

5: Solve Best Type 6: Σ–(when F10 set) 9: stop in CV

S: 027 R: 6-26 F: 8-10 SL: 4 C: 42

CX — CURTAIN TO DECIMAL ADDRESS IN X XROM 10,33

Places hex version of X into the appropriate 3-nibble slot (the pointer to R00) in status register c. **WARNING:** Values 17 through 192 (mod 1024) or greater than 512 (mod 1024) *may result in* "MEMORY LOST." Y preserved in X, Y; T contains old c. Σ-reg absolute location is not changed. Not interruptible if printer is attached.

S: 000 R: A F: (R) SL: 5 C: 60

DC — DECIMAL TO CHARACTER XROM 10,11

Similar to Extended Functions XTOA. Appends to alpha contents the character corresponding to the decimal integer (mod 256) in X. Y, Z preserved in X, Y; (L contains old X + 256).

S: 000 R: A F: (R) SL: 6 C: 59

DF — DECIMAL TO FRACTION XROM 20,13

Store display accuracy (0-9) in R07. Input decimal in X and XEQ DF. Reduced fraction is left in Y (numerator) and X (denominator). In addition, if flag 10 was set, the fraction is displayed in alpha. The keyboard function d will XEQ DF after positioning to FR, DF, NP, GN, or RN.

S: 011 R: 7-10, (A) F: 10,25 SL: 4 C: 36

DP — DECIMAL TO PROGRAM POINTER XROM 10,53

The inverse to PD. Converts a decimal byte address in X to a RAM program pointer that via a STO b (be sure to return to RAM first!) can resume program operation where desired. See Ab regarding program pointers. Byte addresses begin with 0 at the bottom of status register memory through 111; this is followed by a 'hole' from 112 to 1343; then follows user memory from 1344 to 3583 (for the full complement of user registers). Y is preserved.

S: 000 R: A F: None SL: 5 C: 60

DR — DELETE RECORD XROM 20,38

Store:

R07: 1st register of entire file
R08: number of registers per record
R09: number of records in the file.

To delete the kth record, input k in X and XEQ DR. R09 is automatically updated. Inverse routine is IR.

S: 010 m R: None F: None SL: 5 C: 61

DS — DISPLAY SET XROM 10,29

If FIX, SCI or ENG n is set then keying m XEQ DS changes the display mode to FIX, SCI, or ENG m. X, Y, Z, T are preserved in L, X, Y, Z.

S: 000 R: A F: None SL: 6 C: 60

DT — DISPLAY TEST XROM 10,17

Turns on all 12 commas for 1 PSE (execution can be interrupted only at this point), then all display segments and annunciators except for the comma tails. Review the display, then push the PRGM switch and R/S to clean up. X, Y, and Z are preserved.

S: 000 R: A F: (R) SL: 6 C: 64

E? — .END. FINDER ? XROM 10,62

Returns the absolute decimal address of the register containing the .END. in its last 3 bytes (bytes 02-00) by decoding the appropriate pointer digits in status register c. X, Y preserved in Y, Z.

S: 000 R: A F: None SL: 5 C: 60

EP — ERASE PROGRAM MEMORY XROM 10,31

As long as flag 14 is clear and there is a program labeled "/ /" (as described below) in RAM, XEQ EP will clear programs following that labeled "/ /."

```
LBL "/ /"
RCL b
END or RTN
```

(followed by at least 6 bytes before .END.)

If flag 14 is set or if there is no program "/ /" as described, all programs will be erased. XEQ EP should be followed by PACK to reinstate CATalog 1.

If keyboard assigned global labels are erased by EP, use ASN to clear keys, or read any program or status card. X is preserved.

S: 000 R: A F: 14, 25 SL: 0 C: 60

EX — EXPONENT OF X XROM 10,27

Replaces X by its exponent portion, −99 to +99. The old X is saved in L; Y, Z, and T are preserved.

S: 000 R: A F: None SL: 6 C: 60

F? — FREE REGISTER FINDER ? XROM 10,04

Returns the number of free (available) registers between the last used assignment register and the .END. register. There will be a non-zero fractional part 0.5 and flag 10 will be set whenever the top assignment register contains only a single assignment in the left half of the register. See PK. If I/O buffers (like Timer Alarms) are present they will be disrupted and the count will be inaccurate. *See warnings under* LF.

S: 000 R: A F: 10 SL: 3 C: 61

FD — FIRST DERIVATIVE XROM 20,11

Calculates f′(X). Store the following:

R10: global label name of function
R11: pointer to register containing X (function input)
R12: step size

Flag 09 set selects quick approximation. F09 clear selects adaptive procedure. If F09 is clear, set F10 to view convergence. Estimate of first derivative is left in X and if F09 is clear an error estimate is left in Y. Maximum accuracy is 6½ digits. The keyboard function D will XEQ FD after positioning to IG, SV, or FD.

S: 018 R: 10-17 F: 9, 10 SL: 4 C: 43

FI — FINANCIAL CALCULATIONS XROM 10,63

GTO FI and the keyboard functions are:

a: 12x	b:12 ÷	c: C/D?	d: B/E?	e: Clear
A: n	B: % i	C: PV	D: PMT	E: FV
		H: CF	I: PF	J: Status

Register usage:

R01 through R05 hold the values defined by the keys above, plus R06: Fcn call #, R07: % i as decimal. F08 set/clear = C/D. F09 set/clear = B/E. Set F10 to view convergence when solving for % i. Accuracy for i is set by display mode.

Store call # in R06 and XEQ FI
0:clear/init. 1:solve n 2:solve % i 3:solve PV
4:solve PMT 5:solve FV 12:stop in FI

S: 010 R: 1-9, M F: 8-10 SL: 4 C: 47

FL — FLAG INPUTS FOR LB XROM 10,43

Provides the seven decimal numbers for a synthetic text line from the flags set inputs. To use XEQ FL, key first flag set, R/S. If X is negative, key next flag, R/S. If TONE sounds, record byte number, R/S. Key flags set in order of lowest to highest. Use 56 as last input if required. To use LB start with 247, followed by seven bytes. In a program use sequence: Text line, RCL M, STO d. Related routines are BL and XL.

S: 000 R: A F: None SL: 4 C: 46

FR — FRACTIONS XROM 20,12

GTO FR and the keyboard functions are:

a: GN	b: RN	c: GCD	d: DF	e: NP
A: +	B: −	C: ×	D: ÷	E: Reduce

Set F10 and clear F29 to display fractional forms in alpha.

Store call # in R06 and XEQ FR
1:+ 2:− 3:× 4:÷ 5: Reduce Y/X 6:GCD(x,y)

S: 000 R: None F: 10,25 SL: 4 C: 36

GE — GO TO .END. XROM 10,60

GE provides a handy way to move out of ROM back to RAM by placing the program pointer at line 00 of the program file that contains the .END. of program memory. X, Y, Z, L are preserved.

S: 000 R: A F: (R) SL: 0 C: 60

GN — GAUSSIAN RANDOM NUMBER GENERATOR XROM 20,15

Input:

R06: Mean of distribution
R07: Standard deviation of distribution
X: Pointer to register with seed.

Generates two random numbers (in X and Y) with Gaussian distribution. Use DEG mode, X is preserved in Z, T. The keyboard function b will XEQ GN after positioning to FR, DF, NP, GN, or RN. GN calls RN as a subroutine.

S: 008m R: 6, 7+ F: None SL: 4 C: 36

HA — HIGH RESOLUTION HISTOGRAM WITH AXIS XROM 20,25

Prints a bar-chart bar whose height is proportional to the input in X, where X is between Ymin (stored in R00) and Ymax (stored in R01). Plot width (1 to 168 columns) is integer part; and column position of the axis (1 to 168) is fractional part of R02. Bar is printed from axis to value, either up or down. Character (ACCHR #) to print portion of bar is stored in R05. Store values in R00 to R03 and R05, place the number in X, XEQ HA and a bar is added to the print buffer. Returns Fix 4 mode.

S: 006 R: 0-5 F: 12, 13 SL: 5 C: 29

HD — HIDE DATA REGISTERS XROM 10,20

Input k, XEQ HD to raise the curtain by k registers, and place in R_k (R00 after the curtain is raised) an alpha constant used by UD to quickly lower the curtain. Y, Z, T preserved in X, Y, Z; Σ-reg is set to R00 (former R_k). Not interruptible if a printer is attached.

S: k+6 R: 0, A F: (R) SL: 6 C: 64

HN — HEX TO NNN XROM 10,41

Converts up to 14 hex characters in alpha to a non-normalized number (NNN) in X. Leading zeros need not be entered, and the space character can be used instead of zero. There are two acceptable characters for each hex digit greater than 9: 'A' is equivalent to ':', 'B' to ';', 'C' to '<', 'D' to '=', 'E' to '>', 'F' to '?'. (The status of flag 10 is irrelevant.) X, Y, Z are preserved in Y, Z, T.

S: 000 R: A F: (R) SL: 6 C: 33

HP — HIGH RESOLUTION PLOT XROM 20,29

Plots 1 to 9 user RAM functions simultaneously in high resolution in the X direction (7 plot points per printed line). Store Ymin in R00, Ymax in R01, plot width (1 to 168 columns) in R02, Xmin in R08, Xmax in R09, X increment in R10. Function names (global labels 6 char's or less) are stored in R15 to R23. Place the number of functions in X and XEQ HP. See HP writeup for flag usage and other options.

S: 040 R: 0-39, A F: 4-10 SL: 3 C: 86

HS — HIGH RESOLUTION HISTOGRAM XROM 20,26

Prints a bar-chart bar whose height is proportional to the input in X where 0 ≤ X ≤ 1. Plot width (1 to 168 columns) is stored in R04. Character (ACCHR #) to print bar is stored in R03. Partial character (ACCOL #) to print portion of the bar is stored in R05. Store values in R03 to R05, place the number in X, XEQ HS, and a bar is added to the print buffer.

S: 009 R: 6-8 F: None SL: 5 C: 29

IF — INVERT FLAG XROM 10,49

Toggles flag (changes state: clear to set or vice versa) specified in X (0 through 55). Y, Z preserved in X, Y.

S: 000 R: A F: A/R SL: 6 C: 60

IG — INTEGRATE XROM 20,09

Store f(x) global name in R10. Set flag 10 to view iterations. Set display mode to indicate desired accuracy of result. Key in limits a ENTER b, XEQ IG. Integral approximation is returned in X.

Register usage:

R10:	function label name	R15:	S_k
R11:	counter k	R16:	(b-a)/4
R12:	u_i	R17:	(b+a)/2
R13:	$1 - u_i^2$	R18:	M(k,0)
R14:	2^{1-k}	R19:	M(k,1)

The keyboard function B will XEQ IG after positioning to IG, SV, or FD. IG uses R10-R29.

S: 030m R:10-29 + F: 9, 10 SL: 4 C: 43

IP — INITIALIZE PAGE XROM 10,45

Stores information from status register c in absolute location 256 (decimal), the bottom register of the external portion of memory. This stored information will be used by PS to restore the proper pointers when the page is switched back on line. If you decide **not** to switch the page off line immediately after executing IP, execute PS (without actually switching pages — just R/S in response to the switching prompt) to clear location 256. X, Y are preserved. Σ-reg is set to 000 absolute.

S: 000 R: 256 ABSOLUTE F: (R) SL: 3 C: 46

IR — INSERT RECORD XROM 20,37

Store:

R07: 1st register of entire file
R08: number of registers per record
R09: number of records in the file

To make room to insert a new kth record, input k and XEQ IR. R09 is updated. Inverse routine is DR.

S: 010m R: 7-9 F: None SL: 5 C: 61

JC — JULIAN DAY NUMBER TO CALENDAR DATE XROM 20,22

Clear flag 10 for Gregorian (modern) calendar. Set flag 10 for Julian calendar. Key JDN in X and XEQ JC. Date is returned in stack as:

Z: year Y: month X: day of month

Valid from March 1, 0 AD (1BC). Inverse routine is CJ. The keyboard function e will XEQ JC after positioning to BD, TB, PM, CM, CJ, or JC.

S: 000	R: None	F: 10	SL: 5	C: 53

L — — LOAD PART OF LB XROM 10,23

Prepare the program area (identified by LBL "++") as for LB. Then the program-writing program uses the instruction XROM L — to initialize the byte-loading process and return without prompting for bytes. (See — B for the loading of individual bytes.)

S: 012	R: 6-11, A	F: 8,9,25,50	SL: 4	C:71

LB — LOAD BYTES XROM 10,22

Permits the loading of arbitrary bytes into program memory, to facilitate synthetic coding. At location in program where bytes are to be loaded, key in LBL "++", +, +, +, . . ., XROM LB. The number of +'s should be at least n+6, where n is the smallest multiple of 7 not less than the number of bytes you intend to load using LB. With the program pointer somewhere in this keyed-in sequence, switch to RUN mode and press R/S. The prompt "HEX/DEC INPUT" which precedes the prompt for byte #1 reminds you that either hex or decimal input is acceptable, depending only upon whether the mode is ALPHA or not, at the time you key in an input. You **can** change the mode at will during the sequence. Press R/S after each entry. Pressing R/S without an entry tells the program you are through. You can back up a byte by using a negative entry or by XEQ 03 (even if you have told the program you are through, providing you have not begun to carry out the terminating instructions).

The prompt "SST, MORE +'S" indicates you do not have enough +'s to load even one byte. Pushing SST once will get you to LBL "++", where in PRGM mode you can insert more +'s and restart. A reprompt can be obtained by XEQ 01.

The terminating procedure is prompted. The SST is in RUN mode. The DEL is in PRGM mode. Following your loaded bytes, there may be some final +'s (at most 6). The X-register contains a number of the form p.00q. The termination prompt called for DEL 00p. Positioned at the first of any final +'s in PRGM mode, DEL 00q will remove these excess +'s and the XROM instruction.

S: 012	R: 6-11 A	F: 8,9,22,23,25,29	SL: 0	C: 71

LF — LOCATE FREE REGISTER BLOCK XROM 10,05

Add 16.016 to returned value to get bbb.eee where **bbb** and **eee** are the absolute decimal addresses of unused registers between the last used assignment register (if any) and the register containing .END. If flag 10 is set on completion of LF, the left half of the bbb register is occupied by a key assignment.

WARNING: Do not execute LF if I/O buffer exists (e.g., *Timer Alarms).* They will be disrupted and the free register block indices will be incorrect. **Use the Save Alarms routine from PPC CJ V9N4P17.**

S: 000 R: A F: 10 SL: 4 C: 59

LG — PPC LOGO XROM 20,24

XEQ LG, ADV or PRBUF to print PPC Logo. SF 12 for double wide. 21 columns (can fit 10 char/line w/std logo; 18 char/line w/wide logo; half of these with wide char). Stack is preserved.

S: 000 R: M,N,O, F: None SL: 5 C: 29

LR — LENGTHEN RETURN STACK XROM 20,02

Stores ≤ 5 return pointers (calls prior to that on LR) in data registers R_x and R_{x+1} in a format permitting reinstatement by SR. Allows call depths as deep as available data storage space permits, provided that successive calls on LR are separated by no more than 5 levels of subroutine nesting. Y, Z, T are preserved in X, Y, Z (L contains old x plus 1).

S: 002m R: A/R, A F: None SL: A/R C: 40

M1 — MATRIX, INTERCHANGE TWO ROWS XROM 20,33

Store:

R07: start reg. of matrix
R08: # columns in matrix

To interchange rows i and j, input i ENTER j XEQ M1.

S: 009m R: 7,8+ F: None SL: 4 C: 61

M2 — **M**ATRIX, MULTIPLY ROW BY CONSTANT XROM 20,31

See M1. To multiply row j by the constant k, input k ENTER j XEQ M2.

S: 009m R: 7,8+ F: None SL: 4 C: 61

M3 — **M**ATRIX, ADD MULTIPLE OF ROW TO ANOTHER XROM 20,32

See M1. To add k times row i to row j, input j ENTER i ENTER k XEQ M3. Row j will change. Row i will not change.

S: 009m R: 7,8, A F: None SL: 4 C: 61

M4 — **M**ATRIX, REGISTER ADDRESS TO (i,j) XROM 20,35

See M1. Input register r and XEQ M4. Row number i is returned in Y, column number j is returned in X. Inverse routine is M5.

S: 009m R: 7,8, + 0 F: None SL: 4 C: 61

M5 — **M**ATRIX, (i,j) TO REGISTER ADDRESS XROM 20,36

See M1. Input i ENTER j and XEQ M5. Register number r is returned in X. Inverse routine is M4. Z, T are preserved in Y, Z.

S: 009m R: 7,8+ F: None SL: 5 C: 61

MA — **M**EMORY TO **A**LPHA XROM 20,54

Alpha recalls the contents of a block of data registers using an ISG control number in X of the form bbb.eeeii. Inverse of AM. L, Y, Z, T are preserved.

S: 005m R: A/R, A F: None SL: 5 C: 16

MK — **M**AKE MULTIPLE **K**EY ASSIGNMENTS XROM 10,01

Clear I/O Buffer (Timer Alarms) before using MK. *See warning under* LF.

XEQ MK first reports the number of registers available for assignments. (Should "NO ROOM" be reported, take corrective action before continuing, pressing R/S if your corrective action did not move the program pointer.) Then the program prompts "PRE↑POST↑KEY." Key in decimal equivalent of the first byte (prefix), ENTER, decimal equivalent of the second byte (postfix), ENTER, user keycode, R/S. After each successful assignment, the program will either prompt for another assignment or indicate no more available room with the message "DONE, NO MORE." (In the latter case, proceed as with the "NO ROOM" message.) If you do not wish to make any more assignments, there is no termination procedure; simply go on to whatever subsequent task you intended.

The messages "KEY TAKEN" followed by "KEYCODE?" is suggesting you select another keycode, since the one you specified is already in use. Your options are: (1) enter another keycode and press R/S; (2) enter zero, indicating your desire to restart the assignment in process, and press R/S; (3) delete the previous assignment to the key you want to use and press R/S.

The messages "NO SUCH KEY" followed by "KEYCODE" indicate that your keycode entry is illegal. Options (1) and (2) in the preceding paragraph apply to these error messages.

Error messages above and on/off will clear flag 20 and the MK program will recount key assignment registers to ensure no overlaps or gaps occur. Between key assignments, if PACK or SIZE are used, clear flag 20 before continuing assignments.

Not interruptible

S: 012 R: 6-11, A F: 7-10,20,25 SL: 3 C: 61

ML — **M**EMORY **L**OST RESIZE TO 017 XROM 10,12

ML *should only be executed immediately after* MASTER CLEAR, when the curtain and .END. are at their MEMORY LOST positions. XEQ ML is essentially equivalent to XEQ SIZE 017, making more registers available for loading in long programs. Returns in FIX 2 mode. X, Y are preserved. Does not work on CX.

S: N/A R: A F: (R) SL: 0 C: 64

MP — **M**ULTIPLE VARIABLE **P**LOT (1-9) XROM 20,28

Plots 1 to 9 user RAM functions or numerical values simultaneously in standard resolution (1 plot point per printed line). Store Ymin in R00, Ymax in R01, plot width (1 to 168 columns) in R02, Xmin in R08, Xmax in R09, X increment in R10. Function names (global labels 6 char's or less) are stored in R15 to R23. Place the number of function in X and XEQ MP. See MP writeup for flag usage and other options.

S: 035 R: 0-34,M,N,0 F: 4-10 SL: 3 C: 86

MS — MEMORY TO STACK XROM 10,48

Recalls five data registers in sequence and stores them in X, Y, Z, T, and L. R06 must contain the location of lowest register of the five register block. To use: N STO 06, XEQ MS. (If N=0, then finish with RCL IND 06.) Inverse routine is SM.

S: N+5 R: A/R F: None SL: 5 C: 46

MT — MANTISSA OF X XROM 10,28

Replaces X by its mantissa. Old X to L; Y, Z, T preserved.

S: 000 R: A F: None SL: 6 C: 60

NC — NTH CHARACTER XROM 10,38

Extracts the Nth character (1≤N≤10) from the right end of alpha register. This extracted character becomes the new contents of X and the alpha register.

Old X to L; Y, Z preserved.

S: 000 R: A F: 25 SL: 6 C: 63

NH — NNN TO HEX XROM 10,40

Decodes a non-normalized number (NNN) in X to 14 hex characters in alpha. X, Y, Z are preserved. The characters for hexadecimal digits greater than 9 depend on flag 10:

Flag 10 (set):	:	;	<	=	>	?	
(clear):	A	B	C	D	E	F	(slower)

S: 000 R: A F: 10 SL: 6 C: 33

NP — NEXT PRIME XROM 20,14

Input integer n in Y and starting trial divisor d in X. (d=2 or d is an odd number greater than 2.) XEQ NP. n is returned in Y and next divisor p is returned in X. Press R/S for the next factor. The keyboard function e will XEQ NP after positioning to FR, DF, NP, GN, or RN.

S: 000 R: None F: None SL: 5 C: 36

NR — NNN RECALL XROM 20,50

Recalls non-normalized number (NNN) stored by NS in R_x and R_{x+1}. The NNN replaces the contents of X. Y, Z, T, L are preserved.

S: 002m R: A/R, A F: None SL: 6 C: 16

NS — NNN STORE XROM 20,49

Stores Y and R_x and R_{x+1} in a format that allows recall by NR of the NNN. Y, Z, T preserved in X, Y, Z; (L contains old X plus 1).

S: 002m R: A/R, A F: None SL: 6 C: 16

OM — OPEN MEMORY XROM 10,58

Places curtain at absolute decimal address 16 (just above the status registers). OM returns with the former contents of status register c in X. X, Y, Z, L preserved in Y, Z, T, L.

S: 000 R: A F: (R) SL: 5 C: 60

PA — PROGRAM POINTER ADVANCE XROM 10,59

PA is a selectable byte jumper (not programmable). In PRGM mode position the program pointer to the line from which you want to byte jump. In RUN mode fetch the pointer with a RCL b. Then key n and XEQ PA to yield a program pointer in X moved by n bytes: a plus integer n moves the pointer downward in user memory, i.e., forward in the program. A STO b will effect the actual byte jump. Switch to PRGM mode and see a line 00 display and press SST. (This SST from line 00 does not advance the program pointer. The HP-41 merely displays what it believes to be line 01.) A GTO. (any line) or a BST will reestablish correct line numbers. X is preserved in Y.

S: 000 R: A F: (R) SL: 0 C: 60

PD — PROGRAM POINTER TO DECIMAL XROM 10,52

Converts a program pointer in X (from the last 2 bytes of status register b in RAM format) to a decimal byte address. Inverse routine is DP. Y is preserved.

S: 000 R: A F: None SL: 5 C: 60

PK — PACK KEY ASSIGNMENT REGISTERS XROM 10,09

To recover as many registers as possible, XEQ PK after several key assignment deletions. Interruptible, but execution must be completed. Returns number of assignment registers used in X. Flag 25 may end up set, so CF 25 after PK for safety. (See Warning on Page 17, under LF.)

S: 000 R: A F: 9, 10, 25 SL: 4 C: 59

PM — PERMUTATIONS XROM 20,19

P(n,k) = number of permutations of n objects taken k at a time. Input n ENTER k and XEQ PM. P(n,k) is returned in X. Z and T are preserved in Y, Z. The keyboard function C will XEQ PM after positioning to BD, TB, PM, CM, CJ, or JC.

S: 000 R: None F: None SL: 5 C: 53

PR — PACK REGISTER XROM 20,45

Initialize: R10: base b R11: register pointer = j. To store the number n in position k in register Rj, key n ENTER k XEQ PR. Inverse routine is UR. Note Rj should be cleared/initialized prior to its first use.

Data Range	Base b	Position Numbers
0-1	2	1-30
0-2	3	1-19
0-3	4	1-15
0-4	5	1-13
0-6	7	1-11
0-9	10	1-10
0-13	14	1-8
0-20	21	1-7

Data Range	Base b	Position Numbers
0-36	37	1-6
0-99	100	1-5
0-214	215	1-4
0-1413	1414	1-3
0-99999	100000	1-2

S: 012m R: 10,11 + F: None SL: 4 C: 61

PO — PAPER OUT XROM 20,51

Advances the paper five times if the printer is enabled, else it may be used as a delay of about 1/5 second.

S: 000 R: None F: None SL: 5 C: 16

PS — PAGE SWITCH XROM 10,46

Input:

Y: module number to turn off
X: module number to turn on
Alpha: destination program name

Execution of **PS** from the keyboard or in a program implements a switch from page Y to page X by first storing information from status register c into absolute location 256 (decimal) of page Y, the bottom register of the switchable part of memory. Then if flags 10 and 24 are clear, a user prompt appears to switch page Y off and page X on.

Flag 10 is set, 24 is clear: two tones sound for switching page Y off and X on.

Flags 10 and 24 are set: a RTN is executed.

If **PS** continues, then location 256 of page X, which was previously initialized by **IP** or **PS**, is recalled and placed in status register c. Execution is then transferred to the destination program. X, Alpha are preserved in Y, Z. Σ-reg is set to address 256 absolute. Works on 41C only.

S: 000 R: A F: 10, 24(R) SL: 0 C: 46

QR — QUOTIENT REMAINDER XROM 10,54

Replaces Y and X by (Y-Y mod X)/X (the quotient) and Y mod X (the remainder). Z, T are preserved; old X to L. Also, up to

14 characters in alpha will be preserved.

S: 000 R: 0 F: None SL: 6 C: 60

RD — RECALL DISPLAY MODE XROM 20,05

Restores an earlier display mode stored by **SD** in R_X (the register designated by the number in X). Restores the earlier state of flags 16 through 55. X, Y, Z, T preserved in L, X, Y, Z.

S: 001m R: A/R, A F: A/R SL: 6 C: 40

RF — RESET FLAGS XROM 10,13

Stores hex 00 00 00 2C 02 80 00 in status register d; this resets flags to Master Clear status (except for FIX 2, rather than FIX 4). X, Y, Z, T, L are unchanged. Sets flags 26, 28, 29, 38, 40.

S: 000 R: A F: VAR SL: 6 C: 64

RK — REACTIVATE KEY ASSIGNMENTS XROM 20,06

Transfers assignment bit maps stored in R_X and R_{X+1} (by **SK**) into status registers ⊢ and e. This reactivates the suspended assignments. Y, Z, T preserved in X, Y, Z; (L contains old X plus 1).

S: 002m R: A/R, A F: None SL: 6 C: 40

RN — RANDOM NUMBER GENERATOR XROM 20,16

Store initial seed in R_k. To generate next random number r, $0 < r < 1$, key in k and XEQ **RN**. The keyboard function "a" will XEQ **RN** after positioning to **FR**, **DF**, **NP**, **GN**, or **RN**.

S: 001m R: A/R F: None SL: 5 C: 36

RT — RETURN ADDRESS TO DECIMAL XROM 10,51

Converts a RAM return address (first return address, bytes 03 and 02 — third and fourth from the end of status register b) placed in X (by a RCL b for example) to a decimal byte address. See **DP** regarding legal byte addresses.

S: 000 R: A F: None SL: 5 C: 60

RX — RECALL FROM ABSOLUTE ADDRESS IN X XROM 10,57

Only valid decimal addresses are 192 to 511 (64-511 with extended functions). **Content of register accessed is normalized** (so USE WITH CARE) and that is the form returned in X.

WARNING: If "NONEXISTENT" occurs restore the curtain (status register c) by ENTER, SST (in PRGM mode), R/S. Avoid using RX with flag 25 set. Y, Z preserved; *(L contains old X minus 16).*

S: 000 R: A F: (R) SL: 4 C: 60

Rb — RECALL b XROM 20,52

Yields an address in the PPC ROM permitting identification of the port it is plugged into. XEQ Rb, XEQ NH; the last 4 nibbles will be xF12, where X = 9, B, D, F for ports 1 through 4, respectively. X, Y, Z, L are preserved in Y, Z, T, L.

S: 000 R: None F: None SL: 6 C: 16

S1 — STACK SORT XROM 20,46

Arranges (sorts) the stack registers, X, Y, Z, and T in numerical order, lowest value in T, highest in X. Set flag 10 to place the lowest value in X, highest in T. L is preserved, flag 10 cleared.

S: 000 R: None F: 10 SL: 5 C: 47

S2 — SMALL ARRAY SORT (N≤32) XROM 20,48

Sorts any block of registers in memory into numerical order (lowest value in lowest register) using a block control number in X of the form bbb.eeeii. Optimum for arrays ≤32, or for non-contiguous registers. X is saved. Not interruptible.

S: 003m R: 1,2,A+ F:10 SL: 5 C: 47

S3 — LARGE ARRAY SORT (N > 32) XROM 20,47

Sorts a block of registers in memory (from R03 up) into numerical order (lowest value in lowest register) using a block control number in X of the form bbb.eee. For arrays ≤32 or for non-contiguous registers use **S2**. X is saved. *Not interruptible.*

S: 003m R: 1,2,A+ F: 10 SL: 4 C: 47

S? — SIZE FINDER ? XROM 10,15

Returns number of data registers (above curtain) in X. X, Y, preserved in Y, Z.

S: 000 R: A F: (R) SL: 5 C: 64

SD — STORE DISPLAY MODE XROM 20,03

Saves a display mode in R_x (actually the status of flags 16 through 55). The earlier mode can be restored via **RD**. X, Y, Z, T preserved in L, X, Y, Z.

S: 001m R: A/R, A F: None SL: 6 C: 40

SE — SELECTION WITHOUT REPLACEMENT XROM 20,56

Store:

R06: 1st register of selection block
R07: number of registers in block (consecutive)

SE calls routine **RN**. Register k holds the random number seed. To make selection, key in k and XEQ **SE**. The selected value is returned in X. R07 counts number of items remaining (as the block is rearranged).

S: 008m R: 6,7+ F: None SL: 4 C: 26

SK — SUSPEND KEY ASSIGNMENTS XROM 20,04

Stores assignment bit maps from status registers ⊢ and e into R_x and R_{x+1}, respectively, and clears both of these status registers. Without these bit maps, the HP-41 assumes no user key assignments are in effect. Y, Z, T preserved in X, Y, Z; (L contains old X plus 1). Restore key assignments with **RK** or by reading in a program or status card.

S: 002m R: A/R, A F: None SL: 5 C: 40

SM — STACK TO MEMORY XROM 20,55

Stores the stack registers X, Y, Z, T, and L into a continuous block of five registers, the lowest register number being stored in R06. To use, input n, STO 06, XEQ SM. Inverse routine is MS.

S: 007m R: 6+ F: None SL: 5 C: 26

SR — SHORTEN RETURN STACK XROM 20,00

Recalls 5 return pointers stored in R_x and R_{x+1} (by LR) combining them in status registers a and b with the return to the routine calling SR. Y, Z, T are preserved in X, Y, Z (L contains old X plus 1).

S: 002m R: A/R, A F: 10 SL: A/R C: 60

SU — SUBSTITUTE CHARACTER XROM 10,39

With a single character in Y and an integer in the range of 1 through 10 in X (and with at most 13 characters in alpha), XEQ SU replaces the x-th character (counting from the right) of alpha by the character in Y. X, Y, Z preserved in L, X, Y.

S: 000 R (A) F: 25 SL: 6 C: 63

SV — SOLVE FOR ROOTS XROM 20,10

Store f(x) global label name in R06. Set display mode. Set flag 10 to view iterations. Input stepsize, ENTER, input guess, XEQ SV. (NOTE: if stepsize = 0 then default is 1 percent of guess.) Register usage:

R06: function label name	R08: $f(x_i)$
R07: X_i	R09: dx_i

The keyboard function C will XEQ SV after positioning to IG, SV, or FD.

S: 010 R: 6-10 F: 10 SL: 4 C: 43

SX — STORE Y IN ABSOLUTE ADDRESS X XROM 10,56

Only valid decimal addresses are 192 to 511 (64-511 with extended functions). Contents of Y is placed in register addressed by X.

WARNING: If 'NONEXISTENT' occurs, the code in Z must be stored in status register c to regain the former curtain position (by SST in PRGM, then R/S). Y, Z are preserved in X, Y *(L contains old x minus 16).*

S: 000 R: A F: (R) SL: 4 C: 60

Sb — STORE b XROM 20,01

Provides a STO b with the ROM-mode interpretation. This permits ultra-fast ROM entry. See **Ab**. Stack is preserved.

S: 000 R: None F: None SL: A/R C: 40

T1 — BEEP ALTERNATIVE XROM 10,47

Used in place of BEEP to produce a short sound burst (0.6 sec.) of 13 tones. Stack is preserved.

S: 000 R: None F: None SL: 5 C: 46

TB — BASE TEN TO BASE B XROM 20,18

Store base b in R06 (2≤ =b≤ =19). Input base 10 number and XEQ **TB**. Base b result is limited to 13 digits in alpha and will be displayed if flag 10 is set. *(A missing single quote indicates overflow.)* The stack is cleared. Inverse routine is **BD**. The keyboard function B will XEQ **TB** after positioning to **BD**, **TB**, **PM**, **CM**, **CJ**, or **JC**.

S: 007 R: 6, A F: 10,25 SL: 4 C: 53

TN — TONE N (0-127) XROM 10,32

Effectively a TONE IND X instruction for synthetic tones. Place the TONE number in X, XEQ **TN**. Valid inputs: 0-127 for TONE, 128-255 for TONE IND, 256-383 TONE, etc. Y, Z are saved in X, Y.

S: 000 R: A F: 14, 25 SL: 4 C: 60

UD — UNCOVER DATA REGISTERS XROM 10,08

Uses the contents of R00 (established by **HD**) to lower the curtain to its previous position. *If R00 has not been initialized,* *MEMORY LOST results. Use of* UD *after editing or PACK will lose CAT 1.* Stack including L is preserved. ΣREG set to 01.

S: 002 R: 0, A F: None SL: 6 C: 59

UR — UNPACK REGISTER XROM 20,44

Store:

R10: base b R11: register pointer = j

To recall the number stored in position k in register j. Input k in X and XEQ UR. The unpacked number is returned in X. Inverse routine is PR. Y is preserved in T.

S: 012m R: 10,11 F: None SL: 5 C: 61

VA — VIEW ALPHA XROM 10,07

Like AVIEW, but VA **never** causes the program to stop. If the printer is plugged in, turned on, and enabled by flag 21 being set, then the alpha register is also printed. The status of flag 21 remains unchanged and stack is preserved.

S: 000 R: (A) F: 25 SL: 6 C: 59

VF — VIEW FLAGS XROM 20,58

XEQ VF displays the numbers of those flags which are set in groups of four (although the last group may contain less than four). X and Y are preserved.

S: 000 R: A F: (R) SL: 4 C: 26

VK — VIEW KEY ASSIGNMENTS XROM 10,36

Defaults to printer function PRKEYS if printer is connected. Otherwise displays key codes assigned key by key from top to bottom, and from left to right (negative numbers correspond to shifted keys). If used in a program, first CLD or CF50. Stack is cleared.

S: 000 R: A F: 21 SL: 2 C: 63

VM — VIEW MANTISSA XROM 10,26

Views full mantissa of number in X. Leaves stack intact, but alters L and alpha register. *Not interruptible.*

S: 000 R: A F: 21 SL: 5 C: 60

VS — VERIFY SIZE XROM 10,30

Insert the sequence n, XROM VS, FC?C 25, PROMPT in a program to verify that the SIZE is at least n. If it is not, the message "RESIZE > =n" will be displayed following a quick tone. X, Y, Z and T are preserved in L, X, Y, and Z. Alpha is not disturbed if SIZE is sufficient.

S: 000 R: A F: 25 SL: 6 C: 60

XD — HEX TO DECIMAL XROM 10,25

Convert two hex digits — no more, no less — from the alpha register to the decimal equivalent (0 through 255). X is preserved in Y.

S: 000 R: A F: None SL: 4 C: 71

XE — XROM ENTRY XROM 10,19

XE Allows entry into ROM at any point using a pointer from the last two bytes of alpha register M, set up by the user prior to calling XE. A RTN activates this ROM entry address, and any subsequent END or RTN in the ROM program returns the pointer to the RAM program which called XE.

To set up the pointer in alpha register M, prior to program execution, position the pointer at the desired ROM line entry and manually perform the sequence (in RUN mode) CLA, RCL b, STO M, ASTO n, where R_n is any data register you want to use. In the RAM program which is to enter the specified ROM line place the sequence ARCL n, XEQ XE. Stack is preserved and alpha is cleared.

S: 000 R: A F: 14 SL: 4 C: 64

XL — XROM INPUTS FOR LB XROM 20,57

Provides two LB or MK bytes for user of synthetic instructions or synthetic key assignments. An XROM number of the form AA, BB is converted by AA ENTER BB XEQ XL. The Y register will contain the postfix bytes, and the X register the prefix byte. Z is preserved.

S: 000 R: 0 F: None SL: 4 C: 26

Σ? — ΣREG FINDER **?** XROM 10,14

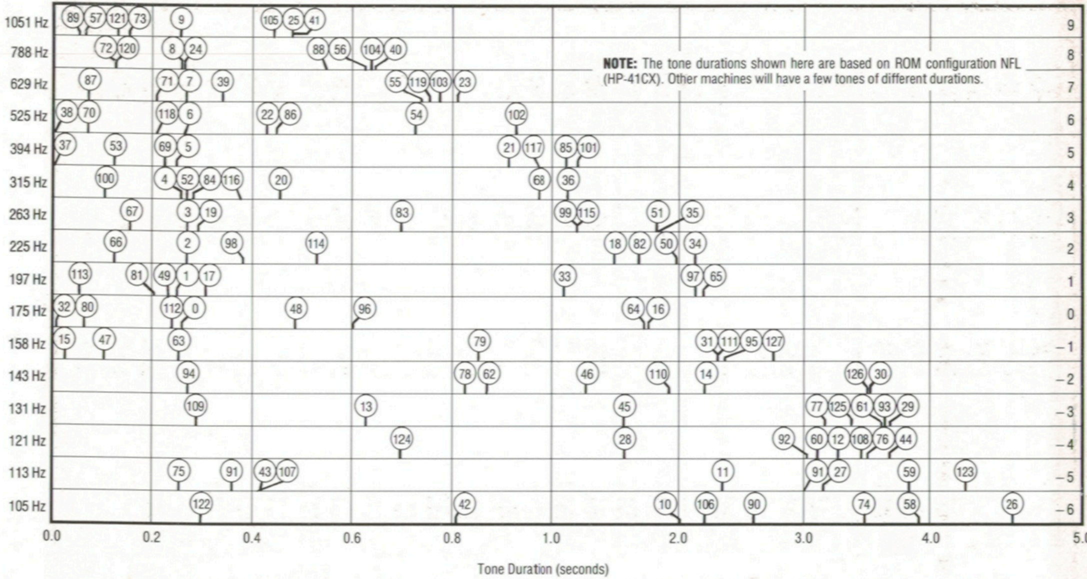
XEQ Σ? yields the number of the first register of the statistical block of 6 registers. If the result is negative, the statistical block lies below the curtain (see ΣC). X is preserved in Y.

S: 000 R: A F: (R) SL: 5 C: 64

ΣC — ΣREG **C**URTAIN EXCHANGE XROM 10,21

Interchanges pointers in status register c to the statistical register block and to R00. Provided SIZE ≥ k+6, the sequence ΣREG k, XEQ ΣC makes the former R_k now R00, (but statistical register commands should not be used: Σ? yields -k). A second XEQ ΣC re-establishes the former position of the curtain (R00 again becomes R_k). X, Y, Z preserved, *not interruptible if printer is attached.*

S: K+6 R: None F: (R) SL: 6 C: 64



NOTE: The tone durations shown here are based on ROM configuration NFL (HP-41CX). Other machines will have a few tones of different durations.

+K
–B
1K
2D
A?
AD
AL
AM
Ab
BA
BC
BD
BE
BI
BL
BM
BR
BV
BX
BΣ
C?
CA
CB
CD
CJ
CK
CM
CP
CU
CV

CX
DC
DF
DP
DR
DS
DT
E?
EP
EX
F?
FD
FI
FL
FR
GE
GN
HA
HD
HN
HP
HS
IF
IG
IP
IR
JC
L –
LB
LF
LG

LR
M1
M2
M3
M4
M5
MA
MK
ML
MP
MS
MT
NC
NH
NP
NR
NS
OM
PA
PD
PK
PM
PR
PO
PS
QR
RD
RF
RK
RN
RT

RX
Rb
S1
S2
S3
S?
SD
SE
SK
SM
SR
SU
SV
SX
Sb
T1
TB
TN
UD
UR
VA
VF
VK
VM
VS
XD
XE
XL
Σ?
ΣC

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