APX ATARI® PROGRAM EXCHANGE

Thomas D. Newton

KEYPAD CONTROLLER, Rev.2

Convert ATARI Keyboard Controllers
to numeric keypads and a program editor

Cassette: 8K (APX-10106) Diskette: 24K (APX-20106)

User-Written Software for ATARI Home Computers

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by

Thomas D. Newton

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ATARI 850™ Interface Module

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1. INTRODUCTION

OVERVIEW

KEYPAD CONTROLLER lets you use a pair of ATARI Keyboard Controllers along with the computer keyboard to edit programs and enter numbers. One controller has the number keys arranged in calculator style. The other has several editing keys, such as cursor movement, and arithmetic operators. The combination lets you enter numbers quickly, without typing. With another feature of KEYPAD CONTROLLER you can control the speed with which program listings display on your TV screen.

You can also incorporate KEYPAD CONTROLLER into your own applications programs. Using less than 790 bytes of memory (690 for the cassette version), it works with both the ATARI BASIC Language Cartridge and the Assembler Editor Cartridge. Once loaded, KEYPAD CONTROLLER remains in computer memory until you turn off your system. By following the instructions in the Changing the Keypad Layouts section, you may customize KEYPAD CONTROLLER for your applications. A new feature in Revision 2.0 allows you to use KEYPAD CONTROLLER for two-player games. Advanced users with the diskette version of KEYPAD CONTROLLER and an Assembler Editor Cartridge can modify the program, using the source code on the diskette.

REQUIRED ACCESSORIES

ATARI BASIC Language Cartridge or Assembler Editor Cartridge
A pair of ATARI Keyboard Controllers (CX50) (The same keypads as used by the programmable ATARI Video Computer System)

Cassette version
- 8K RAM
- ATARI 410 Program Recorder

Diskette version
- 24K RAM
- ATARI 810 Disk Drive

RELATED PUBLICATIONS

ATARI Operating System User's Manual and Hardware Manual (CO16555)
This manual is invaluable to advanced programmers who want to understand or modify the KEYPAD CONTROLLER program. Although it's heavy reading, it contains information on all aspects of ATARI Home Computers.

CONTACTING THE AUTHOR

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2. GETTING STARTED

PREPARING THE "BOOT" TAPE FOR THE CASSETTE VERSION

As shipped, the cassette version of KEYPAD CONTROLLER has two BASIC programs: one for a cassette-based ATARI Home Computer (with at least 8K RAM) and one for a disk-based ATARI Home Computer (with at least 24K RAM). However, to use KEYPAD CONTROLLER, you need a "boot" tape, a special tape that loads when you turn the computer on. Follow these steps to make your "boot" tape:

a. Insert the ATARI BASIC Language Cartridge in the cartridge slot of your computer.

b. Insert the program cassette into your ATARI 410 program recorder and rewind it to the beginning of side 1. Press PLAY on th recorder.

c. Type CLOAD and press the RETURN key. When you hear the buzzer, press the RETURN key again.

d. When the program has loaded into computer memory, you will see the READY prompt again. Press STOP on the recorder.

e. Type RUN and press the RETURN key. The screen will clear, then show the layout of the keypads.

f. The following questions will appear. After each question, type the underlined answer and press the RETURN key. When answering the second question, be sure not to leave any space between the question mark and your answer.

```
Which keypad do you want to change
(1=exit, 2=control, 3=numeric)?1

Do you want to save the changes to
cassette for future use (Y/N)?Y

     (screen clears)

Do you want to use the keypads for
 (1) normal use, or
 (2) game use? 1
```

g. The computer will now ask you to place a blank tape in the program recorder and press the RETURN key. After you press the RETURN key, you'll hear the buzzer twice. Press PLAY and RECORD on the recorder and press the RETURN key on the computer.

h. When the computer is through saving the program, the READY prompt will appear. Press STOP on the recorder.

LOADING KEYPAD CONTROLLER INTO COMPUTER MEMORY

1. Insert the ATARI BASIC Language Cartridge or the Assembler Editor Cartridge in the cartridge slot of your computer.

2. Plug your Keyboard Controllers into the third and fourth (the two rightmost) controller jacks at the front of your computer console.

3. If you have the cassette version of KEYPAD CONTROLLER:

   a. Have your computer system turned OFF.

   b. Have your ATARI 850 Interface Module turned off.

   c. Insert your "boot" cassette into the program recorder's cassette holder and position the tape at the start of the recording. Then press PLAY to prepare the program recorder for loading the program.

   d. Turn on your TV set, and then turn on the computer while holding down the START key.

   e. When you see a white cursor on the TV screen and hear a beep, release the START key and press the RETURN key. The program will load into computer memory.

   f. After the program has finished loading in, you'll see the READY prompt (if you're using the BASIC cartridge) or the EDIT prompt (if you're using the Assembler Editor cartridge). Press STOP on your program recorder.

   If you have the diskette version of KEYPAD CONTROLLER:

   a. Have your computer turned OFF.

   b. Turn on your disk drive.

   c. When the BUSY light goes out, open the disk drive door and insert the KEYPAD CONTROLLER diskette with the label in the lower right-hand corner nearest to you. (Use disk drive one if you have more than one drive.)

   d. Turn on your computer and your TV set. The program will load into computer memory and you'll see either the READY prompt (if you're using the BASIC cartridge) or the EDIT prompt (if you're using the Assembler Editor cartridge).

4. The program will remain in computer memory until you turn off your system.

3. USING KEYPAD CONTROLLER

INTRODUCTION

KEYPAD CONTROLLER has two functions: (1) using the Keyboard Controllers (hereafter called the "keypads") for editing and entering numbers quickly, and (2) controlling the speed of program displays and printouts on the TV screen.

USING THE KEYPADS FOR EDITING AND NUMERIC ENTRY

Preparing the keypads

As sold, the keypads are labeled for use with the ATARI Video Computer System. Make a new set of labels for the keys as follows:

1. Cut a sheet of paper the size of each keypad.

2. Punch holes in each piece to correspond to the location of the keys.

3. Using the layout in Figure 1, write what each key does in the spaces above the holes.

4. Tape the label over the keypads.

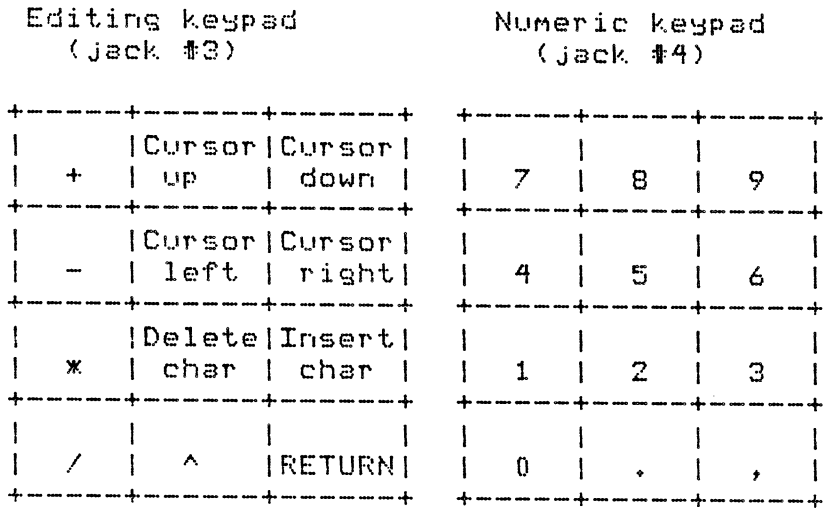

Figure 1 Keypad Layouts

Using the keypads

After plugging the keypads into controller jacks #3 and #4 at the front of the computer console, you can turn them on by holding down the SHIFT and CTRL keys on the keyboard while pressing first the E key (to activate the editing keypad) and then the N key (to activate the numeric keypad). Figure 1 shows what each key does. You can auto-repeat a key by holding it down for more than one second. (Note. The SHIFT and CTRL keys have no

effect on the keypads.)

Before unplugging the keypads, turn them off by holding down the SHIFT and CTRL keys and again pressing first the E key and then the N key. If you forget to turn off the keypads, the computer becomes confused and types garbage on the TV screen. Should this happen, either plug the keypads back in, or then turn them off with CTRL-SHIFT-E and CTRL-SHIFT-N. Use the BACK S key to remove the garbage on the screen.

Using only one keypad

You don't have to use both keypads. Use SHIFT-CTRL-E to turn on and off the editing keypad in controller jack #3. Use SHIFT-CTRL-N to turn on and off the numeric keypad in controller jack #4. Once you turn off a keypad, you may unplug it.

When you've turned off both keypads, you can use Joystick Controllers or Paddle Controllers in controller jacks #3 and #4. Of course, you may always use them in jacks #1 and #2.

CHANGING THE SPEED OF PROGRAM DISPLAYS AND PRINTOUTS

You can also use KEYPAD CONTROLLER to slow down program displays on your TV screen and printouts from a running program. To change the speed of a listing, hold down the SHIFT and CTRL keys and press one of the number keys, 0 - 9, on the computer keyboard, not on the keypad. The speed changes according to this guide:

```
SHIFT-CTRL-1 --> slowest speed
SHIFT-CTRL-2 --> next slowest speed
  .
  .
  .
SHIFT-CTRL-8 --> next-to-fastest speed
SHIFT-CTRL-9 --> fastest speed
SHIFT-CTRL-0 --> normal speed for printing/TV listing
```

Note. If you have the cassette version of the package, you may enter programs only from tape, not from diskette. This limitation is because of the nature of the autoload routine, which requires that the drive be turned off when the KEYBOARD CONTROLLER program loads in.

Note: If you have the cassette version of the package, you can make a copy of KEYPAD CONTROLLER which will work with the disk drives by following the instructions in COMMAND SUMMARY AND OTHER USEFUL INFORMATION.

4. TIPS FOR DISK USERS

Because KEYPAD CONTROLLER and the DOS menu share the same area of memory, some restrictions must be observed when using the KEYPAD CONTROLLER program. They are:

1. There must be a MEM.SAV file on the diskette in drive 1 when you type DOS to go to the DOS menu. When you return to BASIC or the ASSEMBLER, the same disk should be in drive 1. After returning from DOS, press SYSTEM RESET to reenable KEYPAD CONTROLLER.

2. While you're in DOS, you won't be able to use the keypads or slow down the speed of listngs and printouts. Since the DOS menu and KEYPAD CONTROLLER share the same area of memory, KEYPAD CONTROLLER temporarily shuts off while you're in DOS.

3. While you're in DOS, you should not use option J (duplicate disk) or give DOS permission to use the program area. If you need to do one of these things, turn the computer off and restart it using a diskette that does not have the KEYPAD CONTROLLER program.

4. The program is set up to work with the "standard" version of DOS 2, the DOS stored on the Master Diskette. If you change the number of disk drives or sector buffers that DOS uses, you must relocate the KEYPAD CONTROLLER program. Use the following steps:

   a. Turn on the computer in BASIC with your version of DOS (but without KEYPAD CONTROLLER). Type PRINT PEEK(743)+256*PEEK(744) and press the RETURN key. Write down the number that appears on the TV screen.

   b. Run the DCHANGE.BAS program, described in CHANGING THE KEYPAD LAYOUTS. When the program asks if you want to relocate the program, type Y and press the RETURN key. You will now be asked for an address. Type the number you wrote down and press the RETURN key.

   c. When you're asked to insert your diskette, insert a diskette that has your special version of DOS 2 and press any key. The program will create an AUTORUN.SYS file that will work with your DOS.

5. KEYPAD CONTROLLER won't work with many other AUTORUN.SYS programs, due to the nature of the AUTORUN.SYS file. Advanced prgrammers may be able to combine KEYPAD CONTROLLER with other AUTORUN.SYS programs using the methods in the ADVANCED TECHNICAL INFORMATION.

USING KEYPAD CONTROLLER WITH THE 850 INTERFACE MODULE

If you want to use disk drives with the ATARI 850 Interface Module, you must normally use the AUTORUN.SYS file on the Mater Diskette. This program checks to see if an ATARI 850 Interface is present. Of so, the device handler is loaded over the serial bus. If the interface is not present, the program does nothing and does not use any memory.

For your convenience, the diskette version of KEYPAD CONTROLLER includes the code to recognize the ATARI 850 Interface Module. This feature saves you the trouble of combining the two prgrams using the 20-step method in Section 7 each time you change the keypad layouts.

Advanced users should note that the ATARI 850 handler uses parts of page six while loading. Therefore, when combining KEYPAD CONTROLLER with an AUTORUN.SYS file that uses page six, the user should attach the other program to KEYPAD CONTROLLER (not the other way around as described in Section 7).

5. TROUBLESHOOTING

If the keypads do not work:

a. Make sure that you have the keypad(s) in use firmly plugged into controller jack #3 (editing keypad) and #4 (numeric keypad).

b. Make sure that you have the keypad(s) turned ON. If you have the keypad turned off, you may turn it on by holding down the SHIFT and CTRL keys and pressing E (for the editing keypad) or N (for numeric keypad).

c. Are you using the keypad layouts in Figure 1? The labels printed on the keypads are for use with the ATARI Video Computer System.

d. Remember that the SHIFT and CTRL keys only work with the main keyboard and have no effect on the keypads. Holding down the SHIFT key and typing a 0 on the keypad produces a "0", not a ")".

e. If you have the diskette version of KEYPAD CONTROLLER (or have made a diskette version from your cassette using te instructions in COMMAND SUMMARY AND OTHER USEFUL INFORMATION), did you remember to press SYSTEM RESET after returning from DOS?

If the computer is typing garbage:

The computer is looking for a keypad that is not plugged in. If the computer is typing mostly slashes, the editing keypad is turned on but not plugged in. If the computer is typing mostly zeroes, the computer is looking for the numeric keypad. You have two possible solutions:

a. Plug the keypad into controller jack #3 (editing) or #4 (numeric) on the front panel, or

b. Turn the keypad off by holding the SHIFT and CTRL keys down and pressing E (editing keypad) or N (numeric keypad).

Then use the BACK S or SHIFT DELETE keys to erase the garbage.

If the computer is slow:

You have set the printing speed too slow. To return printing to normal speed, hold down the SHIFT and CTRL keys and press the 0 (zero) key. You may want to use another speed (such as 6 or 9) instead.

PROGRAM LIMITATIONS

Since the program uses 786 bytes of memory (687 bytes for the cassette version), some programs may not load or run with it. Solution: buy more memory, use the programs without KEYPAD CONTROLLER, or reduce the size of the programs.

Because the KEYPAD CONTROLLER program is supplied in "auto-boot" format (cassette) or AUTORUN.SYS format (diskette), it will not work with other "auto-boot" or AUTORUN.SYS programs. These programs include the driver for the Mactronics printer interface, Supersort (APX-20030), and Screen Dump Utility (APX-20045). Advanced programmers who have a disk-based ATARI Home Computer may be able to get around this limitation using the information in Section 7, ADVANCED TECHNICAL INFORMATION.

The keypads must be used in controller jacks #3 and #4. You should only use Joystick Controllers in these jacks when both keypads are off. Although plugging a Joystick in will not harm it, you will not get an accurate reading.

See Section 4, tips for disk users, for restrictions on the use of the diskette version with DOS.

6. CHANGING THE KEYPAD LAYOUTS

This section describes how to customize your copy of KEYPAD CONTROLLER so that the keypads will use your layouts.

When designing keypad layouts, you may use any key except CTRL-1 or the keys used to turn the keypads on and off and to set the printing speed. You will need to use a separate cassette file or separate system diskette for each layout.

If you have the cassette version ofthe program, get a tape with some blank space. If you have the diskette version, get a system diskette that does not have an AUTORUN.SYS file that you want to keep. Make sure that there are at least 7 free sectors on the diskette (this inofrmation is displayed at the end of the directory listing).

Insert the BASIC cartridge and turn on your computer. If you have the cassette version, rewind the program tape to the beginning of side 1. Then type CLOAD, press the RETURN key, press PLAY on the recorder, and press the RETURN key again. When the screen shows the READY prompt, press STOP on the recorder, type RUN, and press the RETURN key. If you have the diskette version, insert the program diskette into drive 1 and type RUN "D:DCHANGE.BAS", then press the RETURN key.

The display will now show the layouts of both keypads. The line at the top of the screen should read KEYPAD CONTROLLER -- REVISION 2.0. THe keypad on the left, referred to as the "control" keypad, is used in controller jack #3. The keypad on the right, referred to as the "numeric" keypad, is used in controller jack #4.

At the bottom of the screen, you see:

```
Which keypad do you want to change
(1=exit, 2=control, 3=numeric)/
```

The computer is asking if you want to change a key on either keypad. If you're satisfied with the layout displayed, type 1 and press the RETURN key. Then skip to the paragraph headed "When you are through changing the keypad layouts."

You can change one key at a time. If you have several keys to change, the computer will return to this question until you are through.

Choose which keypad holds the key you want to change by typing 2 for the "control" keypads or 3 for the "numeric" keypad and pressing the RETURN key. A dot will appear beside the label under the keypad you pick.

You will now be asked

```
What row do you want to change?
```

The rows are numbered from top to bottom. The top row is row 1 and the bottom row is row 4. The row numbers are given in the space between the keypads layouts. Type in the row that the key is in and press the RETURN key. An arrow will appear by the row that you have selected.

Next, the computer will ask

```
What column do you want to change?
```

The columns are numbered from left to right. The column numbers are displayed above the keypad layouts. Type in the column that the key is in and press the RETURN key. An arrow will appear by that column.

You will now see:

```
Please press the key that you want to
put on the keypad.  You do not need
to press RETURN.
```

Type the key that you want to put on the keypad exactly as you would type it on the keyboard. You may select any key except CTRL-1 and the keys used to control KEYPAD CONTROLLER. Note: if you enter one of the keys A-Z without pressing SHIFT or CTRL, the SHIFT and CTRL locks will affect that key. If you want to guarantee that the keypad will produce a capital A, for example, you should enter SHIFT-A as the key. If you just press A, that key will enter lower case, capital letters, or graphics symbols depending on the setting of the SHIFT and CTRL locks.

As soon as you enter the new key, it will be displayed on the keypad layout, the arrows and dot will disappear, and the computer will return to the first question.

Note that the special control keys appear as graphics symbols. These symbols appear in the Atari 400/800 Operator's Manual. Some keys are reprepresented by a three-letter abbreviation in inverse video. The abbreviations and their meanings are:

```
RET   RETURN key
INV   ATARI (inverse video) key
LWR   Lower case mode (CAPS/LOWR)
CAP   Shift lock mode (SHIFT-CAPS/LOWR)
CTL   Control lock mode (CTRL-CAPS/LOWR)
EOF   End-of-file key (CTRL-3)
```

WHEN YOU'RE THROUGH CHANGING THE KEYPAD LAYOUTS

After you have entered 1 to exit, the computer will ask if you want to save the changes to cassette (tape version) or diskette (diskette version). If you have changed your mind and don't want to save the keypad layouts, enter N. Otherwise, enter Y.

Assuming you entered Y, the screen will clear and the computer will ask

```
Do you want to use the keypads for
  (1) normal use, or
  (2) game use?
```

Normally, you would type 1 and press the RETURN key. The game option prevents any keypress from showing up on the screen automatically and is useful only to programmers writing two-player keypad games. Game designers should see Section 7, ADVANCED TECHNICAL

INFORMATION, for more details.

If you have the diskette version of the program, you will be asked if you want to relocate it. Unless you have a special situation (TIPS FOR DISK USERS, ADVANCED TECHNICAL INFORMATION), you should answer with the letter N an press the RETURN key. If you answer Y, you will be asked for the new starting address, in decimal. You are responsible for preventing memory conflicts with DOS.

If you have the cassette version of the program, you will be asked to place a blank tape in the recorder, press the RETURN key, push PLAY and RECORD on the recorder, and press the RETURN key again. When the computer is throuh making the boot tape, it will return to BASIC READY mode. Push STOP on the recorder.

If you have the diskette version of th program, you will be asked to insert a diskette into disk drive 1 and press the RETURN key. Insert the diskette you prepared earlier an press the RETURN key. When the computer is through writing the AUTORUN.SYS file, it will return to BASIC READY mode.

To use your version of KEYPAD CONTROLLER, use the new tape or diskette whn you turn the computer on as described in GETTING STARTED (LOADING KEYPAD CONTROLLER INTO COMPUTER MEMORY).

7. ADVANCED TECHNICAL INFORMATION

USING KEYPAD CONTROLLER FOR TWO-PLAYER GAMES

Revision 2.0 of KEYPAD CONTROLLER has an option for use with two-player games. When you chnge the keypad layouts, you're asked it you want to use the program for normal use or game use. If you choose game use, any keys pressed on the keypads will not shw up on the screen.

When the game option is in effect, there are two registers that hold the last key pressed on each keypad. Normally, they hold 255 ($FF in hexadecimal). When a key is pressed, they hold the internal code for that key. The contents of the registers are elft alone between keypresses. Therefore, the program that detects a keypress should set the appropriate register back to 255.

The contents of the registers arinternal keyboard codes corresponding to the layout of the keypads. These codes are listed in the Operating System User's Manual and Hardware Manual and reproduced on the next page. In effect, the registers are to the keypads what CH is to the keyboard.

Here are the locations that must be PEEKed and POKEd to reads the keypads:

```
Keypad in jack #3: PEEK(548) + 256*PEEK(549)-4
Keypad in jack #4: PEEK(548) + 256*PEEK(549)-3
```

These addresses wil work for both cassette and diskette versions of KEYPAD CONTROLLER. They will not work for any revision before Revision 2.0, but they will work for any future revisions.

The flag that controls whether the keypads will be used for games or for normal use is at location PEEK(548 + 256*PEEK(549)-5. It is 0 for normal use or 255 for game use. This flag is automatically set by the program that changes the keypad layouts.

TURNING THE KEYPADS ON AND OFF FROM A BASIC PROGRAM

If KEYPAD CONTROLLER is not in game mode, your BASIC programs may turn the keypads on and off. Here are the statements used:

```
POKE PEEK(548)+256*PEEK(549)-2,0   : REM Editing keypad OFF
POKE PEEK(548)+256*PEEK(549)-2,255: REM Editing keypad ON
POKE PEEK(548)+256*PEEK(549)-1,0   : REM Numeric keypad OFF
POKE PEEK(548)+256*PEEK(549)-1,255: REM Numeric keypad ON
```

If the game option is in effect, these POKEs will have no effect. Note that the user can still turn the keypads on and off with SHIFT-CTRL-E and SHIFT-CTRL-N.

INTERNAL KEYBOARD CODES

Key Code	Key Press	Key Code	Key Press	Key Code	Key Press
63	a	127	A	191	CTRL-A
21	b	85	B	149	CTRL-B
18	c	82	C	146	CTRL-C
58	d	122	D	186	CTRL-D
42	e	106	E	170	CTRL-E
56	f	120	F	184	CTRL-F
61	g	125	G	189	CTRL-G
57	h	121	H	185	CTRL-H
13	i	77	I	141	CTRL-I
1	j	65	J	129	CTRL-J
5	k	69	K	133	CTRL-K
0	l	64	L	128	CTRL-L
37	m	101	M	165	CTRL-M
35	n	99	N	163	CTRL-N
8	o	72	O	136	CTRL-O
10	p	74	P	138	CTRL-P
47	q	111	Q	175	CTRL-Q
40	r	104	R	168	CTRL-R
62	s	126	S	190	CTRL-S
45	t	109	T	173	CTRL-T
11	u	75	U	139	CTRL-U
16	v	80	V	144	CTRL-V
46	w	110	W	174	CTRL-W
22	x	86	X	150	CTRL-X
43	y	107	Y	171	CTRL-Y
23	z	87	Z	151	CTRL-Z
50	0	114	)		
31	1	95	!	159	CTRL-1
30	2	94	"	158	bell
26	3	90	#	154	EOF
24	4	88	$		
29	5	93	%		
27	6	91	&		
51	7	115	'		
53	8	117	@		
48	9	112	(		
2	;	66	:	130	spade
6	+	70	backslash	134	curs left
7	*	71	^	135	curs right
12	RETURN	76	RETURN	140	RETURN
14	-	78	underline	142	curs up
15	=	79	vert. bar	143	curs down
28	ESC	92	ESC	156	ESC
32	,	96	left bracket	160	heart
33	space	97	space	161	space
34	.	98	right "	162	diamond
38	/	102	?		
39	ATARI	103	ATARI	167	ATARI
44	TAB	108	SET TAB	172	CLR TAB
52	BACK S	116	delete line	180	delete char
54	less than	118	clear screen	182	clear screen
55	greater than	119	insert line	183	insert char
60	CAPS	124	CAPS lock	188	CTRL lock

USING KEYPAD CONTROLLER WITH OTHER AUTORUN.SYS PROGRAMS

If you have the diskette version of KEYPAD CONTROLLER, you may be able to combine KEYPAD CONTROLLER with other AUTORUN.SYS programs. The following guidelines should prove helpful in deciding whether or not to attempt combining programs:

1. Programs which use the DOS INIT vector are more likely to work with KEYPAD CONTROLLER than programs which use the RUN vector.

2. Programs which use VKEYBD (the keyboard interrupt vector) probably will not work with KEYPAD CONTROLLER.

3. PROGRAMS WHICH USE THE VVBLKD and the Screen Editor vectors should save the previous contents and call the previous routines when through.

4. Similar cautions apply to DOSINI and DOSVEC.

5. Programs which use page 6, the timer vectors, or the display list interrupt vector will not interfere with KEYPAD CONTROLLER.

If you think that the twoprograms can work together, try this procedure:

1. Turn on your ATARI Home Computer system with the other AUTORUN.SYS program. In this step, you're trying to find where the other program ends in memory.

   a. If you're using BASIC, type:

      PRINT PEEK(743) + 256*PEEK(744)

   and write down the numer that the computer prints out.

   b. If you're using the Assembler Editor Cartridge, type:

      LOMEM

   and write down the deimal equivalent of the first (hex) number displayed.

2. Make a copy of the diskette containing the other AUTORUN.SYS program. This diskette will be referred to as the destination disk in future steps. Pages 36 through 38 in the DOS Reference Manual tell how to duplicate a disk. Be sure not to do the duplication with KEYPAD CONTROLLER loaded.

3. Turn your computer off. Insert the BASIC cartridge. then insert the KEYPAD CONTROLLER diskette and turn the computer back on. when you see the READY prompt, typeRUN "D:DCHANGE.BAS" and press the RETURN key.

4. Change the keypad layouts as you wish. When you're through, type 1 to exit and press the RETURN key. You'll be asked if you want to save the changes to diskette. Type Y and press the RETURN key.

5. The program will ask if you want to use the program for games. Make your choice and press the RETURN key.

6. You'll now be asked if you want to relocate the program. Type Y and press the RETURN key. When you're asked for the new address, five the number you wrote down in step 1.

7. When you're asked to place a diskette in disk drive 1, use a diskette that does not have an AUTORUN.SYS file tat you want to save. Then press the RETURN key. The diskette will be referred to from now on as the source diskette.

8. After the computer has created the file, the screen will show the READY prompt.

9. Insert a system diskette into disk drive 1. Then type DOS and press the RETURN key. After a delay of 9 to 30 seconds, the DOS menu will appear.

10. Insert the source diskette into disk drive 1. Then type E and press the RETURN key. When DOS asks for the filename, type D:AUTORUN.SYS,KEYPAD.SYS (no spaces) an press the RETURN key.

11. When DOS asks for your selection, type O and press the RETURN key. Enter D:KEYPAD.SYS for the name of the file to move. When you're asked if it is OK to use

12. Insert the source and destination diskettes as requested.

13. When the computer finishes copying the file, insert the destination diskette. Then type C and press the RETURN key. When DOS asks COPY--FROM,TO? type D:KEYPAD.SYS,AUTORUN.SYS/A and press the RETURN key.

14. Delete the temporary file KEYPAD.SYS by selecting DOS option D and entering D:KEYPAD.SYS for the name of the file. When DOS asks if it is OK to delete the file, type Y and press the RETURN key.

15. Insert the source diskette and repeat step 14.

You have now created a new AUTORUN.SYS file on the destination disktte that combines both programs. The next few steps will test to see if the combination is successful.

16. Turn on your ATARI Home Computer system with the destination disktte the same way that you would with the other program.

17. Test out all the functions of the other program and the KEYPAD CONTROLLER program.

18. Type NEW to clear out the computer's memory and enter a short program.

19. Press SYSTEM RESET and repeat step 17. Then type LIST to see if your program is still in memory (it should be).

20 Insert a system diskette with a MEM.SAV file and type DOS. When the DOS menu appears, type B and press the RETURN key to return to BASIC or the Assembler.

21. When the READY or EDIT prompt appears, press SYSTEM RESET and repeat steps 17 through 19.

If the combined program passes these tests without locking, it is probably OK. However, if the computer locks up or some of the functions don't work, the two programs will not work together. Go back to DOS and delete the AUTORUN.SYS file on the destination diskette.

HOW THE KEYPAD CONTROLLER PROGRAM WORKS

The KEYPAD CONTROLLER program can be divided into four modules. These modules are:

a. Initialization. This module links the KEYPAD CONTROLLER modules with the Operating System when you turn on the computer or you press the SYSTEM RESET key.

b. Keyboard interrupt. This module recognizes the keys that turn the keypads on and off and set the printing speed.

c. Keypad scanning. When the keypads are on, this module checks for keypad entries and fools the computer into accepting them (normal use) or store them (game use).

d. Printing. This module slows down printing to the screen.

The diskette version of the program has a fifth module:

e. DOS menu -- Intercept the DOS command and restore all vectors to their original values before returning to DOS so that the system will not crash.

If you have the Assembler Editor Cartridge and the diskette version of the program, the source code is stored in three files on the diskette. You will need 32K of RAM to load and edit these files. The files and their contents are:

TAPEPROG.SRC -- holds the source code for the cassette version of KEYPAD CONTROLLER.

DISKPROG.SRC -- holds the source code for the diskette version of KEYPAD CONTROLLER.

DISKREL.SRC -- DISKPROG.SRC with equates marking the code that has to be fixed when the program is relocated. The equates take the form of L# (low byte) and H# (high byte).

If you want to list the files but you have less than 32K of RAM, type DOS to go to the DOS menu. Then use option C (copy file) to copy the file you want to list to E: (screen), or P: (printer). The following example shows how to list DISKPROG.SRC to the printer.

```
SELECT ITEM OR RETURN FOR MENU
C

COPY--FROM,TO?
D:DISKPROG.SRC,P:

TYPE "Y" IF OK TO USE PROGRAM AREA
CAUTION: A "Y" INVALIDATES MEM.SAV. N
```

Assemble the programs to diskette if you decide to make any changes.

A description of each module follows.

A. Initialization module The Operating System calls this module when you turn on the computer or press the SYSTEM RESET key. The module does the following:

a. Checks if it is "power up" or SYSTEM RESET--if "power up", the program saves the contents of the VVBLKD vector in THRU. The diskette version of the program also saves the contents of the VKEYBD, DOSINI, and DOSVEC vectors.

b. The diskette version of the program now calls the old DOSINI to intialize DOS.

c. Sets VVBLKD, the second stage VBLANK exit vector, to the start of the keypad module. Since the keypad module is executed during the second stage of the VBLANK routine, it does not interfere with cassette/serial bus I/O.

d. Sets the keyboard interrupt vector VVBLKD to the start of the keyboard interrupt module. This allows the program to intercept the keys used to control the keypads and the printing speed.

e. Resets the Screen Editor's entry in the Device Table, copies the Screen Editor vector table into RAM, and changes the PUTBYTE (printing) vector to the start of the printing module.

f. The program does a SEI which disables IRQ interrupts (such as keyboard interrupts) and signals the VBLANK routine that this is critical and VVBLKD should not be used.

g. Does a CLI, restores all 6502 registers from the stack, and returns to the Operating System.

h. The diskette version of the program now resets DOSINI to the start of the initialization module.

i. The program sets MEMLO to protect itself.

j. The diskette version of the program now resets DOSVEC, which points to the DOS utility package (DOS from BASIC or the Assembler Editor) to the DOS menu module, which resets the interrupt and printing vectors before calling DOS.

k. The program resets the printing speed to normal.

B. Keyboard interrupt module

When you press any key on the keyboard, the Operating System calls the keyboard interrupt module. The module does the following:

a. Checks for SHIFT-CTRL-E, SHIFT-CTRL-N, and SHIFT-CTRL-number (0-9) keys and uses these keys to turn the keypads on and off and to set the printing speed.

b Treats all other keys normally.

C. Keypad scanning module

Sixty times per second, the ATARI Computer displays the TV picture. Each time, the display hardware interrupts the 6502, and the Operating System executes the VBLANK routine. The VBLANK routine has two parts; Stage 1, always executed, and Stage 2, executed only if the program interrupted was not critical. If the program interrupted was not critical, the Operating System code ends with a jump through VVBLKD to the keypad scanning module.

If the keypads are off, the module sets up controller jacks #3 and #4 to read a Joystick and exit. When either keypad is on, the module scans one row on each keypad during each VBLANK interrupt. Since a keypad has four rows and the module is executed 60 times per second, the keypads are scanned at the rate of 15 times per second. If one keypad is off, it is scanned in the normal fashion but any key presses are ignored. The module keeps two tables that translate keypad entries into the internal keyboard code used by the ATARI Computer. The code obtained is stored in CH, the keyboard buffer.

Each controller jack has four pins which read the Joystick up, down, left, and right inputs. These pins are connected to a PIA chip. This means that they can be used for output as well as input. Each row on a keypad is connected to one of the Joystick pins. the first column and second column are connected to the two paddle inputs in each controller jack, and the third column is connected to the input from the red Joystick button.

To read a row on the keypad, a 0 must be written to the Joystick pin for that row and 1's must be written to the Joystick pins for the other rows. The program must then wait for the capacitors that read the paddles to discharge. In the "fast pot scan" mode, this only takes a short time. However, using the "fast pot scan" mode makes the paddle readhings less accurate. Therefore, the program sets the Joystick pins to scan a row and then checks the row set during the last VBLANK. The row just set is checked during the next execution of the program.

After allowing 1/60th of a second for the paddle readings to stabilize, the program checks the row using the two paddle inputs and the red Joystick button input for each controller jack. The table below lists conditions that indicate when a key has been pressed.

	Column 1	Column2	Column 3
Keypad #3	PADDL5>10	PADDL4>10	STRIG2=0
Keypad #4	PADDL7>10	PADDL6>10	STRIG3=0

If a keypress is detected, a number from 1 to 12 is stored in P1 (for the keypad in controller jack #3) or P2 (for the keypad in controller jack #4). This index is used later to look up the keyboard key that has been assigned to that position on the keypad.

After checking the results of the last row scan, the program exits three out of four times. The fourth time, all the rows have been read, and the program processes any keypresses.

For each keypad, any keypress is compared to the last keypress on that keypad. If they are the same, the new keypress is accepted only if a suitable debounce time has expired. If they are different, the new keypress is accepted immediately. If a key has been held down, the repeat timer is checked to see if the key should be repeated. since keypresses are checked 15 times each second, the repeat timer stays at zero once it reaches zero. If the keypad is turned on, the keypress is also stored in TEMPCH, which holds the value to be stored in CH.

After both keypads are processed, CH is checked. If it is $FF (no key pressed), TEMPCH is copied into CH if the game flag is not set. Since TEMPCH may be $FF (and usually is), keyboard keys are given priority.

D. Printing module

This module delays for a short amount of time and jumps to the Screen Editor. The amount of time to delay is stored in DELAY by the keyboard interrupt module.

E. DOS menu module (diskette version only).

This module restores the VVBLKD, VKEYBD, and Screen Editor printing vectors to their original values and jumps to the DOS menu. Restoring the vectors is necessary to that the system does not crash when the DOS menu is swapped with the KEYPAD CONTROLLER program.

Here is the variable list for the program:

RES -- is a flag indicating power up ($00) or SYSTEM RESET ($FF)

ED,SC -- are the file names of the Screen Editor and graphics screen.

VECTOR -- is a copy of the Screen Editor vector table with the PUTBYTE address changed to point to the start of the printing module.

PUTBYTE -- is the address of the Operating System printing routine.

THRU -- is the address of the Operating System VVBLKD exit routine.

KBSAVE -- (diskette version) holds the old value of VKEYBD so that the interrupt vector can be stored before going to the DOS menu.

DOSSAV -- (diskette version) holds the old value of DOSVEC--the address to jump to to bring up the DOS menu.

EDOFFS -- (diskette version) holds the index to the Screen Editor's

entry in HATABS, so that the DOS menu module does not have to find the Editor entry all over again.

SPKEY -- is the table of keyboard codes corresponding to SHIFT-CTRL-1, 2, 3, 4, 5, 6, 7, 8, 9, and 0. The keyboard interrupt module uses it to check for requests to change the printing speed.

SPDEL -- is the table of delay values corresponding to keys in SPKEY.

GAME -- is the game use flag, $00 for normal use and $FF for game use. It is used with the two KBFLAG bytes to set the direction of the Joystick lines in controller jacks #3 and #4.

KBFLAG -- is the keypad on/off flag table. The first byte controls the editing keypad and the second byte controls the numeric keypad. Since the flags are $00 for off and $FF for on, they are used to set the direction of the Joystick lines in controller jacks #3 and #4.

KPRESS -- is the keypress table. When the GAME flag is set or the keypads are on, it holds the last keypress for each keypad. It should be read like CH.

STAGE -- is the number of the row (0-3) that will be scanning during the next 1/60th of a second.

STROBE -- is a table of row-select values corresponding to STAGE.

TEMP -- holds the offset into the CONTROL and NUMBER tables for the row currently being read.

CONTROL -- is the table of keyboard codes for the keypad in controller jack #3. The first byte is $FF (no key) and the next 12 bytes hold the codes for the keypad in left-to-right, top-to-bottom order.

NUMBER -- is the table of keyboard codes for the keypad in controller jack #4.

P1 -- holds the offset into the CONTROL table for the key pressed on the keypad in controller jack #3. If P1 is zero, no key has been found yet.

P2 -- holds the offset into the NUMBER table for the key pressed on the keypad in controller jack #4.

LAST -- is the keyboard code for the last key pressed.

LASTIN -- is the keyboard code for the last keypad scan. It may be either LAST or $FF (no key pressed). The auto-repeat logic uses LASTIN to check whether or not a key has been held down.

DEBNCE -- is the keypad debounce timer. It is set to 2/15 of a second when a new key is pressed.

REPEAT -- is the auto-repeat timer. When a new key is pressed, it is set to 1/2 of

a second. After REPEAT reaches zero, it stays there. This results in a repeat rate of 15 times per second.

8. SAMPLE APPLICATIONS

Using the instructions in Section 5, you may change any key on either keypad. Here are some ideas for other keypad arrangements.

1. For use with the Assembler cartridge:

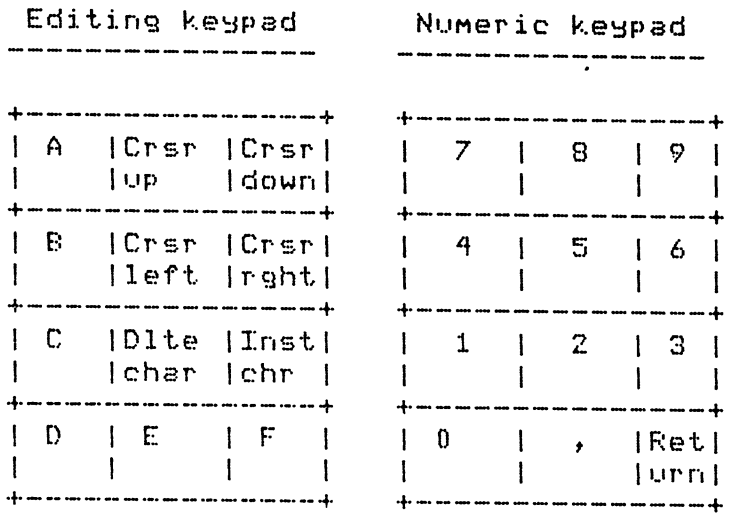

Figure 2 Keypad Layouts

2. To simplify menus for young children or non-typists:

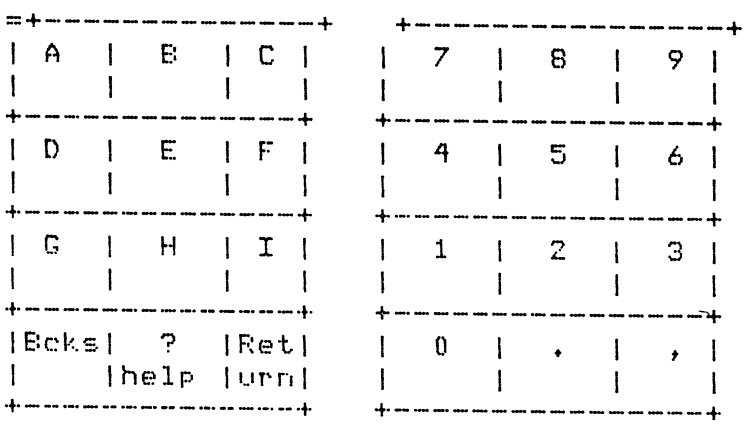

Figure 3 Keypad Layouts

9. COMMAND SUMMARY AND OTHER USEFUL INFORMATION

When the program first loads, the keypads are turned OFF. Always plug in the keypads BEFORE you turn them on and unplug them AFTER you turn them off.

Holding down SHIFT and CTRL and pressing the E key:

a. turns the editing keypad on if it was turned off, and
b. turns the editing keypad off if it was turned on.

Holding down SHIFT and CTRL and pressing the N key:

a. turns the numeric keypad on if it was turned off, and
b. turns the numeric keupad off if it was turned on.

The keypads are plugged into controller jacks #3 and #4 on the front panel. They have the following functions:

Editing keypad Controller jack #3

+	Crsr up	Crsr down
-	Crsr left	Crsr rght
*	Dlte char	Inst char
/	^	Re turn

Numeric keypad Controller jack #4

7	8	9
4	5	6
1	2	3
0	.	,

Figure 4 Keypad Layouts

To control the speed of the listings or printouts to the screen, hold the SHIFT and CTRL keys down and press one of the number keys 0-9. SHIFT-CTRL-1 is the slowest, and SHIFT-CTRL-9 is the fastest. SHIFT-CTRL-0 returns the ATARI Computer to normal speed.

USING THE CASSETTE VERSION OF KEYPAD CONTROLLER WITH DISKETTE

Although you cannot use your "autoboot" tape with diskette because of the nature of the auto loading process, it is possible to use the cassette version of KEYPAD CONTROLLER with diskette. To make a version of KEYPAD CONTROLLER that will work with diskette, follow these steps:

a. Put the BASIC cartridge in the cartridge slot of your computer. Turn on the

computer with the disk drives on, and do NOT load KEYPAD CONTROLLER.

b. Rewind the program cassette to the beginning of side 2. Press PLAY on the recorder to prepare it for loading the program.

c. Type CLOAD and press the RETURN key. When you hear the bell, press the RETURN key again. The computer will load the program into memory (Note: you must have at least 24K of RAM).

d. When the computer finishes loading the program, it will type READY. Press STOP on the recorder.

e. Put a system diskette with the MEM.SAV file and at least 70 free sectors into disk drive 1. Then type SAVE "D:DCHANGE.BAS" to save the program to diskette.

f. The program you have just saved to diskette is described in Section 6, CHANGING THE KEYPAD LAYOUTS. It is the same program distributed with the diskette version of KEYPAD CONTROLLER. The following steps tell you how to make an AUTORUN.SYS file which will load KEYPAD CONTROLLER automatically.

g. Type RUN and press the RETURN key. The screen will clear, then show the layout of the keypads.

h. The following questions will appear. After each question, type the underlined answer and press the RETURN key. When answering the second question, be sure not to leave any space between the question mark and your answer.

```
Which keypad do you want to change
(1=exit, 2=control, 3=numeric)?1

Do you want to save the changes to
diskette for future use (Y/N)?Y

      (screen clears)

Do you want to use the keypads for
  (1) normal use, or
  (2) game use?1

Do you want to relocate the program
(You should only answer Y for special
situations) (Y/N)?N
```

i. The computer will type "Please wait a few seconds while I customize the program." After a few seconds, the computer will type "Put your disk in drive 1 and press any key to write the new AUTORUN.SYS file."

j. Press the RETURN key. The computer will write an AUTORUN.SYS file on your system diskette.

You now have a diskette version of KEYPAD CONTROLLER. Use the instructions for the diskette version of the program and read Section 4, TIPS FOR DISK USERS. Due to

limitations on the number of files that can be placed on a cassette, you will not have the source code forthe program, which is distributed with the diskette version.

FILES INCLUDED WITH THE CASSETTE VERSION OF THE PROGRAM

Side 1

TCHANGE.BAS -- BASIC program to change keypad layouts and write autoboot tapes.

Side 2

DCHANGE.BAS -- BASIC program to change keypad layouts and write AUTORUN.SYS files to diskette.

FILES INCLUDED WITH THE DISKETTE VERSION OF THE PROGRAM

AUTORUN.SYS -- machine language program that loads into memory when the computer is turned on. This file was created by running the DCHANGE.BAS program.

DCHANGE.BAS -- BASIC program to change keypad layouts and write autoboot tapes. Note: the disk drives must stay off when the autoboot tape is used, due to the nature of the autoload process.

DISKPROG.SRC -- source code in ASSEMBLER LIST for for the diskette version of KEYPAD CONTROLLER. To load this file, you need at least 32K of RAM.

DISKREL.SRC -- source code for diskette version of program with equates throughout the file marking the bytes that must be adjusted to relocate the program.

TAPEPROG.SRC -- source code for the cassette version of the program.

TAPEPROG.OBJ -- object code from assembly of TAPEPROG.SRC

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1. Name and APX number of program.

2. If you have problems using the program, please describe them here.

3. What do you especially like about this program?

4. What do you think the program's weaknesses are?

5. How can the catalog description be more accurate or comprehensive?

6. On a scale of 1 to 10, 1 being "poor" and 10 being "excellent", please rate the following aspects of this program:

   _____ Easy to use
   _____ User-oriented (e.g., menus, prompts, clear language)
   _____ Enjoyable
   _____ Self-instructive
   _____ Useful (non-game programs)
   _____ Imaginative graphics and sound

7. Describe any technical errors you found in the user instructions (please give page numbers).

8. What did you especially like about the user instructions?

9. What revisions or additions would improve these instructions?

10. On a scale of 1 to 10, 1 representing "poor" and 10 representing "excellent", how would you rate the user instructions and why?

11. Other comments about the program or user instructions:

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