

System Monitor Commands

Apple II contains a powerful machine level monitor for use by the advanced programmer. To enter the monitor either press RESET button on keyboard or CALL-151 (Hex FF65) from Basic. Apple II will respond with an "*" (asterisk) prompt character on the TV display. This action will not kill current BASIC program which may be re-entered by a C^C (control C). NOTE: "adrs" is a four digit hexadecimal number and "data" is a two digit hexadecimal number. Remember to press "return" button at the end of each line.

<u>Command Format</u>	<u>Example</u>	<u>Description</u>
<u>Examine Memory</u>		
adrs	*C0F2	Examines (displays) single memory location of (adrs)
adrs1.adrs2	*1024.1048	Examines (displays) range of memory from (adrs1) thru (adrs2)
(return)	* (return)	Examines (displays) next 8 memory locations.
.adrs2	*.4096	Examines (displays) memory from current location through location (adrs2)
<u>Change Memory</u>		
adrs:data data data	*A256:EF 20 43	Deposits data into memory starting at location (adrs).
:data data data	*:F0 A2 12	Deposits data into memory starting after (adrs) last used for deposits.
<u>Move Memory</u>		
adrs1<adrs2. adrs3M	*100<B010.B410M	Copy the data now in the memory range from (adrs2) to (adrs3) into memory locations starting at (adrs1).
<u>Verify Memory</u>		
adrs1<adrs2. adrs3V	*100<B010.B410V	Verify that block of data in memory range from (adrs2) to (adrs3) exactly matches data block starting at memory location (adrs1) and displays differences if any.

<u>Command Format</u>	<u>Example</u>	<u>Description</u>
<u>Cassette I/O</u>		
adrs1.adrs2R	*300.4FFR	Reads cassette data into specified memory (adrs) range. Record length must be same as memory range or an error will occur.
adrs1.adrs2W	*800.9FFW	Writes onto cassette data from specified memory (adrs) range.
<u>Display</u>		
I	*I	Set inverse video mode. (Black characters on white background)
N	*N	Set normal video mode. (White characters on black background)
<u>Dis-assembler</u>		
adrsL	*C800L	Decodes 20 instructions starting at memory (adrs) into 6502 assembly mnemonic code.
L	*L	Decodes next 20 instructions starting at current memory address.
<u>Mini-assembler</u>		
(Turn-on)	*F666G	Turns-on mini-assembler. Prompt character is now a "!" (exclamation point).
\$(monitor command)	!\$C800L	Executes any monitor command from mini-assembler then returns control to mini-assembler. Note that many monitor commands change current memory address reference so that it is good practice to retype desired address reference upon return to mini-assembler.
adrs:(6502 MNEMONIC instruction)	!C010:STA 23FF	Assembles a mnemonic 6502 instruction into machine codes. If error, machine will refuse instruction, sound bell, and reprint line with up arrow under error.

<u>Command Format</u>	<u>Example</u>	<u>Description</u>
(space) (6502 mnemonic instruction)	! STA 01FF	Assembles instruction into next available memory location. (Note space between "!" and instruction)
(TURN-OFF)	! (Reset Button)	Exits mini-assembler and returns to system monitor.
<u>Monitor Program Execution and Debugging</u>		
adrsG	*300G	Runs machine level program starting at memory (adrs).
adrsT	*800T	Traces a program starting at memory location (adrs) and continues trace until hitting a breakpoint. Break occurs on instruction 00 (BRK), and returns control to system monitor. Opens 6502 status registers (see note 1).
adrsS	*C050S	Single steps through program beginning at memory location (adrs). Type a letter S for each additional step that you want displayed. Opens 6502 status registers (see Note 1).
(Control E)	*E ^C	Displays 6502 status registers and opens them for modification (see Note 1).
(Control Y)	*Y ^C	Executes user specified machine language subroutine starting at memory location (3F8).

Note 1:

6502 status registers are open if they are last line displayed on screen. To change them type ":" then "data" for each register.

Example: A = 3C X = FF Y = 00 P = 32 S = F2
*: FF Changes A register only
*:FF 00 33 Changes A, X, and Y registers

To change S register, you must first retype data for A, X, Y and P.

Hexidecimal Arithmetic

data1+data2	*78+34	Performs hexidecimal sum of data1 plus data2.
data1-data2	*AE-34	Performs hexidecimal difference of data1 minus data2.

<u>Command Format</u>	<u>Example</u>	<u>Description</u>
<u>Set Input/Output Ports</u>		
(X) (Control P)	*5p ^C	Sets printer output to I/O slot number (X). (see Note 2 below)
(X) (Control K)	*2k ^C	Sets keyboard input to I/O slot number (X). (see Note 2 below)

Note 2:

Only slots 1 through 7 are addressable in this mode. Address Ø (Ex: Øp^C or Øk^C) resets ports to internal video display and keyboard. These commands will not work unless Apple II interfaces are plugged into specified I/O slot.

Multiple Commands

*1ØØL 4ØØG AFFT	Multiple monitor commands may be given on same line if separated by a "space".
*LLLL	Single letter commands may be repeated without spaces.

SPECIAL CONTROL AND EDITING CHARACTERS

"Control" characters are indicated by a super-scripted "C" such as G^C. They are obtained by holding down the CTRL key while typing the specified letter. Control characters are NOT displayed on the TV screen. B^C and C^C must be followed by a carriage return. Screen editing characters are indicated by a sub-scripted "E" such as D_E. They are obtained by pressing and releasing the ESC key then typing specified letter. Edit characters send information only to display screen and does not send data to memory. For example, U^C moves to cursor to right and copies text while A_E moves cursor to right but does not copy text.

<u>CHARACTER</u>	<u>DESCRIPTION OF ACTION</u>
RESET key	Immediately interrupts any program execution and resets computer. Also sets all text mode with scrolling window at maximum. Control is transfered to System Monitor and Apple prompts with a "*" (asterisk) and a bell. Hitting RESET key does NOT destroy existing BASIC or machine language program.
Control B	If in System Monitor (as indicated by a "*"), a control B and a carriage return will transfer control to BASIC, <u>scratching (killing) any existing BASIC program</u> and set HIMEM: to maximum installed user memory and LOMEM: to 2048.
Control C	If in BASIC, halts program and displays line number where stop occurred*. Program may be continued with a CON command. If in <u>System Monitor</u> , (as indicated by "*"), control C and a carriage return will enter BASIC <u>without</u> killing current program.
Control G	Sounds bell (beeps speaker)
Control H	Backspaces cursor and deletes any overwritten characters from computer but not from screen. Apply supplied keyboards have special key "<" on right side of keyboard that provides this functions without using control button.
Control J	Issues line feed only
Control V	Compliment to H ^C . Forward spaces cursor and copies over written characters. Apple keyboards have ">" key on right side which also performs this function.
Control X	Immediately deletes current line.
* If BASIC program is expecting keyboard input, you will have to hit carriage return key after typing control C.	

SPECIAL CONTROL AND EDITING CHARACTERS

(continued)

<u>CHARACTER</u>	<u>DESCRIPTION OF ACTION</u>
A _E	Move cursor to right
B _E	Move cursor to left
C _E	Move cursor down
D _E	Move cursor up
E _E	Clear text from cursor to end of line
F _E	Clear text from cursor to end of page
@ _E	Home cursor to top of page, clear text to end of page.