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# THE COMPUTER SCIENTIST

## EXPERIMENTING WITH COLECO'S ADAM

**W**HEN Coleco Industries announced its new Adam computer last summer, the press praised the system as a breakthrough in home computing. Indeed, a system complete with keyboard, mass storage unit, and letter-quality printer for under \$600 certainly represented a major development.

But Coleco was late in delivering Adam. Worse, when retailers reported higher than expected customer returns and quality control problems with early shipments of the system, the press began to chastise both Coleco and the Adam.

The most devastating blow came when *Consumer Reports* magazine announced in its January 1984 issue that the word-processor portion of its Adam "... wasn't functioning properly within hours after we began using it." The day this item appeared in late December, Coleco's stock lost a fourth of its value! *The Wall Street Journal* added to Adam's image problem by reporting in its December 28, 1983 issue "... *Consumer Reports* magazine said it couldn't rate the Adam because none of the four early production models it bought worked."

While Coleco can certainly be faulted for its decision to hype Adam long before the machine was even in production, some of the press deserves criticism for incomplete and misleading reporting about Adam's alleged problems. For example, the *Consumer Reports* article failed to note that Adam is much more than a word processor. It's also an electronic typewriter. And it's an 80K computer that can be programmed in BASIC and play a wide range of high-resolution, arcade-quality video game cartridges and tapes. (A review of Adam appeared in the February, 1984, issue of this magazine.)

Nor did *Consumer Reports* reveal the nature of the problem with the word-processor mode of the Adams it purchased. If the problem was so serious, why did it take "hours" to discover it?

Fortunately, I bought an Adam before the press ganged up on the ma-

chine. (Would you have bought one after reading items like those in *Consumer Reports* and *The Wall Street Journal*?) The Adam I bought was one of those "customer returns" the press had cited as evidence of machines that failed to work. Actually, it worked just fine—the first owner had returned it because he

PCjr's rubber block keys could learn valuable lessons in effective keyboard design from Adam's keyboard.

The memory console includes one tape drive assembly and room for a second. These tape drives should not be confused with the cassette tape recorders required by some inexpensive com-

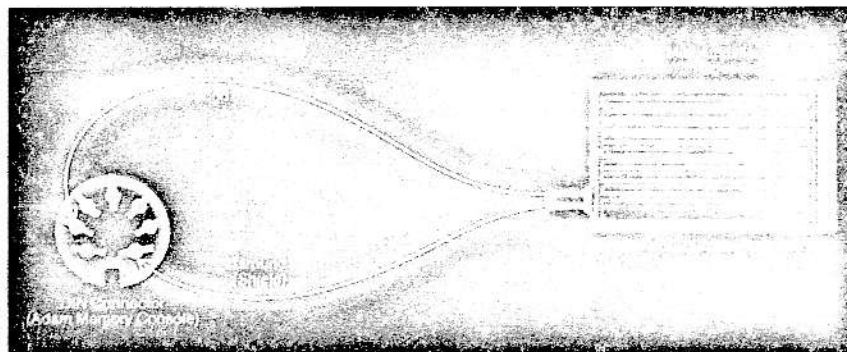


Fig. 1. How to connect an external amplifier to Adam.

needed extra money for a car payment.

Eric R. Mims, my 14-year old son, and I have spent quite some time working with the machine, and we have both become very impressed with Adam's capabilities. Certainly no other "family" computer system comes close to delivering the value for dollar spent that Adam does. In this column I'll report on our observations and describe a couple of Adam add-on projects you may wish to try. Let's begin with a brief review of the hardware.

### Adam's Hardware

Adam consists of three principle system modules: keyboard, printer and a central processor/memory drive unit called the memory console. Also included are a pair of joysticks with built-in 0-9 keypads. Only a television receiver or video monitor is required to place the system in operation.

The superbly designed keyboard has 75 full-travel, stepped and sculptured keys, and is equal in quality to the keyboards of more expensive computers. The people at IBM responsible for the

puters for the storage of programs and text. Their operation is fully automatic and up to sixteen times faster. Moreover, the special high-speed data cassettes used in the memory drive can store up to 250 pages of double-spaced text (about 256K bytes). BASIC programs can also be stored on tape.

On top of the memory console is a slot for inserting Coleco game cartridges; and, on the right side, is a slot for a Coleco Vision expansion module. Inside a user-accessible space behind the tape drive are three card sockets for expansion peripherals. The first of these peripherals, announced at the winter Consumer Electronics Show is a 64K RAM expander that will give Adam 144K of memory.

Inside the sealed portion of the memory console are RAMs and processing circuits, all surrounded by a grounded shield to reduce electromagnetic interference. The machine I purchased was an early production model as revealed by several jumpers plus some bypass capacitors soldered across the power supply pins of several chips.

Adam's letter-quality printer has

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on Adam's back panel (Fig. 1).

I've also assembled an amplifier on a small card that plugs into one of Adam's expansion sockets and provides a built-in sound capability. Figure 2 shows the circuit for this amplifier. It works best when Adam is in its game-playing mode. In its computer and word-processing modes, Adam generates a somewhat higher background noise level that, when amplified, produces an annoying hum. For this reason, you might want to add power switch *S1* to disable the sound card when the game mode is not selected.

Figure 3 shows the location of the +5 volt, ground and sound-output pins of the center card socket inside Adam's memory console. You can use a 22-finger (0.1-inch centers), double-sided card for the amplifier. Or you can make your own card by modifying a pre-etched, copper-clad breadboard such as Radio Shack's "Op-Amp IC Experimental Breadboard" (Cat. No. 276-153). Figure 4 shows how to cut a homemade 22-finger card from one of these boards.

Since the Radio Shack board is single-sided, you'll have to provide a ground contact on its unmetalized side. The best solution is to cut a thin strip of copper foil (about 1/16" x 2") and use cyanoacrylate adhesive to cement the foil along the bottom edge of the card. Be

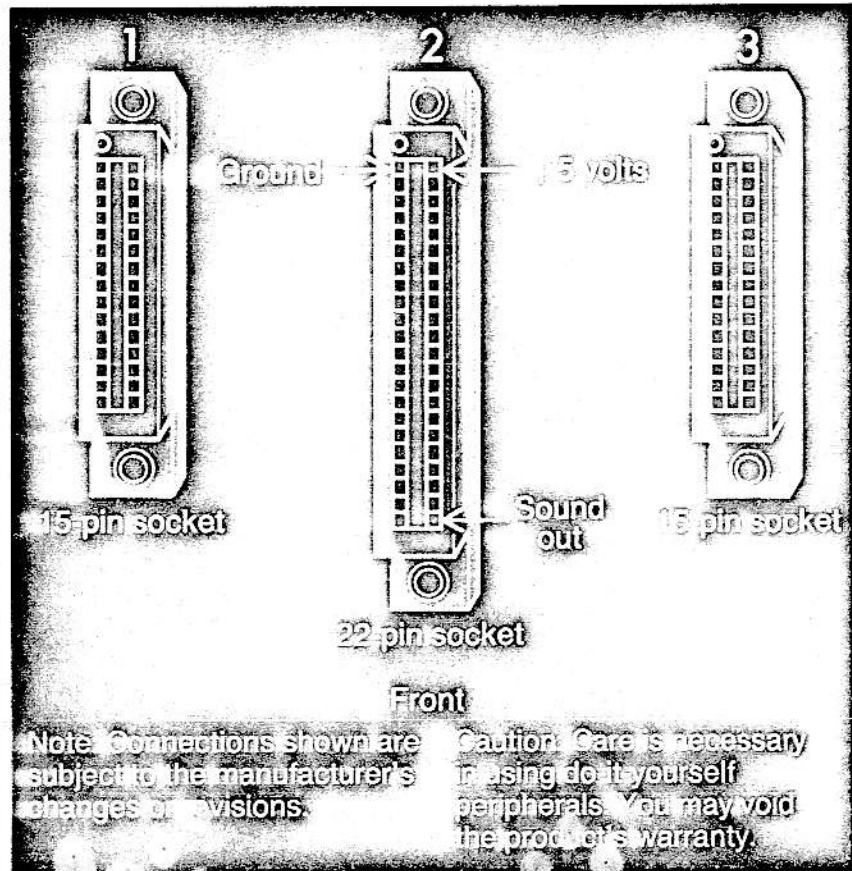
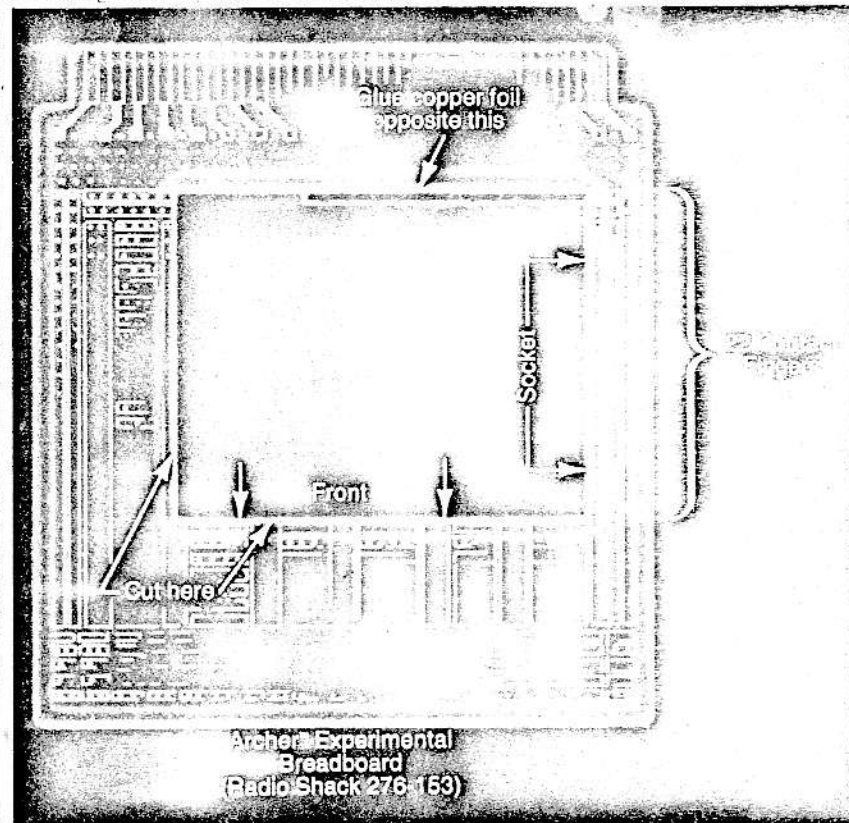


Fig. 3. Expansion sockets inside Adam's memory console.



sure the foil strip is directly opposite the contact finger that will carry +5 V.

As for the circuit, install the components on the front side of the board and connect the various leads to one another with short lengths of wrapping wire soldered in place. Screwdriver adjustable trimmer potentiometer *R1* controls the amplifier's volume.

The speaker should be connected to the card by 6" or so of insulated hookup wire. When the card is inserted into its socket, place the speaker on the shelf behind the tape drive.

Incidentally, you *must* exercise particular care when building and using unauthorized computer peripheral cards.

### Using Adam as an Intruder Alarm

Adam's joysticks offer several interesting applications beyond serving as mere cursor, graphics and game-playing controllers. One I've explored is intruder detection.

Joysticks that incorporate a pair of mechanically linked potentiometers form part of an analog-to-digital con-

Fig. 4. How to make a 22-pin connector card.



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generated the most concern among its competitors. The operation of the wheel that turns the platen (roller) of the printer on my Adam is stiff, which slows down the insertion of paper. Nor does the paper release lever allow the paper to slide freely enough across the platen. In operation, the printer is slower (about 120 words per minute) and much louder than the more expensive letter-quality printer in my office. The paper advance solenoid is particularly noisy, generating a louder sound than the striking of individual characters.

Its drawbacks notwithstanding, Adam's printer works exceedingly well. It features an interchangeable plastic daisy-wheel printing element and it uses a standard ribbon cartridge. The bidirectional printing mechanism prints 80 columns. The bottom line is the quality of the copy, which is every bit as neat as that generated by some printers costing more than a complete Adam system.

### Adam's Software

Adam plays standard ColecoVision cartridge games plus arcade-quality games stored on high-speed digital data tapes. The arcade-quality games include intermissions and a "hall of fame" that records high scores. After numerous test sessions, Eric is convinced that video game enthusiasts will find little to criticize about Adam's game playing abilities. In his opinion, the sound and high-resolution graphics are excellent.

Adam's word-processing software was apparently responsible for the unfavorable item in *Consumer Reports*. Eric and I have spent considerable time testing the word-processing mode and have managed to identify one software bug.

On some occasions, when the left and right horizontal margin settings are placed, respectively, at their minimum

and maximum settings, Adam's keyboard becomes inoperable. The only way to restore the keyboard to normal operation is to reset the computer. Unfortunately, this erases all the text stored in RAM! We have managed to avoid this problem by always setting the left margin to a value greater than 1. Apparently only early versions of Adam have this word-processing bug. We have just tested a later version of the machine that operates perfectly in its word-processing mode.

Incidentally, Adam's word-process-

## Fortunately, I bought an Adam before the press ganged up on the machine

ing manual is excellent. But chances are you'll rarely need it because the on-screen graphics and prompts are so clear. We have used Adam's word-processor to type, edit, and print considerable practice copy, though neither of us has read the manual.

Adam's BASIC is very similar to Applesoft BASIC. Unfortunately, we have not been able to complete our evaluation of Adam's BASIC since the manual supplied with our machine is very poor. We have, however, found many BASIC features and capabilities not even mentioned in the manual. For example, the manual doesn't discuss in detail the editing of programs. Fortunately, Adam's programs can be easily edited simply by moving the cursor and typing in new information.

Nor does the manual mention that Adam has commands for producing sound and special graphics. We discovered some of these special features when a program I wrote went berserk and began displaying on the screen numerous special symbols and functions not listed in the manual. The keyboard then locked-up and we were forced to reset the computer to restore it to normal operation (in the process, losing our program).

Eric wrote the following program that prints the functions of Adam's ASCII codes on the monitor screen.

```
10 REM ADAM CHR$ SEARCH
20 TEXT
```

```
30 FOR A = 0 TO 255
40 PRINT CHR$(A);
50 NEXT A
```

This program revealed that Adam can display five musical notes, various mathematical symbols and a half dozen or so graphics sprites. The machine can also display complete upper- and lower-case alphabets and punctuation symbols in both normal and reverse video.

Incidentally, CHR\$(16) causes Adam's printer to do a rapid series of line feeds. Eric revised his program to avoid this noisy interlude by inserting a conditional test that skips CHR\$(16).

The musical note symbols and Adam's excellent game-playing sound effects imply that the machine has programmable sound effects. Thus far, we have found that a CHR\$(7) produces a beep. We're attempting to identify command sequences that will produce more sophisticated sounds.

A Coleco engineer has informed me that a better Adam BASIC manual is now available. Adam owners can obtain the new manual by calling collect at (800) 842-1225. In the meantime, if you're trying to depend upon the original manual, you'll be pleased to know you can break a program in progress by simultaneously pressing CONTROL and C. To print a program listing, type PR#1:LIST. Hopefully, the new manual will describe in more detail these and many other features of Adam's BASIC.

### Using Adam with a Video Monitor

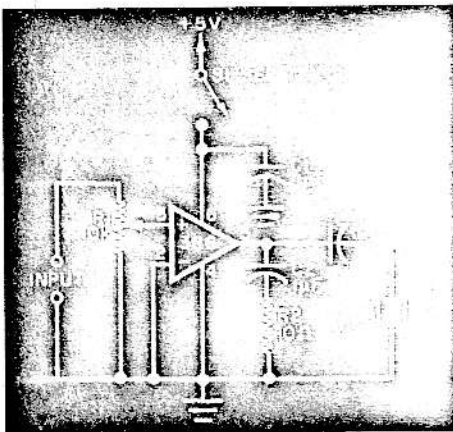
Like most inexpensive "home" computers, Adam can use a conventional color or black & white television as a display. Adam also has a monitor output that produces excellent results. Games, of course, are more fun when a color monitor is used.

We've found that both monochrome and color monitors work well when Adam is in its word-processing mode. Though a color monitor provides better presentation of the on-screen word-processing prompts and graphics, the monochrome monitor provides better text resolution.

### Adding a Sound Card

The monochrome monitor we used with Adam doesn't have a built-in amplifier and speaker. To remedy this problem, I've connected a small commercial amplifier, via a shielded cable, to the sound pin of the DIN connector

Fig. 2. Sound amplifier circuit.



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version system that causes a computer's cursor to follow the position of the joystick handle. They are called *absolute joysticks*.

Joysticks that incorporate an array of on-off switches are called *rate joysticks*. This type of control causes a computer's cursor to move in the direction the joystick handle is moved. When the handle is returned to center neutral, the cursor stops moving. The system responds to a subsequent joystick handle movement, by moving from its last position in the new direction indicated by the new handle position.

Adam uses rate joysticks, which are better suited for game playing than absolute joysticks. They are also relatively sophisticated, and include a 28-diode matrix that functions as a ROM to encode the signals from the joystick, fire buttons, and keypad.

Figure 5 shows the internal color-coding of the seven leads in Adam's joystick cables. Figure 5 also shows the layout of the four joystick switches. It is these switches that can be used to enable Adam to detect intruders.

Each of the four vector switches in a single joystick can support one or more remotely placed, (in this case) magnet-actuated sensor switches. The remote switches should be designed for *normally open* operation. In other words, each magnet switch should be *open* when the protected door or window is closed.

Wires leading to the remote switches can be soldered directly to the circuit board behind each of the four joystick vector switches (Fig. 5). This permits the joystick to be used to activate the system—and to reset it after a sensor switch is closed.

The program in Fig. 6 shows one way to program Adam as a computerized intruder alarm. When this program is run, Adam's monitor displays for several seconds:

```
INITIALIZE JOYSTICKS TO
100.
THEN PRESS CONTROL-C
AND RUN 99.
```

The monitor then displays two columns of numbers representing the current joystick values. Move the joystick in the appropriate directions to set the numbers in both columns to 100. Then break the program by pressing CONTROL C. You can now activate the alarm by entering RUN 99.

The program will sequentially scan each of the four joystick switches (thus any remote switches connected across them). If all the switches are open, the

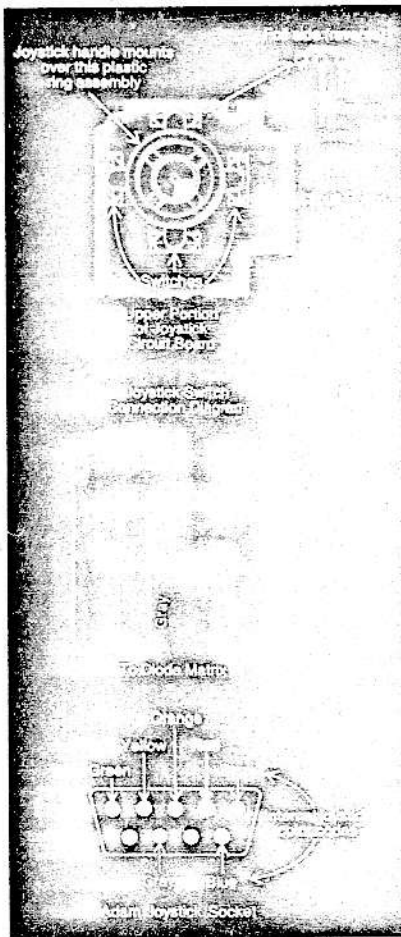


Fig. 5. Diagrams showing operation of Adam's joystick.

values of both a and b (line 110, 120) will be 100, and the screen will display ALL SENSORS SECURE following each scan.

If a closed switch is detected, Adam will immediately print on the monitor the location of the tripped switch and emit a continuous series of beeps. The print and beep loop can be stopped only by pressing CONTROL C. The program can then be reinitiated.

This simple intruder detection program can be easily expanded to include more features. For instance, the second joystick can be added to provide an additional four switches. Presumably, all 18 of the switches in a single joystick can be used when a method of accessing them can be determined. One way would be to couple their binary counterparts directly into the joystick sockets. However, this would require external hardware. A better way would be software access via Adam's keyboard.

Incidentally, I learned a valuable lesson about Adam while developing this intruder alarm program. During a test

run, I tried to activate the program by entering RUN 99 while the keyboard CAPS LOCK key was depressed. Nothing happened. Instead, Adam printed on the monitor I/O ERROR and erased the entire program, which I had yet to print out or store on tape! It was necessary to reconstruct the entire program from memory—my memory.

What happened? Eric observed that Adam will run a labeled program whose name is entered *without* the quote marks we're used to using with our other computers (they all use Microsoft BASIC.) Typing RUN 99 in all caps appeared on the screen as RUN (). Therefore, Adam interpreted () as a program label. It then erased the resident program to make room for the nonexistent program labeled (). It printed I/OERROR when its search for () was unsuccessful.

```
10 REM INTRUDER ALARM PROGRAM
15 REM COPYRIGHT 1984. FORREST M.
    MIMS. III
20 REM FRONT JOYSTICK SOCKET
    SELECTED
30 REM PDL(1) IS UP-DOWN
40 REM PDL(3) IS LEFT-RIGHT
45 TEXT
50 ? "INITIALIZE JOYSTICKS TO
    100."
60 ? "THEN PRESS CONTROL-C AND
    RUN 99."
70 FOR x=1 TO 5000: NEXT x
80 a=PDL(1): b=PDL(3)
90 ? a, b: GOTO 80
99 a=PDL(1): b=PDL(3)
110 IF a=100 THEN GOSUB 300
120 IF b=100 THEN GOSUB 300
130 IF a<100 THEN ? "INTRUDER AT
    FRONT DOOR!": CHR$(7):
    GOTO 130
140 IF a>100 THEN ? "INTRUDER AT
    BACK DOOR!": CHR$(7): GOTO
    140
150 IF b<100 THEN ? "INTRUDER AT
    FRONT WINDOW!": CHR$(7):
    GOTO 150
160 IF b>100 THEN ? "INTRUDER AT
    BACK WINDOW!": CHR$(7):
    GOTO 160
200 GOTO 99
300 ? "ALL SENSORS SECURE.":
    RETURN
```

Fig. 6. Intruder alarm program.

So, *never* run an Adam program from a specified line number unless the CAPS LOCK key is in the lower-case mode!

### Summing Up

Eric and I have used many different personal computer systems. We've always felt that Radio Shack's Color Computer was vastly underrated by some computer magazines. Now, we feel the same about Adam.

Adam does occasionally do the unexpected, but we've managed to identify, and thereby avoid, most of its quirks. In short, we feel Adam offers excellent value for its ultra-low price. ◇