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JULY 1986

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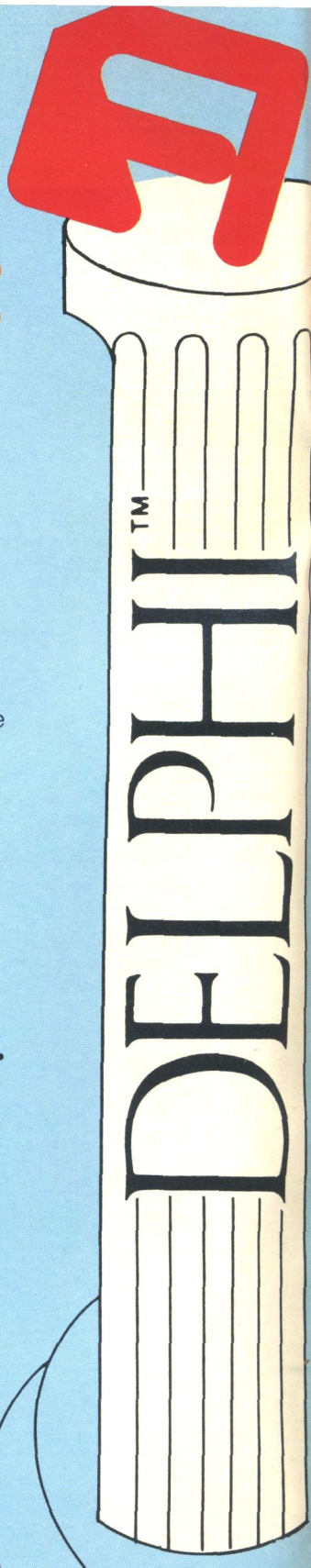

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But now, Delphi offers the Atari Users' Group, operated by the same people who bring you the #1 Atari magazine, **ANALOG Computing**. You can access Delphi for as little as 10 cents a minute from most cities in the U.S. There are no additional telephone charges, and there's no extra charge for access at 1200 or 2400 bps.

On Delphi, we'll give you a variety of services, including a Forum, where you can send and receive messages from Atari users worldwide. The Atari database consists of hundreds (soon to be thousands) of programs you can easily download and use right away. . .even those from the pages of **ANALOG Computing**. You can also upload your own programs for others.

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ANALOG Computing has set up some of the most knowledgeable people in Atari-dom. Matthew Ratcliff will handle your 8-bit questions, while Arthur Leyenberger will keep you posted on what's hot (and what's not).

Specials for current TCS and *ANALOG Computing* subscribers.

Your TCS membership (before April 15, 1986) entitles you to join Delphi and the Atari Users' Group absolutely free. If you were a TCS subscriber before the date above, you've probably already received our letter about the switch. You should receive a free lifetime Delphi membership, a Delphi Command Card and $10 of line time.

ANALOG Computing magazine subscribers may join Delphi free of charge, too. All subscribers will receive the lifetime Delphi membership and a $5 line-time credit. If you purchase the Delphi Handbook for $29.95, you'll get $20 worth of line-time. And you can subscribe to **ANALOG Computing** directly, while you're on-line, to be eligible for these bonuses.

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FEATURES

FEATURES *continued*

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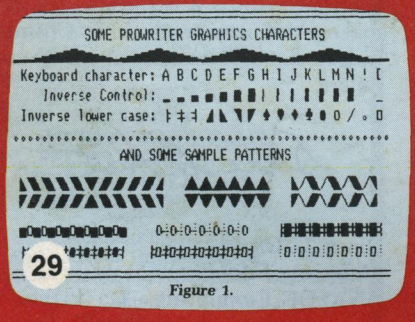
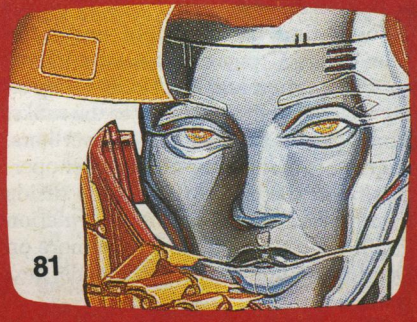


Figure 1.



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EDITORIAL

It's been a busy season for Atari Corp. and their computers, and we at **ANALOG Computing** have been . . .well, my normal phrase for the condition is "vaguely insane." It's all in the name of communication, folks.

As you may know, Matthew Ratcliff represented us on a panel at the West Coast Computer Faire this spring. Fellow panelists included Sam and Leonard Tramiel of Atari Corp. and Bill Wilkinson of OSS and *Compute!*, among others. David Small of Data Pacific moderated.

The discussion was both humorous and spirited, with plenty of straight-shooting questions—and answers. We couldn't manage to get Matt's article on the Faire into this issue, but you'll see it next month.

And, in **8-Bit News** (as we've rechristened the **New Products** spot in these pages), you'll get some tidbits gleaned from Jack Tramiel during his recent trip to the East Coast. As above, there's plenty going on for Atari Corp.

A lot of the activity is centered on Europe, where consumers are *hungry* for affordable high-performance computers. Shipping quotas are well into the six-figure range, and their sales are keeping right up. The U.S. has actually been a slower market for STs than have England and the Continent, in terms of per capita buying.

Users everywhere should know what that means: Atari's machines are thriving, all over the world. We're looking forward to new software for all Ataris.

Now for **ANALOG Computing** news . . .Quite a few readers have written (or phoned) to say that they're not satisfied with our new **BASIC Editor**. The original appeared in issue 43 and is duplicated this time, on page 17.

The major complaint is that it takes too long. We believe the many requests for an error checker to find mistakes as a program is typed are still indicative of a need. So Clayton Walnum will be busy speeding up and improving **BASIC Editor** for everyone's benefit.

In another area, the response to our TCS (Telecommunications System) has been so overwhelming that we're switching the network over to Delphi. Your long-distance phone bills will go down, and telecommunicating should be easier than ever.

You'll find us on Delphi under the Atari Users' Group SIG. General Videotex Corporation and **ANALOG Computing** welcome new members to the ranks, along with our earlier TCS subscribers. For details on how the changeover operates, read the ad on this issue's inside front cover. It's got all the information you'll need to start. We'll have more on Delphi, beginning with commands, next issue. Join us!

The **ANALOG Computing** staff thinks it's time to say a "thank you" to all the user groups who have helped make Atari ownership an adventure. We sometimes forget to express our appreciation of all the time and enthusiasm expended on Atari's behalf—and on ours.

This debt of gratitude was reawakened in us during a radio talk show for the southeastern states. It seemed that most of the callers had gotten their starts (and an education) in user groups. The rest needed information which would be easily obtained through a user group or BBS.

We suggest to readers who, for some reason, may not belong to a user group: join one today! You'll have access to public domain programs in virtually every interest group, as well as help when you need it and—let's not forget—the network of enthusiasts who've supported one another and will do the same for you.

Enthusiasm is a key word. It's what makes Atari users noticeable. Ultimately, it's what attracts more people to computers.

Diane L. Gaw

Diane L. Gaw
Managing Editor
ANALOG Computing

ANALOG COMPUTING STAFF

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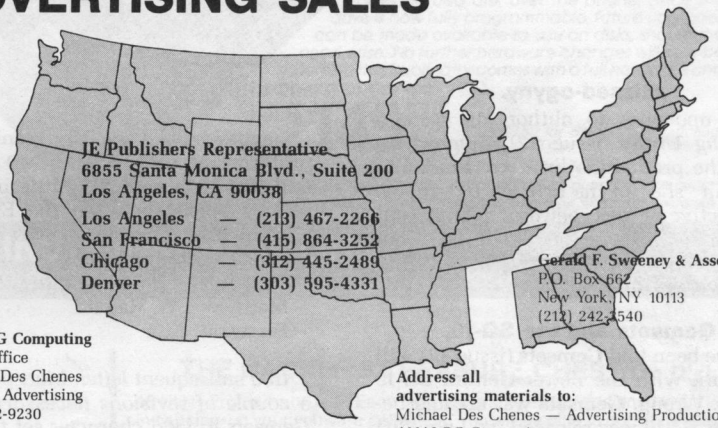

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AUTHORS

When submitting articles and programs, both program listings and text should be provided in printed *and* magnetic form, if possible. Typed or printed text copy is mandatory, and should be in upper- and lowercase, with double spacing. If a submission is to be returned, please send a self-addressed, stamped envelope.

READER COMMENT

Missed-ogyny.

*Our apologies to author Jan Iverson (**Printing Utility**, issue 42). Somewhere along the production line, we decided to call him "she" in the article's biography. Prospective writers, beware: submit your "bio" in the third person. We're sorry, Jan.*
—Ed.

Gemsets and the SG-10.

I have been told **Gemsets** (issue 42) will not work with the newer Gemini SG-10 printer. Wrong. **Gemsets** was created before the SG-10 was released, so I couldn't anticipate "problems" that have arisen. No software modifications are required to make the program work with the SG-10, just switch changes.

Your SG-10 should have the following switch settings for use with **Gemsets** (or just about any Epson-compatible software, such as **Matt*Edit** (issue 21).

1-1	on	11″ Page Length
1-2	on	IBM Set #1
1-3	on	10 CPI, Normal
1-4	on	Normal Print Mode
1-5	off	Enable Download Characters
1-6	on	USA
1-7	on	Character
1-8	on	Set
2-1	on	Enable Paper Out Detect
2-2	off	IBM (100% Epson) Mode
2-3	off	Auto LF with CR, Ataris
2-4	on	Standard Buffer

With these switch settings, your SG-10 should run virtually any Epson FX-80 (and most FX-85) compatible software. Whenever you run **Gemsets**, with the above settings, select the Epson FX series printer, not Gemini.

Remember: always make switch changes with the printer's power off. Most of them are read by the printer's electronics at power-up time only. So, if switches are changed while power is on, you won't see any difference until the printer is power cycled.

I apologize for the inconvenience this problem has caused for SG-10 users. It's odd that such annoying little incompatibilities persist between the Epson and Gemini printers; Gemini was started by former Epson employees!

Sincerely,
Matthew J.W. Ratcliff
Ferguson, MO

*In a subsequent letter, Matt pointed out a couple of revisions necessary to allow **Gemsets** to load character set files larger than 1024 bytes. The character sets created with **SuperFont** (and, possibly, some downloaded over a modem) fall into this category. A small change is also necessary to make **Gemsets** compatible with Sparta DOS.*

*The following BASIC program will install these changes into your current copy of **Gemsets**. To make the conversion, type the following program. For the filename GEMSET.COM in Line 10, substitute the filename you gave **Gemsets** when you first typed it. Put the disk containing your copy of **Gemsets** in drive 1, type* RUN, *and press* RETURN. *The conversion will then begin. When the program has finished, your disk will contain the file NEWGSET.COM, the new version of **Gemsets**.*

```
10 OPEN #1,4,0,"D:GEMSET.C
OM"
20 OPEN #2,8,0,"D:NEWGSET.
COM"
30 FOR X=1 TO 461:GET #1,A
:PUT #2,A:NEXT X:GET #1,A:
PUT #2,2
40 FOR X=1 TO 16:GET #1,A:
PUT #2,A:NEXT X:GET #1,A:G
ET #1,A:GET #1,A:GET #1,A
50 PUT #2,16:PUT #2,23:PUT
 #2,201:PUT #2,136:TRAP 70
60 GET #1,A:PUT #2,A:GOTO
60
70 CLOSE #1:CLOSE #2:? "AL
L DONE!"
```

*To be consistent with the above modifications, the following lines should be substituted into the MAC/65 source code (it's available on the **ANALOG Computing** disk version of issue 42 and on the Atari Users' Group in Delphi):*

```
1630    BGET 1,SETBUFF,1026
1700   BPL G10XDLD
1710   CMP #136
1740   BNE BADSET
```

*Finally, Matt informed us of a typo in the original **Gemsets** article, page 107, second column, third paragraph. The third sentence should read:*

To re-enable it use: ^027^036^01.
—Ed.

No connection.

I have just ordered a 520ST with both color and black-and-white monitors. I still plan to keep my trusty 800 up and running, and would like to be able to connect it to either of the new ST monitors. How can I do this?

Sincerely,
Sinclair Ash
APO, NY

Unfortunately, you can't. The ST monitors are incompatible with the 8-bit machines. *—Ed.*

M/L Editor fix.

I love your new **M/L Editor** (issue 42). I typed **Gemsets** in about thirty minutes, and it was a whole lot easier than typing in the hexadecimal listing (which probably was the reason for writing the **Editor** in the first place).

I could only find one slight bug, which was: when you type a number, erase it and press RETURN (to get the character above), the program stops with an error.

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CIRCLE #102 ON READER SERVICE CARD

The solution would be to type *CONT*, enter the number, type *CONT*, enter the number, etc.

I wrote these three lines, which will alleviate the problem:

```
11 DIM MOD$(4)
201 MOD$=N$
331 IF A=RETRN AND N$="" T
HEN N$=MOD$
```

Keep up the superior work, **ANALOG**.
Sincerely,
Paul A. Hanley
Crestview, FL

Cassette Clash.

Cassette users should add the following lines to the BASIC listing of ***The Clash of Kings*** *from issue 40.* —*Ed.*

```
200 ? "READY CASSETTE AND
PRESS RETURN";:OPEN #1,8,1
28,"C:":RESTORE 230:FOR X=
1 TO 40:READ N:PUT #1,N:NE
XT X
240 DATA 133,15,169,236,13
3,10,169,42,133,11,24,96
```

MicroCheck memo search.

I have subscribed to **ANALOG Computing** for the past three years, and I think it is one of the best magazines written just for the Atari. The articles and reviews have really helped me decide on what peripherals and programs to buy for my system.

One of the main reasons I can hardly wait for my magazine to arrive in the mail: the helpful programs. They make it possible to use my computer in ways to make everyday tasks a lot easier. One such program (I think it's the best yet) is **MicroCheck** (issues 27 and 28). I use this both at home and at my place of employment.

I did make a small modification to the program, so that when you're in the search mode you can also search by the memo. The reason I added this additional search was to be able to classify checks by memos, to help at the end of the year in figuring out how much money went for what and to whom.

When I was finally able to see how the search portion of the program worked, it only took an addition of seven lines and changes of a few other lines in the CHECKPRT subroutine.

```
931 POSITION 20,14:? "■";:
COL=20:ROW=14:L1=15:POSITI
ON COL,ROW
932 GOSUB SND1:POSITION 23
,19:? "    MEMO      "
933 GOSUB IN:IF TEMP$="" T
HEN TEMP$="ANY"
934 MEMO1$=TEMP$:POSITION
COL,ROW:? B$(23):POSITION
COL,ROW:? MEMO1$:RETURN
940 GOSUB 300:GOSUB 470:GO
SUB 660:GOSUB 900:GOSUB 93
1
1250 PAYEE$=CHECK$(14,34):
IF PAYEE1$="ANY" THEN 1265
1265 MEMO$=CHECK$(42,57):I
F MEMO1$="ANY" THEN 1270
1266 IF LEN(MEMO1$)>LEN(ME
MO$) OR MEMO$(K1,LEN(MEMO1
$))<>MEMO1$ THEN 1180
1595 DIM MEMO1$(21)
1770 ? "■|AMOUNT          |■|
PAYEE & MEMO      |■"
1800 ? "■|   TO:$          |■|
                  |■"
```

I hope other people will find that these changes make **MicroCheck** even more of a help. By doing a search on the memo for checks marked "tax deductible," a person would have the needed information close at hand.

One of your many readers,
Malcolm Lee DeBroeck
Jefferson City, MO

Debugging Debug+.

The programs in your magazine are getting much more sophisticated. Congratulations to you and the authors, and please keep it up!

For instance, I recently looked hard for back issue 18, to get Tom Hudson's **H:BUG**. It is a fine program, but—a few days after typing it in—issue 39 of **ANALOG Computing** came. . .with Bryan Schappel's **Debug+**. It's like moving from a VW to a Mercedes (no offense, Tom; VWs run longer).

Since I was right in the middle of writing a machine language subroutine, I spent a day typing in **Debug+**. I especially needed the trace feature, to watch the program execute.

Argh! **Debug+** has a bug! It would not execute the *indirect, Y* line of my subroutine properly. I checked my typing of **Debug+** and found no errors.

Specifically, when tracing or running a line with the 0 page, Y index, **Debug+** ignores the MSB. For instance, given this code:

Address		Value
$00	=	$10
$CB	=	$00
$CC	=	$50
$5000	=	$60

```
10 LDA ($CB),Y
```

the result produced in the accumulator is *$10* versus the expected *$60*. Obviously, the MSB is ignored by **Debug+** in execution.

Please help me fix this problem. My programs have too many bugs of their own!

Thanks very much,
Steve Baugh

Mr. Baugh thinks he has found a bug in the "trace" option of ***Debug+****, however, he's found a bug in the "change memory" routine instead. Put simply, here's the problem.*

For the tracer to run properly, the first three pages of RAM must be buffered, then swapped—before the execution of each instruction during a trace. This is easy enough and causes no trouble, but, if you wish to change a location in pages 0 through 2, the change must be made to the buffers and not to actual memory. The buffers reside at location $B85A.

It would be very easy to change the code of the change memory routine to fix this little problem, but it would cause a great many more problems for the disassembler and memory dumper. The main problem is that, if you're disassembling pages 0-2, you must now look in the buffers for the memory instead of in pages 0-2.

The most obvious fix for Mr. Baugh is to simply add $B85A to the address in pages 0-2 he wishes to alter and change that address. Then the tracer will get the correct memory values, and the problem will never occur again.

I appreciate your sending this problem to me. I did know of this bug when I wrote ***Debug+****, but found it easy to overcome by a little addition. I unfortunately overlooked covering the problem in the article. My apologies.*

Happy Debugging,
Bryan P. Schappel

MAC/68K for the ST. . . Please!

Software development on the ST is slow, at best. Currently, you must create your source with an editor program. Then you save the source and load the assembler or compiler. After all compile errors are eliminated, the file must then be linked into an executable form. When you finally have a successful edit, compile and link, you must load the debugger to work out logic errors.

After three years of MAC/65 on my 6502-based Atari, the above is like reverting to the stone age. In developing my last machine language game on the 130XE using MAC/65, I could convert 40K of source into executable object code in less than 10 seconds! Assembling a program of similar size and complexity on a single-drive ST would take upwards of 45 minutes—assuming no errors!

I would like to see a "MAC/68K super cartridge," using a bank switch technology similar to the MAC/65 cartridge put out by Optimized Systems Software for the 8-bit Atari computers. Why a super ST cartridge? Well, it's not that the ST needs a bank switched ROM for lack of addressing space, but it would provide many plusses:

(1) It provides ease of use. The editor, assembler, linker and debugger programs would be merely a command away.

(2) Cartridge-based software leaves more RAM for larger, in-memory compiles or bigger RAMdisks.

(3) These cartridges provide reliable operation that virtually eliminates the need or desire to make backup copies.

This ST super cartridge concept may be

applied to a "MAC/68K," a more complete and faster ST-BASIC, C compiler, PASCAL, LOTUS clones and scads of other applications software.

We need it. We *want* it for the ST. Write to OSS and other software developers, encouraging them to develop products in this format. The ST has a 128K cartridge port; they should use it.

RAM and disks are cheap, but the ST super cartridge can give us the speed we demand of such a powerful machine.

Matthew J.W. Ratcliff
Ferguson, MO

Correction.

The following lines were missing from the ***Home Inventory*** *program listing in issue 43.*

```
IE 4570 GRAPHICS K0:END
BW 4580 E=PEEK(K195)
WI 4590 IF E=170 THEN 4670
TK 4600 IF E<>138 THEN 4420
LF 4620 POSITION K5,K22:? "TU
   RN PRINTER AND INTERFACE O
   N"
ZH 4630 FOR DELAY=K1 TO 250:N
   EXT DELAY
UE 4640 POSITION K5,K22:? "
   "
BD 4650 POKE K195,K0
```

Our apologies. — *Ed.*

Sound criticism.

I enjoyed James Luczak's article on the sound capabilities of the ST (**ST-Log** issue 2). He is wrong, however, about several points concerning Atari BASIC.

First: I have had no trouble with the computer going to sleep when saving/replacing files longer than 10K. My largest has been a little over 18K, and it save fine.

He's also wrong in telling readers they can't use **ST Writer** to edit their BASIC programs. They can. They merely need to print the file to the disk. This produces a file that BASIC is quite happy with.

Keith Mosher (**8-Bit Blues**) would have been bluer if he had spent $1200 for his Atari as I did in 1979. Tell him not to feel so bad. Pioneers always have it rough, but then, "you pays your money and you takes your chances." And taking chances is what makes life fun. I've never regretted money spent on my Atari. In fact, I've always wished I'd bought a computer sooner; they're a lot more valuable than a car or color TV. Also, tell him it will get worse (I hope)!

Let me close by saying how much I enjoy the magazine. I had been running all over the city buying it whenever I could find it for several years. The inconsistency of the supply here finally forced me to subscribe. I haven't regretted it. Keep up the excellent work.

James F. Dearner Jr., Ph.D.
Oklahoma City, OK

Eliminating the buffer.

In issue 40, a machine language "bubble sort" was presented in the **Micro-Mail** article. As in all exchange sorts, a routine to swap two items in a list was used. This is often accomplished with a temporary buffer to hold one of the items. The following routine performs a swap without such a buffer:

```
        LDY #0
SWITCH2
        LDA (SADR),Y
        EOR (SSADR),Y
        STA (SADR),Y
        LDA (SSADR),Y
        EOR (SADR),Y
        STA (SSADR),Y
        LDA (SADR),Y
        EOR (SSADR),Y
        STA (SADR),Y
        INY
        CPY RLEN
        BCC SWITCH2
```

Mark McLeod
Thornhill, Ontario, Canada

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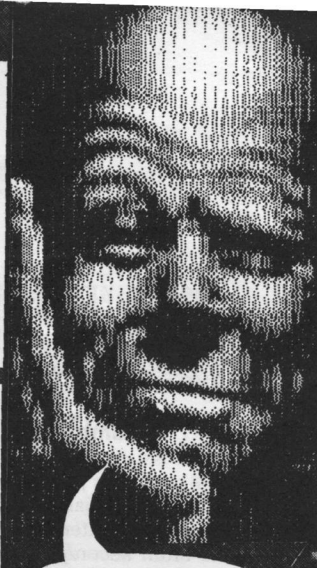

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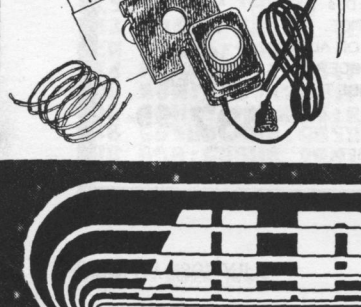

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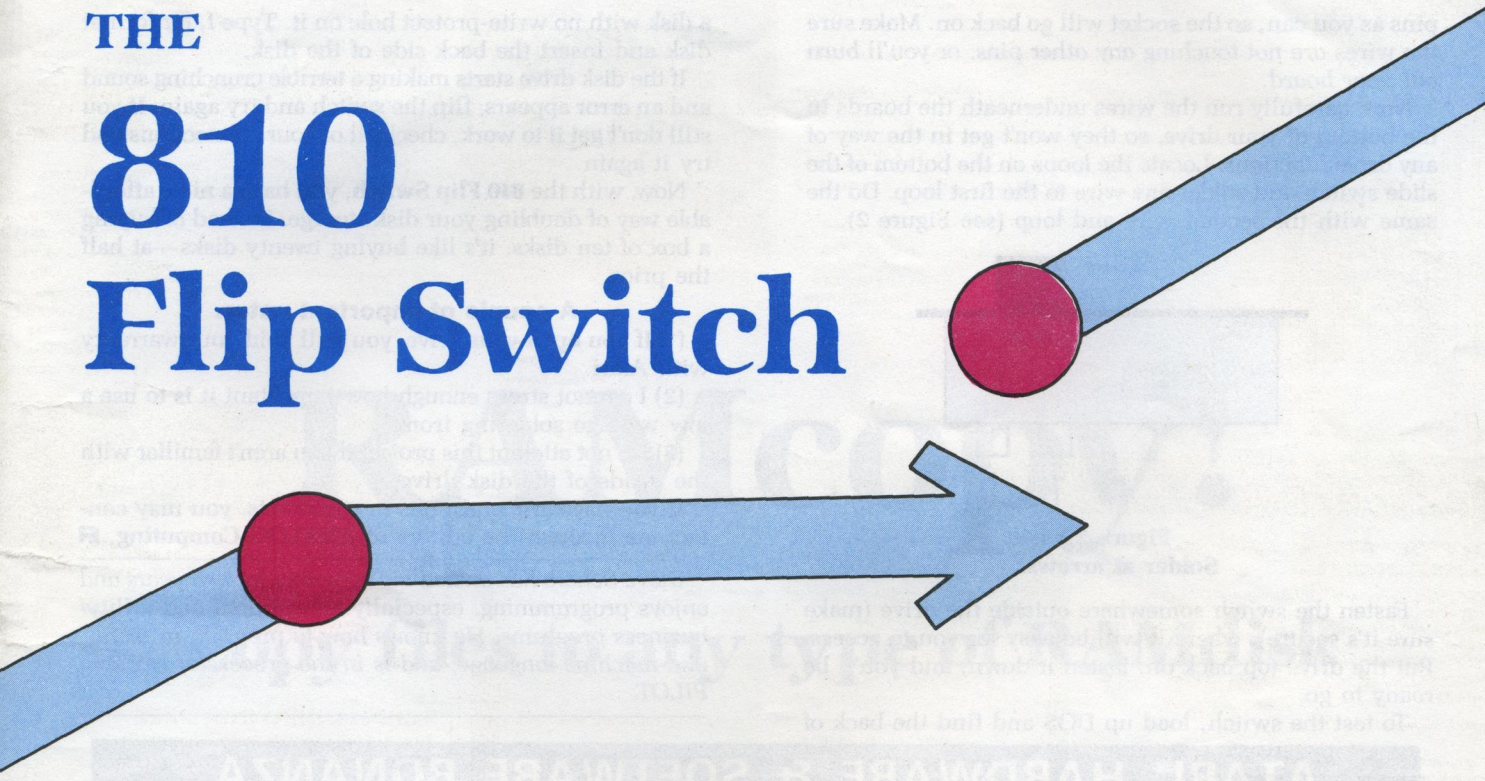


by Steve Schelb

Are you tired of having to punch holes in your disk to make it two-sided? Are you afraid you might snip the disk by accident? If your answer to either of the above was yes, then you're in need of the **810 Flip Switch**.

The **810 Flip Switch** was designed to allow you to write to the back side of your disk *without* punching a hole in it. With about three dollars worth of materials, you'll be able to make the switch, but first you should know how it works.

What's really happening.

When you put a disk in your drive, the drive checks to see if the disk is write-protected, by shining a little beam of light through the write-protect notch to the other side of the disk, where the beam of light is received. If the beam is interrupted, then the disk is write-protected and an error signal is returned to the computer. (For this reason, when you place a write-protect tab on your disk, it should be an opaque color.) The **810 Flip Switch** interrupts this error signal and changes it to an "okay," so the computer can go ahead and write to the disk.

Let's go!

To make the switch, you need a mini slide switch and about 12 inches of insulated copper wire. These parts are available at Radio Shack or any other electronics surplus store.

You'll also need a Phillips head screwdriver and a very, very low wattage soldering iron.

Warning: *It is EXTREMELY important to use a very low wattage soldering iron. If you do not, you run the risk of burning out your board.*

Now that you have the supplies, let's get on with the project.

The first step is to remove the top of your disk drive, by removing the four screws located on the top cover of the drive. Next, you must find the place where you're going to connect the wire (see Figure 1).

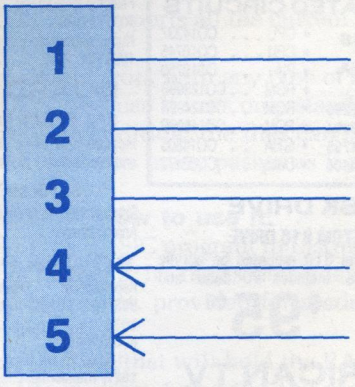


Figure 1.
Solder at arrows.

The pins are labeled 1-5, top to bottom. Now cut the copper wire into two pieces of about 5 inches each. Remove the socket and solder one wire to pin 4 and the other wire to pin 5 (see Figure 1). Solder as close to the back of the

pins as you can, so the socket will go back on. *Make sure the wires are not touching any other pins, or you'll burn out your board.*

Now, carefully run the wires underneath the boards in the bottom of your drive, so they won't get in the way of any drive functions. Locate the loops on the bottom of the slide switch and solder one wire to the first loop. Do the same with the second wire and loop (see Figure 2).

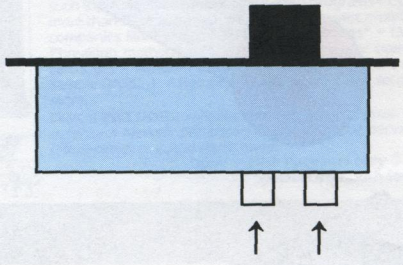


Figure 2.
Solder at arrows.

Fasten the switch somewhere outside the drive (make sure it's *secure*), where it will be easy for you to access. Put the drive top back on, fasten it down, and you'll be ready to go.

To test the switch, load up DOS and find the back of a disk with no write-protect hole on it. Type *I*, for format disk and insert the back side of the disk.

If the disk drive starts making a terrible crunching sound and an error appears, flip the switch and try again. If you still don't get it to work, check all of your connections and try it again.

Now, with the **810 Flip Switch**, you have a nice, affordable way of doubling your disk storage. Instead of buying a box of ten disks, it's like buying twenty disks—at half the price.

A couple of important notes.

(1) If you open your drive, you will void your warranty with Atari.

(2) I cannot stress enough how important it is to use a low wattage soldering iron.

(3) Do not attempt this project if you aren't familiar with the inside of the disk drive.

If you have any questions or comments, you may contact me through the editors of **ANALOG Computing.**

Steve Schelb has owned his computer for two years and enjoys programming, especially educational and utility/business programs. He knows how to program in BASIC and machine language, and is in the process of learning PILOT.

RAMcopy!

Copy files to any type of RAMdisk

by Charles F. Johnson

As I'm sure you know by now, the extra 64K RAM in the Atari 130XE can be used as a RAMdisk—a super-fast simulated disk drive. Atari DOS 2.5 will automatically configure the RAMdisk for you if you have the RAMDISK.COM file on the disk you boot with.

Many people are also performing a simple modification to their 800XLs, to allow a 256K RAMdisk. (You can find out more about this modification on CompuServe in the Atari SIG, or at a local Atari users' group.)

A RAMdisk can dramatically speed up the operation of many different types of programs, especially those which rely heavily on disk access. I've had an Axlon 128K RAMdisk in my trusty old Atari 800 for years; now I don't know what I'd do without it.

If a program (or language) needs to access files from the disk drive often, a good method is to copy those files to the RAMdisk. For example, when I use my AMODEM terminal program, I copy the AUTODIAL.NUM file to the RAMdisk.

This is the file with phone numbers for AMODEM, and it must be accessed almost every time you use the Autodial feature. If this file is read from the RAMdisk, you'll save a considerable amount of time and decrease wear on your disk drive.

Now, wouldn't it be nice to be able to copy your support files to the RAMdisk at boot-up time automatically, instead of having to go to DOS and do the copying manually? Voila—**RAMcopy!**

What RAMcopy! does.

RAMcopy! will create an AUTORUN.SYS file to copy up to sixteen files (which you specify) to the RAMdisk. There are several types of RAMdisks available. The 130XE's is built in, but if you have an Atari 800 you can add extra RAM with memory boards from Axlon or Mosaic.

To use the extra RAM as a simulated disk drive, you need a special DOS. Atari DOS 2.5 automatically sets up the RAMdisk in the 130XE (as stated above); the other RAMdisks usually have their own custom or modified DOS. One DOS that supports all the current RAMdisk options is TOP-DOS 1.5a.

RAMcopy! should work with any type of RAMdisk and any type of DOS, because it uses only standard CIO calls to copy the files. In addition, the files can be any length; **RAMcopy!** will make as many passes as it needs to copy an entire file.

How to use it.

First, type in the BASIC program in Listing 1. You don't have to type in Listing 2. It's the assembly language source code in MAC/65 format, provided for readers interested in assembly language.

Now, insert the disk that will hold the RAMCOPY AUTORUN.SYS file in drive 1 and run the program. **RAMcopy!** will ask you for the drive number of the RAMdisk. If you're using standard DOS 2.5, this will be *8*.

The program then asks you for a filename for the **RAMcopy!** file. If you want it to be called AUTORUN.SYS, type *RETURN*. If you want to give it a different name, enter your filename, including the *D1:* drive specifier.

RAMcopy! *continued*

Now you can enter the names of files you wish to copy to the RAMdisk. Just type the eight-character filename with its three-character extension (if any), no drive specifier. Press RETURN at the > prompt, to finish entering names. Then press RETURN one more time, to write your **RAMcopy!** file to the disk.

If you want to use another autorun file with **RAMcopy!** (e.g., an RS-232 handler), you can append it to **RAMcopy!** using the DOS Copy/with Append option. Most autorun files should be able to be used this way, since **RAMcopy!** doesn't stick around after it's done its job.

Possible applications.

As I stated above, one possible use for **RAMcopy!** is to copy any Autodial number files to the RAMdisk, before running a terminal program like AMODEM. Another example for MAC/65: when you use MAC/65, you can .INCLUDE files of equates and commonly used routines from disk, to save time when you're assembling a program. If you copy those .INCLUDE files to the RAMdisk, the assembly process goes much more quickly. I always copy my SYSTEXT.M65 file to the RAMdisk. This file contains all the standard Atari mnemonic equates as they appear in *Mapping the Atari*.

If you use a word processor with a spelling checker (like **AtariWriter** with **ATSpeller**, or **Writer's Tool**, version 2.2 or later), chances are the dictionary is stored as a disk file. When checking your spelling, the program compares the words in your document against its dictionary and allows you to correct misspellings. The disk drive will usually spin continuously as this takes place.

This is a perfect application for **RAMcopy!** If your word processor loads as an AUTORUN.SYS file, simply append it to the file **RAMcopy!** creates. This can really cut down the wear and tear on your drive.

I'm sure you can come up with even more uses for this program. Have fun!

Charles F. Johnson is a professional musician, currently playing with the band Chicago. He's a self-taught programmer who likes machine language best, because of the total control possible.

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor*, page 17.

Listing 1.
BASIC Listing.

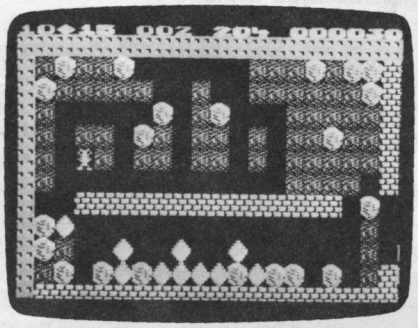
```
DJ 10 DIM FILE$(16*16+1),IN$(16),OUT$(16)
   ,D$(16)
EN 20 GRAPHICS 0:? :? "  RAMCOPY  by Charl
   es F. Johnson"
XO 30 ? :? "  This program enables you to
    copy":? "up to 16 files to the RAMdis
   k at":? "boot-up time."
JX 40 ? :? "What drive number is the RAMd
   isk?":? ">";:OPEN #2,4,0,"K:"
AX 50 GET #2,K:IF K<ASC("1") OR K>ASC("8"
   ) THEN 50
GF 60 ? CHR$(K):DNUM=K
QE 70 ? :? "Press  RETURN  to write to":? "
   D1:AUTORUN.SYS or enter filename"
YX 80 ? :? ">";:INPUT #16;OUT$
FC 90 IF OUT$="" THEN OUT$="D1:AUTORUN.SY
   S":? "↑→";OUT$
WL 130 ? :? "Enter filenames to copy, usi
   ng the":? "format:"
EO 140 ? :? "FILENAME.EXT":? :? "[no driv
   e #,  RETURN  to exit]":?
TR 150 FOR I=0 TO 15
XI 160 ? "#";:IF I<9 THEN ? "0";
CK 170 ? I+1;" >";:INPUT #16;IN$
UO 180 IF IN$="" THEN FNUM=I:I=15:GOTO 21
   0
WR 190 D$="D1:                ":D$(4,LEN(IN$)
   +3)=IN$:D$(16,16)=CHR$(155)
ZL 200 FILE$(I*16+1,I*16+16)=D$
OO 210 NEXT I:FILE$(LEN(FILE$)+1)=CHR$(0)
HA 220 ? :? "Press  RETURN  to write ":? OU
   T$:? :? ">";
TE 240 GET #2,K:IF K<>155 THEN 240
PV 250 ? CHR$(K):CLOSE #2
WK 260 OPEN #1,8,0,OUT$
VP 270 RESTORE 450
SK 280 READ BYTE:IF BYTE=-1 THEN PUT #1,D
   NUM:GOTO 300
MU 290 PUT #1,BYTE:GOTO 280
ZV 300 MEND=12800+LEN(FILE$)-1:MH=INT(MEN
   D/256):ML=MEND-MH*256
GL 310 PUT #1,0:PUT #1,50
SP 320 PUT #1,ML:PUT #1,MH
ZD 330 FOR I=1 TO LEN(FILE$)
DW 340 PUT #1,ASC(FILE$(I))
GD 350 NEXT I
YD 360 PUT #1,226:PUT #1,2:PUT #1,227:PUT
    #1,2
MW 370 PUT #1,0:PUT #1,48
LP 380 CLOSE #1
YA 390 ? :? "  FINISHED!  ":END
CX 450 DATA 255,255,0,48,50,49,169,11,141
   ,66,3,169,33,141,68,3,169,49,141,69,3,
   169,13,141
EV 460 DATA 72,3,162,0,32,86,228,169,0,13
   3,203,169,50,133,204,169,0,141,48,49,1
   41,49,49,160
UM 470 DATA 0,177,203,208,1,96,24,165,203
   ,105,3,141,68,3,165,204,105,0,141,69,3
   ,169,16,141
HI 480 DATA 72,3,169,9,141,66,3,162,0,32,
   86,228,32,19,49,169,3,157,66,3,165,203
   ,157,68
YK 490 DATA 3,165,204,157,69,3,169,4,157,
   74,3,32,86,228,16,3,76,255,48,162,32,1
   69,7,157
VG 500 DATA 66,3,169,0,157,68,3,169,64,15
   7,69,3,169,0,157,72,3,169,48,157,73,3,
   32,86
VP 510 DATA 228,48,7,169,1,141,48,49,208,
   5,169,0,141,48,49,189,72,3,141,46,49,1
   89,73,3
LY 520 DATA 141,47,49,173,48,49,208,3,32,
   19,49,160,1,173,50,49,145,203,173,49,4
   9,208,30,162
JT 530 DATA 48,169,3,157,66,3,165,203,157
   ,68,3,165,204,157,69,3,169,8,157,74,3,
   32,86,228
VW 540 DATA 169,1,141,49,49,162,48,169,11
   ,157,66,3,169,0,157,68,3,169,64,157,69
   ,3,173,46
EA 550 DATA 49,157,72,3,173,47,49,157,73,
   3,32,86,228,173,48,49,240,3,76,109,48,
   32,19,49
GV 560 DATA 32,23,49,24,165,203,105,16,13
   3,203,144,2,230,204,76,33,48,162,32,20
   8,2,162,48,169
BD 570 DATA 12,157,66,3,76,86,228,155,67,
   111,112,121,105,110,103,46,46,46,155,1
   55,0,0,0,0
GQ 580 DATA -1
```

Listing 2.
Assembly listing.

```
          .OPT NO EJECT
;
; ### RAMCOPY ###
;
; (C) 1986
; By Charles F. Johnson and
; Little Green Footballs
;
; This program copies any number
; of files to the Ramdisk.
;
;
; Equates
;
ICCOM     =   $0342
ICBAL     =   $0344
ICBAH     =   $0345
ICBLL     =   $0348
ICBLH     =   $0349
ICAX1     =   $034A
CIOV      =   $E456
;
OPEN      =   $03
CLOSE     =   $0C
GETCHR    =   $07
PUTREC    =   $09
PUTCHR    =   $0B
;
POINTR    =   $CB
NAMES     =   $3200
BUFFER    =   $4000
;
; Start of program
;
          *=  $3000
START
          LDA #PUTCHR ;Print
          STA ICCOM   ;"Copying..."
          LDA # <RDM861
          STA ICBAL
          LDA # >RDM861
          STA ICBAH
          LDA #LEN1
          STA ICBLL
          LDX #0
          JSR CIOV
;
          LDA # <NAMES ;Set zero page
          STA POINTR   ;pointer to start
          LDA # >NAMES ;of filename
          STA POINTR+1 ;array
;
COPYLOOP
          LDA #0       ;Clear flags
          STA OPN1
          STA OPN2
          LDY #0       ;Check for end
          LDA (POINTR),Y ;of filenames
          BNE CONT.1   ;Not end, skip
          RTS
;
CONT.1
          CLC          ;Print filename
          LDA POINTR   ;being copied to
          ADC #3       ;E: (IOCB #0)
          STA ICBAL
          LDA POINTR+1
          ADC #0
          STA ICBAH
          LDA #$10
          STA ICBLL
          LDA #PUTREC
          STA ICCOM
          LDX #$00
          JSR CIOV
;
          JSR CLOSE2   ;Close IOCB2
          LDA #OPEN    ;Open file for
          STA ICCOM,X  ;read access
          LDA POINTR
          STA ICBAL,X
          LDA POINTR+1
          STA ICBAH,X
          LDA #$04
          STA ICAX1,X
          JSR CIOV
          BPL CONT.2   ;No error, skip
          JMP RDNEXT   ;Error, do next
;
CONT.2
          LDX #$20     ;Read file into
          LDA #GETCHR  ;memory starting
          STA ICCOM,X  ;at $4000
          LDA # <BUFFER
          STA ICBAL,X
          LDA # >BUFFER
          STA ICBAH,X
          LDA #$00     ;Read in up to
          STA ICBLL,X  ;12K at a time
          LDA #$30     ;($3000 bytes)
          STA ICBLH,X
          JSR CIOV
;
          BMI EOF      ;End of file...
          LDA #1       ;Set open for
          STA OPN1     ;read flag
          BNE SAVLEN   ;Skip ahead
EOF
          LDA #0       ;End of file,
          STA OPN1     ;clear open flag
;
SAVLEN
          LDA ICBLL,X  ;Save length
          STA LENSAV   ;of file
          LDA ICBLH,X
          STA LENSAV+1
;
          LDA OPN1     ;Open for read?
          BNE CHN6NM   ;Yes, skip
          JSR CLOSE2   ;Close IOCB2
;
CHN6NM
          LDY #1       ;Change drive #
          LDA RDNUM    ;to Ramdisk
          STA (POINTR),Y
;
          LDA OPN2     ;Open for write?
          BNE WRITIT   ;Yes, skip
          LDX #$30     ;Open IOCB #3
          LDA #OPEN    ;to the Ramdisk
          STA ICCOM,X  ;using the same
          LDA POINTR   ;filename
          STA ICBAL,X
          LDA POINTR+1
          STA ICBAH,X
          LDA #$08
          STA ICAX1,X
          JSR CIOV
          LDA #1       ;Set open for
          STA OPN2     ;write flag
;
WRITIT
          LDX #$30     ;Write file to
          LDA #PUTCHR  ;Ramdisk
          STA ICCOM,X
          LDA # <BUFFER ;Set to start
          STA ICBAL,X  ;of buffer
          LDA # >BUFFER
          STA ICBAH,X
          LDA LENSAV   ;Set length of
          STA ICBLL,X  ;data
          LDA LENSAV+1
          STA ICBLH,X
          JSR CIOV
;
          LDA OPN1     ;Open for read?
          BEQ RDNEXT   ;No, skip
          JMP CONT.2   ;Go read more
;
RDNEXT
          JSR CLOSE2   ;Close IOCB #2
          JSR CLOSE3   ;Close IOCB #3
          CLC
          LDA POINTR   ;Set pointer to
          ADC #16      ;next filename
          STA POINTR   ;(16 bytes per
          BCC JCLP     ;name)
          INC POINTR+1
JCLP
          JMP COPYLOOP ;Back to top!
;
; ----------
; SUBROUTINES
; ----------
;
CLOSE2
          LDX #$20     ;Enter here to
          BNE CLOSIT   ;close IOCB #2
CLOSE3
          LDX #$30     ;Here for IOCB #3
CLOSIT
          LDA #$0C     ;Close that IOCB!
          STA ICCOM,X
          JMP CIOV
;
;
RDM861
          .BYTE $9B
          .BYTE "Copying...",$9B,$9B
LEN1      =   $-RDM861
;
LENSAV
          .WORD 0      ;File length
OPN1
          .BYTE 0      ;Read/open flag
OPN2
          .BYTE 0      ;Write/open flag
RDNUM
          .BYTE 0      ;Ramdisk drive #
;
;
          .OPT NO LIST
```

8-BIT NEWS!

SEQUEL TO THE 1984 STRATEGY/ARCADE GAME OF THE YEAR



Electronic Arts has re-released **BoulderDash**, the dig'em game that challenged players everywhere, with each new level presenting a different use of strategy.

This time it's accompanied by its sequel, **Super BoulderDash**, in the package of that name. Rockford, the short, sneaker-clad hero of the game is confronted in this outing with sixteen new caves, into which he must venture to dig out more diamonds.

The **Super BoulderDash** package is retailing for $22.95. It's currently available through Electronic Arts, 1820 Gateway Drive, San Mateo, CA 94404.

CIRCLE #166 ON READER SERVICE CARD

A JOYSTICK TO GET YOUR ATARI REALLY FLYING

The **Microflyte ATC** is a specially designed joystick, to be used with **Flight Simulator II** from SubLogik.

Microflyte cuts down on the amount of keyboard interaction through the use of five buttons and a high-quality joystick controlling the flaps, throttle, ailerons, rudder and elevators. The brakes and gun can also be activated in WWI mode.

Software is included, to instruct the computer in using this device. Housed in a steel case, complete with proper connections.

List is $59.95. Microcube Corp., P.O. Box 488, Leesburg, VA 22075 — (703) 777-7157.

CIRCLE #107 ON READER SERVICE CARD

ATARI BREATHES NEW LIFE INTO 8-BITS

In an April interview with Jack Tramiel, **ANALOG Computing** learned of several major products soon to be announced for the 8-bit line.

Look for a 3½-inch disk drive, probably utilizing a new compatible DOS. A Graphics Environmental Manager (GEM) similar to the ST version will also be marketed.

An Atari-produced mouse is planned, too, along with perhaps the most exciting new product, a vastly improved sound chip. Also, for those still clamoring for more memory, a 256K XE is in the foreseeable future, with a 512K XE on the horizon.

Atari is still counting on third-party software manufacturers to fill the program gap. A large 8-bit market still exists, and these new releases should liven up the lower end of the computer industry significantly, at least for Atari Corp.

TINKERTUNE

A four-track recorder that turns your Atari into a 3-octave mini-organ, with a choice of nine different scales, four envelopes and percussion sound.

Over twenty-five built-in music commands create various harmonies from your own scores. Additional features include the ability to play any single note, or up to a full chorus, with a graphic note editor and on-line help, plus a set of tutorials and manual.

Owners of 130XEs will benefit from features just for that computer, although **Tinkertune** works with any 8-bit of at least 48K.

Retails at $29.95, from Minerva Research, Ltd., 35 Olympia Avenue, Victoria, BC V8V 2N3, Canada — (603) 385-3711.

CIRCLE #168 ON READER SERVICE CARD

THE ELITE PERSONAL ACCOUNTANT

Four separate programs comprise this personal finance recordkeeping system. They provide the user with menu-driven screens to assist with every function.

Elite's **Personal Accountant** lets you define seventy-nine categories, in five areas, with eight fields/record. Full editing, report generating and up to 1300 records on a single disk are also supported.

Balancing and reconciling a checkbook, maintaining records for income, expenses, assets, liabilities and credit cards—all are at your fingertips.

Please note: this latest version is incompatible with Atari Rev. A BASIC.

List is $48.95, from Elite Software, 14897 Interurban Avenue S. #60, Seattle, WA 98168 — (206) 246-5122.

CIRCLE #169 ON READER SERVICE CARD

GIVE YOUR COMPUTER A RAT

Rat: a hi-res mouse, with drawing ability, cursor control. $144.95, Zobian-Controls, P.O. Box 6406, Wyomissing, PA 19610 — (215) 374-5218.

CIRCLE #167 ON READER SERVICE CARD

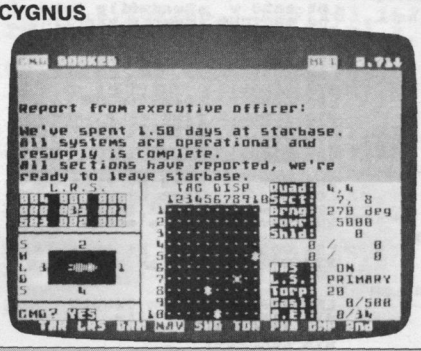
THE LATEST IN SPACE WARFARE, FROM CYGNUS

Star Fleet I — The war begins! A new series of advanced battle action and strategy programs utilizing Cygnus Software's "fleet" concept. Starship simulations feature color animation accompanied by sound effects, music and high-level strategy.

With over twenty commands, attempt to protect the alliance's outer regions from invading warships of the Krellan and Zaldron empires.

Star Fleet I retails for $49.95 and requires 48K. Cygnus, P.O. Box 57825, Webster, TX 77598 — (713) 486-4163.

CIRCLE #170 ON READER SERVICE CARD



AN INTERVIEW WITH:

Russell Smith and Wayne Smith

The men behind the ATR-8000

by David & Sandy Small

In 1983, a new peripheral for the Atari home computers arrived on the market. Soon, word got into the Atari rumor network: "What's this ATR-8000 machine? Who makes it? Does it really run CP/M for the Atari?"

Early that year, I decided to find out for myself what all the commotion was about. I pointed my trusty Camaro north to Arlington, Texas, to the home of Software Publishers (now SWP Microcomputer Products), makers of the ATR-8000. I discussed the machine with them—and ended up buying one.

Other than my 800, the ATR-8000 has been the most useful piece of computer hardware I've ever owned. In the two years since I got the ATR, it's received more use than any other computer I have. (This article was written on it, with ***WordStar****.)*

The ATR-8000 lets Atari users run CP/M programs for a pretty reasonable price. In case you're not familiar with CP/M, a vast library of software exists for this system (and not for the Atari), including some of the most popular programs ever written— ***WordStar****,* ***dBASE II****, and* **SuperCalc**. *If you have an ATR, you can use CP/M software; if you don't, you can't.*

Perhaps another, better way of summing up the situation would be this. . . Remember Atari's CP/M box, which debuted at COMDEX in summer 1984 B.T. ("before Tramiel")? I saw an internal memo circulating around Atari, the gist of which was that they had decided to drop their CP/M module, because they couldn't possibly compete with the ATR-8000.

So who designed this machine? While a number of people had input, two were the main creators. The first, Wayne Smith, designed the hardware; the second, Russell Smith, designed the software.

Russell and Wayne aren't brothers. Both are in their mid-thirties, with a slightly offbeat, relaxed style. They're obviously superbly competent, with that indefinable aura you feel around people who are among the very best in their profession.

Wayne's a hardware man from way back. He worked for many years as a recording engineer, touring with rock bands. He still talks of recording rock shows and meeting Mick Jagger.

Wayne is still remembered at Percom, the Dallas hardware house that made the first double-density Atari disk drive. Wayne designed a wildly successful board, the ***Doubler****, for the TRS-80 to use double density. But Wayne isn't the sort of person who's content to work forever in one place (he has the troubleshooter's personality) and can quickly grow bored with details. He didn't stay at Percom.*

Russell Smith helped design the Big Board Z-80 CP/M machine, a popular computer among hobbyists. Xerox even bought the design rights to the Big Board, changed some things and marketed it as the Xerox 820 computer.

Russell is the finest Z-80 programmer I've ever met. I've written a lot of Z-80 code and, until I saw his source code listings to the ATR-8000, I thought I was pretty good. The closest I've come to Russell in the Atari programming world is John Harris, author of ***Jawbreakers*** *and* ***Frogger****. I learned more tricks and clever ways of doing things from the ATR-8000 code than from any other 8080/Z80 source, period. Now, mix this talent with an easy-to-get-along-with, pleasant person, and you have Russell Smith.*

Russell has no problems sharing his code and explaining how it works. He explains it this way: "The best way to learn programming is by looking at another programmer's code. You can look at it two ways. The polite way is, 'Programming is an art that you need to apprentice at; you need to learn it over a master's shoulder.' The impolite way of saying it is: 'Steal from the best.' "

This irreverence is classic Russell Smith, as are phrases like "I feel so shabby!" (when he finds a coding error) and "hooter" (general noun referring to hardware part).

Our interview took place in the 24-hour restaurant about fifty yards from SWP. Here, during the grim hours in 1982, when nothing was working properly and the debts were mounting up, Wayne and Russell would often repair (at 3 a.m.) for a "coffee and apple pie" break.

DS: *Whose idea was the ATR-8000, originally?*

WS: Originally, it was mine. While working at Percom I'd seen the Atari machines. (This was well before Percom became interested in the Atari.) It seemed to me that what Atari users needed was a double-density disk drive with a printer port.

I talked about it with Russell, and we agreed it was a good idea. Russell, however, suggested that, instead of a simple disk drive, a full CP/M system should be put together— complete with 64K of RAM and 8-inch or 5-inch disks—with what we had learned from the Xerox project.

RS: We got together with John MacFarland (president of Software Publishers) and decided to build the machine. The primary development took place in the last half of 1982, with many sixteen- to twenty-hour days.

One of the more amazing features of the ATR-8000 is what it lacks: a UART. This rather expensive little chip drives a "serial" bus all by itself. However, it is expensive, and remember: any hardware added to construction cost shows up three- to five-fold in the retail cost. So Wayne decided to get by with much cheaper LS chips and let Russell write code to "bitbang," or simulate the UART chip, in software.

RS: It was agony. It was the hardest software design I ever had to do, complete with page boundary restrictions, timed interrupts, special coding for each phase of watching the Atari serial bus...and I know of no one else who has ever written code to bitbang at 19,200 baud. *(Indeed, the designer of the* ***Critical Connection****, Vincent Cates, calls this task "impossible;" he says that "9600 baud is right on the edge.")*

WS: If I had it all to do over again, I probably would have added the UART. It would raise the cost of the ATR today by fifty or so dollars, but it would have saved Russell lots of work. However, my design philosophy has always been to "take parts out until it quits working." Failures caused by nonexistent parts are few.

Wayne constantly pushed for a simpler, easier-to-use product. He felt that "most Atari end-users would not have much expertise with disk drives, and that all the disk drive parameter selection should be automatic." For instance, if you hook two 8-inch drives and two 5-inch drives on the ATR, the ATR figures out by itself which drive is where, and adjusts many internal tables accordingly.

This is an absolutely unique and extremely powerful feature not found on even very expensive CP/M machines, although every now and then you read someone wishing for it. Check out Jerry Pournelle's column in Byte magazine, for instance. Russell produced the code behind these ideas; he and Wayne produced a machine capable of using nearly any standard disk drive on the market. Hook it on and go.

DS: *The disk handler on the ATR is said to be superior to other systems; can you explain why?*

WS: The data separator is the key to the success of a disk system. A good data separator can recover data from marginal disk reads, and a surprising number of disk reads are pretty bad. The bipolar ROM design I put into the ATR is the finest data separator I could design, and better than anything else I know of. It's far superior to phase-locked loop or one-shot designs found on other computers—or in the Atari disk drive. Sometimes we find disks so bad that only an ATR can read them, not even the system that originally wrote them.

About this time, the hardware work for the ATR was completed, and Wayne, perpetual consultant, moved from his steady job there back into freelance consulting (for, among others, Commodore). Russell continued with SWP; he's still there today. SWP is working more on MS-DOS and IBM-related software these days.

DS: *What features are you the most proud of in the ATR?*

WS & RS: The disk controller.

WS: Getting it to run both 8-inch and 5-inch disks on the same cable; that's a very hard thing to do. The ROM data separator is another thing I'm proud of, generally how much value we squeezed from each part—it seems like every part in there has multiple functions. It's a very elegant and solid design.

RS: For me, the automatic disk selection and the CP/M are what I'm the most proud of. The simplified CP/M is also one of my personal favorites.

DS: *We've talked about the strong points of the ATR. What are the weak points?*

RS: The RS-232 port. We found it very difficult to simulate an Atari 850, so, even today, the 850 emulation is not exact. Charlie Marslett's MYDOS comes the closest we can go. But if you have an Atari product which requires an 850, and won't let you load an operating system (such as MYDOS), it won't function. One example might be the Telelink cartridge.

DS: *In summary, how do you feel about the ATR project?*

RS: The hardest job I ever did. It's the last time I'll ever stay up until 3 a.m., in this booth (gestures at the booth we're sitting in) for weeks running. Still, I'm very proud of what we accomplished. I'm a little burned out by the experience.

WS: (smiles) I had a good time. It was nice to work with my friends. That's the most important thing to me. A

David and Sandy Small are both longtime enthusiasts with computer science degrees from Colorado State University. They are the authors of three books and many articles.

BASIC Editor

A new checker for BASIC listings

by Clayton Walnum

BASIC Editor will help you enter BASIC listings from **ANALOG Computing**. To simplify error identification, each program line is evaluated immediately after it's typed—no more checksum listings.

Using the Editor.

Type in Listing 1, then check your work with **Unicheck** (from issue 24, or the updated version in issues 31 and 39). When you're certain the program's correct, save a copy to disk or cassette.

Take a look at one of the BASIC listings in this issue (*not* the one for this program). Each line is preceded by a two-letter code. This is the checksum for that line; it's not part of the program.

To enter a listing from the magazine, run the **BASIC Editor**. Your screen will be divided into two "windows." The upper one is where checksum codes and program lines are entered. The lower window will display each line as it's processed and give you various prompts and messages.

When the program's waiting for input, the cursor will appear next to the code prompt. Type the code preceding the line you're on and press RETURN. The cursor will go to the left margin. Enter the program line and press RETURN.

After your entry is done, the **Editor** will process the line. If typed properly, it'll be placed in the computer's memory. If you made an error in the code or the line, you'll hear a buzzer and the screen will turn red. Check your work in the lower window. When you find a mistake, re-enter both the code and the line.

You may leave the **Editor** at any time, by entering (at the code prompt) either *Q* for quit or *B* for BASIC. If you type *Q*, the **Editor** will ask if you wish to save to disk or cassette. Follow the prompts to save your work.

If you type *B*, you'll immediately return to BASIC. Enter *LIST* to review your work. Note that Line 0 and Lines 32602 through 32694 are the **Editor** program. Your lines fall between. To return to the **Editor**, type *RUN*. The B command is handy if you accidently press the CLEAR key, or somehow change the screen display. Return to BASIC and rerun the program.

If the program you're entering is quite long, you can take a break. To stop, type *Q* for the code entry, then follow the instructions for saving your work. When you're ready to begin again, load the **Editor**, then retrieve your work with the command *ENTER "D:FILENAME.EXT"* where *FILENAME.EXT* is the filename you saved the file under. If you're using a cassette, substitute *ENTER "C:"* for the above.

If you've forgotten where you left off, list the program to the screen. The last line you typed will be immediately before Line 32602.

In large programs, there may not be enough memory for both the **Editor** and the program you're typing. In this case, type the listing in two parts, saving each under a different filename, then combine them as instructed below.

When you've finished a listing, save it (*Q*), then, when the **Editor** has returned you to BASIC, type *NEW* and press RETURN. You may load the finished program with the ENTER command and run it. If you'd like the program to load faster, resave it with the SAVE command.

If the program was typed in two portions, the files must be combined before you can run it. To do this, clear memory with *NEW*, then ENTER both segments into memory and resave the combined result.

You may find that, after typing a program, it still won't run. There are two likely causes.

First, maybe you're not following the instructions properly. Always read the article accompanying a program before attempting to run it, or you could have upsetting results.

Finally, though you can trust **BASIC Editor** to catch typos, it can't tell if you've skipped lines. If your program won't run, make sure you typed *all* of it.

One last word. Some find it a nasty chore to type REM lines. I don't condone their omission, since they may be referenced within the program (a bad practice, but not unheard of). If you want to take chances, **BASIC Editor** will comply.

Listing 1.
BASIC listing.

```
0 GOTO 32602
32602 DIM L$(114),C1$(2),C2$(2),B$(38)
,A$(1)
32604 B$(1)=" ":B$(38)=" ":B$(2)=B$
32606 RETRN=155:BACK5P=126:ESCAPE=27
32608 GRAPHICS 0:POKE 766,0:POKE 752,0
:POKE 82,1:DL=PEEK(560)+256*PEEK(561)+
4
32610 POKE DL-1,70:POKE DL+2,6:POKE DL
+3,112:POKE DL+4,112:POKE DL+13,112:PO
KE DL+14,112:POKE DL+23,112
32612 POKE DL+24,65:POKE DL+25,PEEK(56
0):POKE DL+26,PEEK(561):POKE 559,0
32614 POSITION 20,0:? "analog basic ed
itor":POSITION 0,1:? "                TYP
ING WINDOW
32616 POSITION 0,5:? "                MESS
AGE WINDOW                ":POSITION 1,1
6:? "Last line entered:";LL
32617 POSITION 27,16:? "LAST CODE:";C1
$
32618 POKE 559,34:POSITION 6,3:? " ";C
HR$(30);:L$="":L1=2:GOSUB 32648:C1$=L$
32620 IF C1$="Q" THEN 32674
32621 IF C1$="B" THEN GRAPHICS 0:END
32622 POSITION 1,5:? " ";CHR$(30);:L1=
114:GOSUB 32648:F=0:CHK5UM=0:POKE 766,
1
32624 POKE 752,1:FOR X=11 TO 13:POSITI
ON 1,X:? B$:NEXT X:POSITION 1,11
32625 FOR X=LEN(L$) TO 1 STEP -1:IF L$
(X,X)=" " THEN NEXT X
32626 POP :L$=L$(1,X)
32627 FOR X=1 TO LEN(L$):F=F+1:CHK5UM=
CHK5UM+F*ASC(L$(X))
32628 IF X=39 THEN POSITION 1,12
32630 IF X=77 THEN POSITION 1,13
32632 ? L$(X,X);:NEXT X
32634 CHK=CHK5UM-(INT(CHK5UM/676)*676)
:HI=INT(CHK/26):LO=CHK-(HI*26):C2$(1)=
CHR$(HI+65):C2$(2)=CHR$(LO+65)
32636 POKE 766,0:IF C1$<>C2$ THEN 3264
2
32638 GRAPHICS 0:POKE 559,0:POKE 766,1
:POSITION 1,3:? L$:POSITION 1,8:? "CON
T":POSITION 1,0:POKE 842,13:STOP
32640 POKE 842,12:LL=VAL(L$):GOTO 3260
8
32642 POKE 710,50:SOUND 0,75,12,8:FOR
X=1 TO 40:NEXT X:SOUND 0,0,0,0
32644 POSITION 6,3:? "  ";:L$=""
32646 FOR X=5 TO 7:POSITION 1,X:? B$:N
EXT X:POKE 752,0:POSITION 37,16:? C1$:
GOTO 32618
32648 L=0
32650 GOSUB 32690:IF (A=RETRN OR A=BAC
K5P) AND L=0 THEN 32650
32652 IF A=RETRN THEN RETURN
32654 IF A=BACK5P THEN 32666
32656 IF A=ESCAPE THEN ? CHR$(A);:GOTO
 32650
32658 L=L+1:IF L>L1 THEN RETURN
32660 IF L>38 AND L<76 THEN POSITION L
-INT(L/38)*38,6
32662 IF L>76 AND L<114 THEN POSITION
L-INT(L/38)*38,7
32664 L$(L,L)=CHR$(A):? CHR$(A);:GOTO
32650
32666 L=L-1:IF L=37 THEN POSITION 38,5
:? " ";CHR$(30);:GOTO 32672
32668 IF L=75 THEN POSITION 38,6:? " "
;CHR$(30);:GOTO 32672
32670 ? CHR$(BACK5P);:IF L=0 THEN L$="
":GOTO 32650
32672 L$=L$(1,LEN(L$)-1):GOTO 32650
32674 POSITION 5,12:? "(A)SSETTE OR (D)IS
K";:INPUT L$:IF L$<>"C" AND L$<>"D" TH
EN 32674
32676 IF L$="D" THEN 32684
32678 POSITION 1,12:? "Ready cassette
and press RETURN":GOSUB 32690
32680 LIST "C:",1,32600:GOTO 32688
32684 POSITION 0,12:? "FILENAME (D:FIL
ENAME.EXT)    ";CHR$(30);CHR$(30);CHR$(
30);:INPUT L$
32685 TRAP 32686:OPEN #1,4,0,L$:CLOSE
#1:GOTO 32692
32686 LIST L$,1,32600
32688 GRAPHICS 0:END
32690 OPEN #1,4,0,"K:":GET #1,A:CLOSE
#1:RETURN
32692 ? "(F)ILE ALREADY EXISTS!";? "ERA
SE IT";:INPUT A$:TRAP 32692:IF A$="Y"
THEN 32686
32694 FOR X=12 TO 15:POSITION 0,X:? B$
:NEXT X:GOTO 32684
```

CHECKSUM DATA.
(see beginning of article)

```
0 DATA 631,516,471,883,337,442,749,774
,786,259,213,171,723,448,136,7539
32625 DATA 226,666,338,98,79,900,32,53
6,199,881,116,937,853,303,924,7088
32652 DATA 905,856,492,114,614,686,323
,698,1,39,72,489,146,339,234,6008
32684 DATA 964,121,560,976,936,38,191,
3786
```

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THE 8-BIT PARALLEL INTERFACE

by S. Ravi

This is a spin-off from various articles I've read describing parallel interfaces that use two of the joystick ports on Atari computers. All the interfaces I've seen allow only 7 bits of data, using the remaining PIA (the 6520 Peripheral Interface Adapter) bit for handshaking. This is also true of Paul Swanson's printer interface article (**ANALOG Computing**'s issue 16).

For those of you who need a full 8-bit interface, here's a simple hardware project that'll give you an almost full-blown parallel interface, with eight data lines and four handshaking lines. I'm not going into the various ways in which such an interface can be used, but I've worked out an almost complete IEEE-488 interface and also use it (along with an Alien Voicebox) to run a telephone message delivery setup. Intrigued? Read on. . .

How it works.

The basic idea is very simple. The PIA chip has two 8-bit ports, PORTA (port A) and PORTB (port B), accessible through the computer's operating system (OS). The joystick ports are connected to PORTA on the PIA chip, and the 8 bits of PORTA are split up into 4 bits each for the two joystick ports.

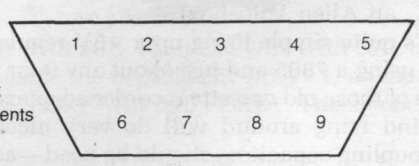
The older 400/800 machines used all 16 bits on the PIA ports, split up among four joystick ports. However, we'll confine our discussion to PORTA only, in order to keep it valid for the new XL computers.

Each of the joystick ports also has an input-only line that normally comes from the trigger on the joystick. These lines don't go to the PIA, but head elsewhere in the machine. Because any handshaking protocol must involve outgoing control lines, it's clear that some of the 8 PIA bits must be reserved for this purpose.

This means that, for any 8-bit data transfer, all 8 bits cannot go out of the PIA port A at the same time. Fortunately, they don't have to. An 8-bit word can be split up into two 4-bit nibbles, which can be sent out one at a time through one half of the PIA port.

The other half can be used to suitably latch the two halves, so that the final output is a full 8-bit word. The latching needs only 2 of the 4 remaining bits of PORTA, leaving the other 2 bits free for outgoing handshaking signals. (Actually, 1 bit is sufficient for the latching, but using 2 is slightly better). The two trigger inputs can be used for incoming signals, giving an 8-bit data bus with a 4-bit control bus.

The schematic for the interface is shown in Figure 1. Two 74LS75 4-bit latches are used to store the two halves of the 8-bit word as they come out of the joystick port 1 (PIA PORTA bits 0-3). Bits 4 and 5 of PORTA, available at joystick port 2, are used to alternately enable the latches to store the data, and bits 6 and 7 are available for handshaking.



Joystick port
Pin assignments

1-4	Data (PIA PORTA)
5	Ignore (no connection)
6	*Trigger input*
7	+5V (ignore)
8	Ground
9	Ignore

IC1: 74LS244 Octal noninverting buffer
pin 20 Vcc (+5V), pin 10 ground

IC2,3: 74LS75 Quad D Flipflops
pin 5 Vcc (+5V), pin 12 ground

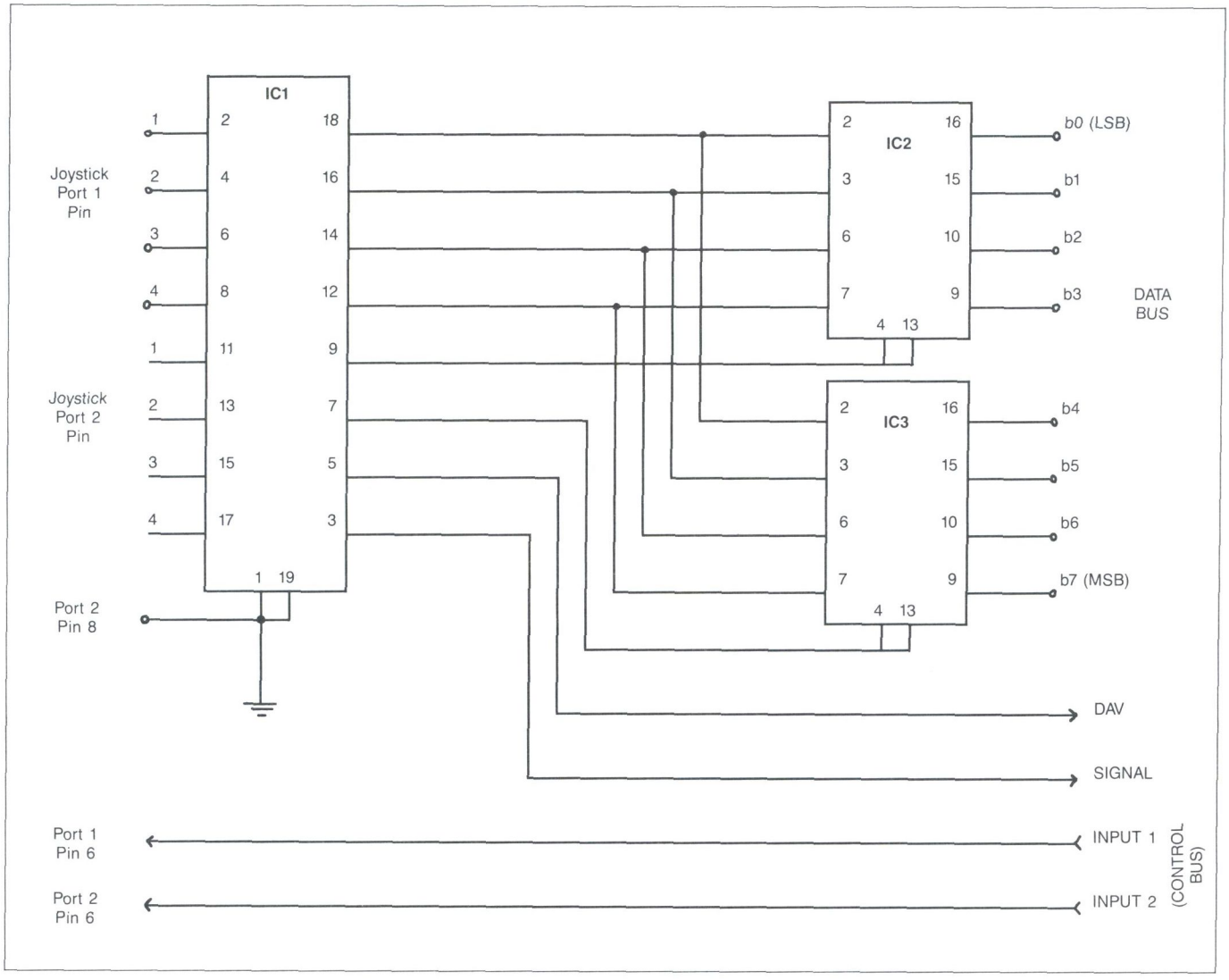


Figure 1.
Circuit schematic and pin connections.

A 74LLS244 octal buffer is used to buffer the outputs of the joystick ports. The 74LS244 may use up quite a bit of current, so it's not advisable to use the +5V available at the joystick ports. The current capacity there is only 20ma, and it may prove bothersome if you have something else on the serial bus that draws power from the computer (e.g., an Alien Voicebox).

It's quite simple to rig up a +5V regulated power supply, using a 7805 and just about any 9- or 12-volt adapter. One of those old cassette recorder adapters that you usually find lying around will do very nicely. A couple of decoupling capacitors should be used—as a general rule. Figure 2 shows a simple schematic, in case you want to build a power supply from scratch.

Programming the interface.

We now come to the interesting part of the story: making the interface work. As you've probably gathered from the above discussion, some bit manipulation is required to do the job. This leads to one immediate problem, namely that BASIC by itself just won't do. (As it turns out, BASIC is too slow for most purposes, anyway, so it doesn't really matter.)

Assembly language is, of course, the best, but—in the interests of general sanity—I've gone through an example below, describing with words and figures the various steps that need to be followed.

Being a recent convert to Action!, I refuse to use assembly language any longer, so the description is followed by a couple of Action! procedures that will do the job. Between these, you ought to get the general picture well enough to program the interface any way you want to. That, believe me, is where half the fun lies.

The first step is to set up PORTA for output. The port is set up for input by the OS during initialization, so your

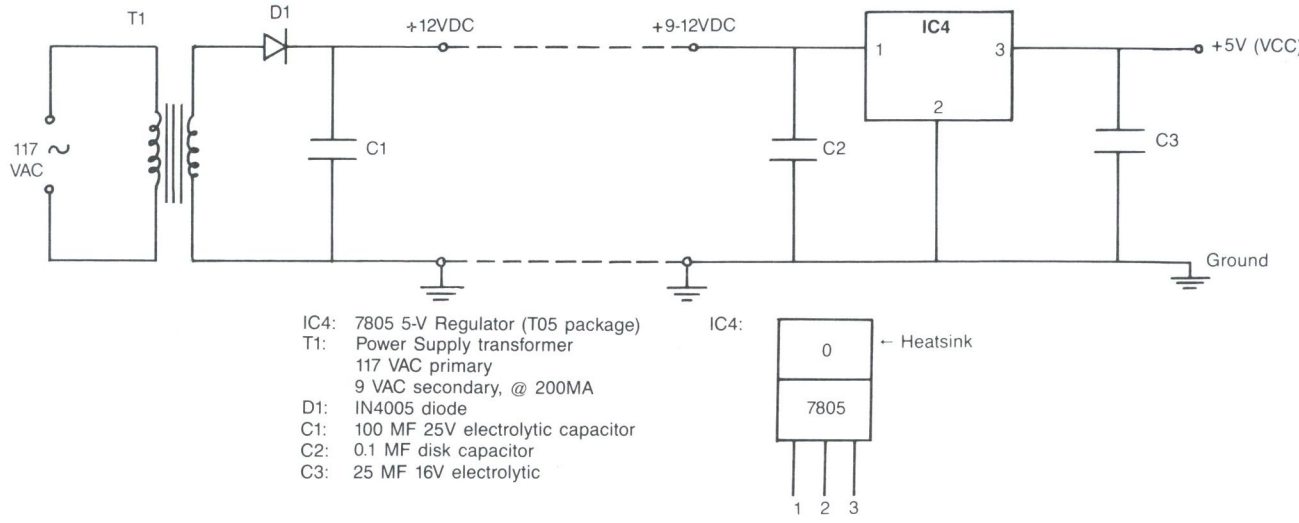


Figure 2.
Power supply.

program will have to reconfigure it. This can be done very simply, as follows:

(1) POKE *$38* into register PACTL at $D302.

(2) POKE *$FF* into register PORTA at $D300.

(3) POKE *$3C* into register PACTL at $D302.

At this stage, PORTA is ready for output, and any byte put into it will appear at the joystick ports. Now, let's see how to break up a byte and latch its two halves separately.

As shown in Figure 3 below, the four Least Significant Bits (LSBs) of the PIA PORTA (address $D300) appear at pins 1-4 of joystick port 1. The four Most Significant Bits (MSBs) appear at pins 1-4 of joystick port 2. As you can see, bits 0-3 are used for the data, bit 4 to latch the LSBs, bit 5 to latch the MSBs, bit 6 as a DAtaValid signal, and bit 7 as another output signal.

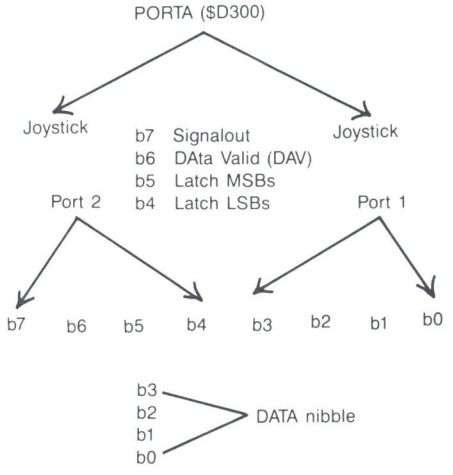


Figure 3.
PORTA/joystick pin assignments.

Accordingly, these bits have to be manipulated to do the required actions. In the discussion that follows, AND and OR operations described are strictly bit-wise operations. The figures show the state of the output byte as the various operations are performed.

Assume the data byte to be output is:

(MSB) d7 d5 d4 d3 d2 d1 d0 (LSB)

(1) Assume a working byte VAR. All surgery will be done on this byte.

(2) Copy the data byte into VAR and AND it with *$0F*.

0 0 0 0 d3 d2 d1 d0

(3) OR VAR with *$20* to put a *0* in bit 4 and a *1* in bit 5, thus enabling the LSB latch and disabling the MSB latch. Note that these latches work on an active low. Note also that the DAV bit, bit 6, is *0*.

0 0 1 0 d3 d2 d1 d0

(4) POKE VAR into PORTA; this will latch the LSBs.

(5) OR VAR with *$30* and POKE in PORTA. This disables the LSB latch, while keeping the LSB bits the same. We do this because it's desirable *not* to change the inputs to the latch while disabling it.

0 0 1 1 d3 d2 d1 d0

(6) Copy the data byte into VAR again and do four right shifts on VAR, to get the MSBs of the data byte into the LSB positions of VAR.

0 0 0 0d7 d6 d5 d4

(7) AND VAR with *$0F*. Then OR VAR with *$10*, to set bit 5 = 0, and enable the MSB latch. Bit 4 = 1, so the LSB latch is disabled. POKE VAR into PORTA. This latches the MSBs.

0 0 0 1 d7 d6 d5 d4

(8) OR VAR with *$70* to keep MSBs intact, then set bits 4 and 5 to *1* to disable both latches. Bit 6 is set to *1* to tell whatever's sitting on the bus that the data is now valid.

Now, if the signal on the outgoing control line, bit 7, is to be *0*, POKE VAR into PORTA. If the signal is to be a

1, OR VAR with *$80*, then POKE VAR into PORTA.

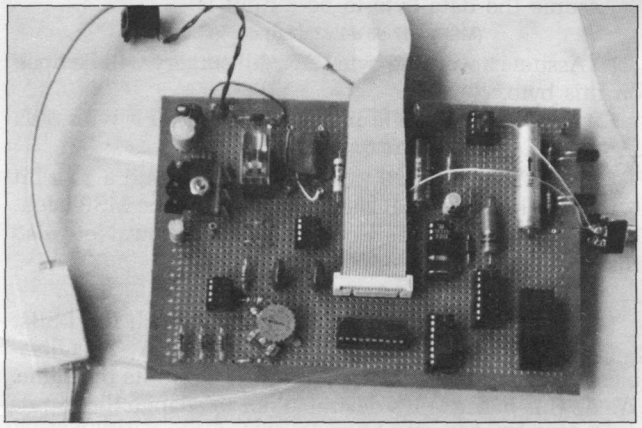
```
x 1 1 1 d7 d6 d5 d4
^ ^
||
| DAV
OUTSIGNAL
```

To read incoming signals, you have to know that they're coming into pin 6 (the trigger input pins) on each joystick port. Therefore, all you have to do is the equivalent of a BASIC STRIG function.

The trigger values are available in memory locations $D010 (53264) and $D011 (53265) for joystick ports 1 and 2, respectively. The values will be: *1* if a high signal is present at the trigger pin, and *0* if a low signal is present. No special stuff here, just a straightforward read on the locations will tell you the logic level of the incoming signal.

That's all there is to it. Simple, isn't it? Incidentally, it's a fairly straightforward matter to build this right into Paul Swanson's printer interface software, to get an 8-bit printer interface. The addition of a few lines of machine code should do the trick. (Hint: all you really need to modify is the PUTBYTE subroutine.)

Well, I *hope* that's all that necessary. This isn't a very big project, so extensive construction details aren't really needed. I built the interface (along with some other stuff) on a Vectorboard, choosing to wire wrap, rather than make a Printed Circuit Board (PCB) for it.



I used a 20-wire ribbon cable, with two D-9 miniature female plugs on one end to go into the joystick ports, and a 20-pin connector at the other end to put onto the wire-wrap board. The TTL chips can be clearly made out on the picture above, which will give you some idea of how I laid the circuit out.

The heat sink on the 7805 can be made out, too, and —before you start getting confused—I must point out that the rest of the stuff on the board is my interface to the phone.

The empty Dual In-Line Package (DIP) socket is used when I hook up my interface to something else. I then use a DIP connector with a ribbon cable leading out. The parts needed are all easily available; I ordered everything at one shot from my Jameco catalog, but you can also pick up all the components at your local Radio Shack.

That's about it. Hope you have a fun time trying to wire up the house. If anybody has any questions, I'd be happy to help in any way. Contact me in care of **ANALOG Computing**, P. O. Box 23, Worcester, MA 01603.

S. Ravi is a graduate student working towards an M.S. degree in Electrical Engineering at Duke University. He's had an 1200XL for about 1½ years now, and is interested in hardware/software projects, and writing and using telecommunications programs.

Listing 1.
Action! listing.

```
PROC Configure( BYTE inout)
     ;sets PORTA for output if
     ;inout=$255, for input if
     ;inout=$0

     Poke(54018,56)
     Poke(54016,inout)
     Poke(54018,60)
RETURN

PROC OutByte( BYTE data,outsignal)
     ;puts out 'data' byte
     ;puts DAtaValid on PORTA
     ;bit 7 & 'outsignal' on
     ;PORTA bit 8 when both
     ;nibbles have been latched
     ;outsignal must =0 for Lo
     ;or =128 for Hi

BYTE var
CARD porta=[54016]
                    ;latching LSBs
var=data&$0F
var==%$20
Poke(porta,var)
      ;PrintF("%H%E",var)
var==%$30
Poke(porta,var)
      ;PrintF("%H%E",var)
                  ;tackling MSBs now
var=data RSH 4
var==%$10
poke(porta,var)
      ;PrintF("%H%E",var)
var==%$70
var==%outsignal
Poke(porta,var)
      ;PrintF("%H%E",var)
RETURN

PROC main()
 BYTE data,outsignal=[128],END=[0]

WHILE END=0
DO
 Put('?):data=InputB()
 OutByte(data,outsignal)
OD
RETURN

;NOTE: PROC main & the PrintF's in
;      PROC OutByte can be used to
;      follow the workings of the
;      PROC.  Just remove the ';'s
;      from the PrintF statements.
```

D:CHECK in Action!

by Steven Yates

Because of the nature of the Action! system, typing checkers like **D:CHECK** (issue 16) cannot be implemented. A lack of line numbers leaves no way to communicate to the user where typos are. Moreover, the flexibility in the source program's form makes finding errors difficult—without requiring the reader to type the program *exactly* as it appears.

D:CHECK in Action! gives you a program (D:CHECK.ACT) which works with the Action! system to provide interactive checking and correcting of typing errors. Instead of printing a list of numbers which you compare to a similar list in the magazine, this Action! version finds the errors and puts you back into the editor at their approximate locations in your source.

This extra power takes some more typing on your part. If you look at Listing 1, you'll notice the first few lines contain a set of numbers headed "CHECKSUM DATA." All other Action! programs printed in **ANALOG Computing** from now on will have similar lines at the start of their listings.

These lines give **D:CHECK in Action!** its power. The program generates numbers from what you've typed and compares them to the numbers here. If there are any discrepancies, it will then help you to find the problems, so they can be corrected.

When typing in the listing, these lines must be typed in *exactly as printed*.

There are square brackets at the beginning and end of the checksum list, and one space between each value. All values are two-digit numbers and must be typed as such. After these lines are typed, the remainder of the program can be entered in any way you wish.

You may type it as listed, or you may decide not to include the blank lines inserted for easier reading. You may add *more* blank lines, if you like. You may combine short lines to form one line with a space or more between the originals; or you could break long lines into two or more lines, so everything fits on the screen.

The program ignores spaces, so you don't need to indent lines, and you can add spaces if it's more readable for you. **D:CHECK in Action!** also ignores comments, so you can leave them out and save some typing, or add some of your own.

This flexibility of program form is basic to the Action! system which **D:CHECK in Action!** preserves. Remember, any modifications to the form of the program may make it more difficult to compare to the original if there's a problem—so use your judgement. Anything between quotes must be typed exactly as shown; including spaces, and upper and lower case letters.

The latter present another problem. Action! allows you to type in whatever case you want, but also offers the option of being case sensitive. This lets you have two or more variables of the same name, with different letters in upper case to distinguish them.

D:CHECK in Action! offers the same option. If the article doesn't specify otherwise, you may use either case. If the program must be compiled with the case-sensitive option, the words *Case Sensitive* will appear with the checksum data. You must type all letters in the case in which they're listed. Because it must be able to handle other case-sensitive programs, **D:CHECK in Action!** must also be able

to compile under this option, so remember to type each letter properly.

Using it.

First, type in Listing 1 and save it. Because the program can't check itself until it compiles successfully, you must be careful keying it in. Don't forget that the program is case sensitive.

Try compiling. If there are any compile errors, fix them as you normally would. Once **D:CHECK in Action!** compiles, run it. If the program says there are no problems, you're ready to use it for other programs printed in **ANALOG Computing**.

If it tells you there are problems, follow the directions below. The program cannot guarantee the locations it gives for errors in its own source file, because typing errors may be causing problems with its error-locating routines. Be sure to save a final copy after you've fixed all the errors, as *D:CHECK.ACT* (cassette users may save it as *C:*).

To check another program containing the checksum numbers, type it in and save a copy. With the newly typed program still in memory, go to the monitor. If the article says the program is case sensitive, use the monitor option command to set it for this. Otherwise set this option to "no."

When this is done, type *R"D:CHECK.ACT"* (cassette users, type *R"C:*). The program will load from disk, compile, then run. It must be uncompiled when stored, because it needs to relocate itself for each program checked.

If the program being checked isn't too large (about 100 disk sectors), time can be saved by loading D:CHECK.ACT into the second editing window. It can then be compiled and run without accessing the disk each time.

To do this, type in the program to be checked and save it. Enter window 2 by pressing CTRL-SHIFT-2, read D:CHECK.ACT, then enter the monitor and use *C* and *R* to compile and run.

To rerun D:CHECK.ACT after a problem's corrected, just enter window 2 (CTRL-SHIFT-2) before returning to the monitor, then compile and run as before. If you don't move the cursor to window 2 before entering the monitor, Action! will attempt to compile the program in window 1, and D:CHECK.ACT won't be executed.

If you get an out-of-memory error when loading or compiling D:CHECK.ACT, make sure your source program is saved and use the monitor boot command to reset Action! Then reload your program and run D:CHECK.ACT from disk or tape as explained previously.

If the D:CHECK.ACT program says there are no problems, you should be able to compile the program. If it does find a problem, it will display the checksum lines onscreen, with one number highlighted. It will ask if that sum was typed correctly.

Check the highlighted value against the magazine listing. If they don't match, press *N* in response to its question. Return to the editor. The cursor will be on the first digit of the incorrect sum. Retype the sum, return to the monitor, and repeat the command to run D:CHECK.ACT.

If the highlighted sum matches that printed in the magazine, press *Y*. The program will tell you to return to the editor and check the line containing the cursor, plus a certain number of lines following it. The number of lines to check depends mostly on line length, and blank lines aren't counted.

Find any mistakes you can on these lines, correct them, return to the monitor, and rerun D:CHECK.ACT. Once you've found all errors and are given a clean check, save a final copy, then compile and run it, according to the directions in the related article.

It's possible that a program which checks out all right won't compile. If this happens, return to the editor and make sure you didn't insert or delete a space, which would confuse the compiler. Check the word the cursor's on and change it to look exactly as it does in the magazine. This should be the only thing to cause a problem in a properly checked program.

Now you should be able to enjoy printed Action! programs without being frustrated by cryptic compiler errors, or having a program compile and not perform as expected. If you remember the difference **D:CHECK** made in the time it took to get a BASIC program running, you'll type in **D:CHECK in Action!** as soon as possible. A

(Listing starts on next page)

Steven Yates has owned his Atari 400 (with 48K and an external keyboard) for three and one-half years. He has an associate's degree in data processing and is currently pursuing a bachelor's in electrical engineering.

Listing 1.
Action! listing.

```
;  CHECK.ACT
; Steven Yates
;   12/02/85

;       CHECKSUM DATA
;[9E 43 B1 2D 74 DD 67 7C
; 13 30 E5 8F 7A CA C9 77
; AD AE 96 44 B0 F8 99 39
; EB ]

BYTE StartChar,CurChar,Count,X,
     Flag=[0],Character,Sum,ISum,
     Product,Key,Case=[0],Column=1152,
     Sensitive=[1],Lines,SumLine,
     WrongLine,Segment=[0],String=[1],
     SubString=[2],Space=[32]
CARD StartLine,Line=1160,
     FirstLine=1156
BYTE ARRAY Sums(256)
CARD ARRAY SumLines(32)
BYTE POINTER Length
CARD POINTER CurLine,NextLine,
             WrongSum

DEFINE is="=", not="<>", Done="Flag=1"

PROC End_Of_Line()

  DO
    CurLine=NextLine^
    CurChar=7
    Length=CurLine+6
    NextLine=CurLine+4
    IF CurLine=0 THEN
      EXIT
    FI
    UNTIL Length^>0
  OD

RETURN

PROC Quotes()

  IF Segment is String THEN
    Segment=0
  ELSE
    Segment=String
  FI

RETURN

PROC Ignore()

  X==-1
  Count==-1
  Character=0

RETURN

PROC Check_Line()

  Character=Peek(CurLine+CurChar)
  IF Segment is SubString THEN
    Segment=0
  ELSEIF Character='" THEN
    Quotes()
  ELSEIF Segment is String THEN
  ELSEIF Character='' THEN
    Segment is SubString
  ELSEIF Character is Space THEN
    Ignore()
  ELSEIF Character='; THEN
    Ignore()
    CurChar=Length^+6
  ELSEIF Case not Sensitive AND
         Character>96 AND
         Character<123 THEN
    Character==-32
  FI
  Product=(X*Character) RSH Case
  Sum==+Product
  CurChar==+1
  X==+1
  IF X=4 THEN
    X=1
  FI

RETURN

PROC Find_Sums()

  DO
    DO
      Character=Peek(CurLine+CurChar)
      IF Character not '; THEN
        End_Of_Line()
      ELSEIF Length^>1 THEN
        EXIT
```

```
      ELSE
        End_Of_Line()
      FI
      IF CurLine=0 THEN
        Done
        EXIT
      FI
    OD
    CurChar=8
    Character=Peek(CurLine+CurChar)
    IF Character is '[ THEN
      EXIT
    FI
    IF Done THEN
      PrintE("Listing does not")
      PrintE("contain checksums.")
      PutE()
      PrintE("Cannot CHECK!")
      EXIT
    FI
    End_Of_Line()
  OD

RETURN

PROC Get_Sums()

 BYTE I
 BYTE ARRAY Hex(1)

  Find_Sums()
  SumLine=0
  DO
    IF Done THEN
      EXIT
    FI
    SumLines(SumLine)=CurLine
    CurChar=9
    FOR ISum=0 TO 7 DO
      FOR I=0 TO 1 DO
        Hex(I)=Peek(CurLine+CurChar+I)
        IF Hex(I)>='A THEN
          Hex(I)==-('A-'9-1)
        FI
        Hex(I)==-'0
      OD
      Sum=(Hex(0) LSH 4)+Hex(1)
      Sums(SumLine*8+ISum)=Sum
      IF Peek(CurLine+CurChar+3) is ']
       THEN
        Done
        EXIT
      FI
      CurChar==+3
    OD
    End_Of_Line()
    IF Done THEN
      Flag=0
      EXIT
    FI
    SumLine==+1
  OD

RETURN

PROC Mistyped()

  Line=StartLine
  Column=StartChar
  PrintE("Return to editor and check")
  Print("the ")
  PrintB(Lines)
  PrintE(" lines following the line")
  Print("the cursor is on for a ")
  PrintE("typo.")

RETURN

PROC Bad_Sum()

 BYTE I

  IF Case is Sensitive THEN
    Print("If article does not ")
    PrintE("specify")
    Print("case sensitive, use ")
    PrintE("option")
    Print("command to set this to ")
    PrintE("no.")
    PutE()
    PutE()
  FI
  WrongLine=ISum/8
  Sum=ISum&7
  WrongSum=SumLines(WrongLine)+9+Sum*3
  WrongSum^==%$8080
  FOR I=0 TO SumLine DO
    PrintE(SumLines(I)+6)
  OD
  WrongSum^==!$8080
  PutE()
  Print("Is highlighted sum correct?")
  Key=GetD(1)
  Key==%32
  PutE()
  PutE()
  IF Key='y THEN
    Mistyped()
  ELSE
    Print("Return to editor and ")
    PrintE("correct")
    PrintE("mistyped sum.")
    Line=SumLines(WrongLine)
    Column=(Sum+1)*3
  FI

RETURN

PROC No_Problems()

  PrintE("Program CHECKs out fine.")
  PrintE("Save program and use")
  PrintE("according to directions")
  PrintE("in the article.")
  Done

RETURN

PROC Check_Sum()

  IF Sum()Sums(ISum) THEN
    Bad_Sum()
    Done
  FI
  ISum==+1

RETURN

PROC Initialize()

  IF Peek(1226)=255 THEN
    Case is Sensitive
  FI
  X=1
  CurLine=FirstLine
  Length=CurLine+6
  NextLine=CurLine+4
  IF Length^=0 THEN
    End_Of_Line()
  FI
  CurChar=7
  Close(1)
  Open(1,"K:",4,0)

RETURN
```

```
PROC D_Check()

  Initialize()
  Get_Sums()
  ISum=0
  DO
    IF Done THEN
      EXIT
    FI
    Sum=0
    Lines=0
    FOR Count=0 TO 127 DO
      IF Count=0 THEN
        StartLine=CurLine
        StartChar=CurChar-6
      FI
      Check_Line()
      IF CurChar=Length^+7 THEN
        End_Of_Line()
        IF CurLine=0 THEN
          Check_Sum()
          IF Done THEN
            EXIT
          FI
          No_Problems()
          EXIT
        FI
        Lines==+1
      FI
    OD
    IF Done THEN
      EXIT
    FI
    Check_Sum()
  OD
  Close(1)

RETURN
```

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Cassette LogWriter

Label *all* your cassettes easily

by Frank Kweder

What? You say disk is "in" and cassette is "out"? *Wrong!* Music's the subject here, and, in music, cassette is definitely "in". . . in a Sony Walkman, for instance.

Musical mobility creates a problem: how to keep track of the contents of a constantly increasing pile of tapes. A database? Well, fine. But do you really want to lug a computer and power supply out jogging? Also, do you groove on writing those tiny log sheets with a smeary ballpoint pen, only to discover you've re-invented hieroglyphics? Still, be it music or BASIC programs, it's nice to know what's on a tape in advance.

Cassette LogWriter is a text processor designed to write and print a 4x4-inch log sheet to be cut out, folded and inserted into the cassette's protective shell. Set up for the Prowriter 8510 printer, the program is easily changed to work with other dot-matrix printers.

Our line length exceeds 40 columns, so the format is displayed on a graphics 7 screen. The lines are entered, one at a time, in the text window. Each character is plotted graphically, using three colors to distinguish between letters, spaces and functions. A small graphics window indicates functions being used.

Special materials and techniques.

Like Broderbund's **Print Shop**, **Cassette LogWriter** enables you to design and print, with special materials and techniques. Colored paper may be used decoratively or as part of your filing code. Color ribbons add another dimension.

In this program, we use the character graphics set found in the printer itself. In the Prowriter, many of these are available from inverse lower case letters and inverse control characters. Figure 1 illustrates some of these.

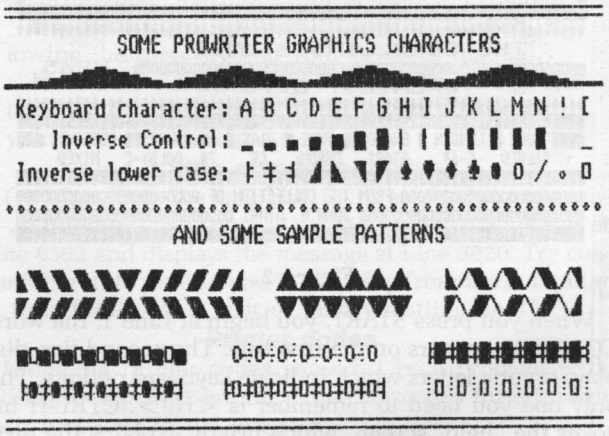

Figure 1.

If your printer can't do this, substitute asterisks, dashes, and so on—you can still create an attractive finished product. On the other hand, using custom-designed fonts allows you to make your logs totally unique.

Program operation.

I refer to the "cassette" here as a finished product—in its protective shell, with the printed log cut out, folded and inserted. Use the sample log (Figure 2) as a reference.

Title screen — I think a lively title screen is a great psychological boost.

Input name — On the back of many cassettes, there's only a small transparent area of wasted space. In the lower half of this area, centered, is *FROM THE COLLECTION OF* and, on the next line, the user's name. When entered, the name is automatically centered before printing. No formatting is required.

Choose audio or computer — On the "tape specifications" line you'll be entering tape parameters: bias and equalization for audio; *boot* or *Cload* for computer, among others. Your choice here determines which set of parameter headings will print on the top line on the back of the cassette. The specs you input will be printed on the line below, just above the name.

Input text — eighteen of thirty-one lines to be printed contain text: song titles, computer programs, tape counter readings, etc. Each "string" line has sixty-eight spaces (variable C). One space at each end defines the border (EDGE$); three spaces are reserved for the left margin, leaving sixty-three spaces for text (variable TXL).

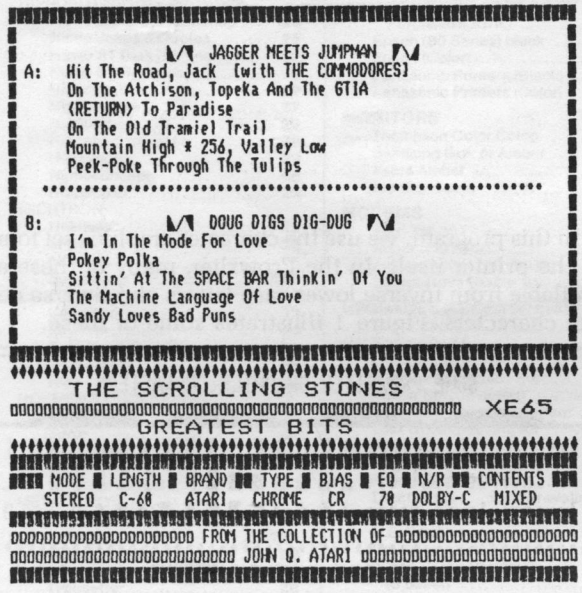

Figure 2.

When you press START, you begin at Line 1; the word *CONTROL* appears on the first line. The second line displays cryptic letters which indicate keyboard options. The only one you need to remember is <H!!>. CTRL-H invokes the "help" screen, which briefly explains the rest.

The options.

<A:B:X> — Press CTRL-A, and *A:* is printed in the left margin, outside of the text area. CTRL-B prints *B:*. These markers indicate side A or B of the tape. CTRL-X erases a misplaced marker.

<C> — CTRL-C enables you to change the "center tab" position. CTAB defaults to position 31. Displayed graphically, it's used to help align your columns visually while formatting. CTAB is operated by the ESC key.

<D> — Press CTRL-D to fill an unused line with a decorative string (DOT$), to divide the text space into sections.

<E> — CTRL-E turns off the edit function.

<M> — CTRL-M takes you directly to the menu, from which most program functions may be accessed.

<R> — If you realize the line you just finished is all wrong, CTRL-R will return you to it, erasing the offending line and its graphic counterpart. Reenter the line and proceed normally. Minor mistakes are best corrected later with the edit function.

<T> — This is a quick way to get to title input from any line.

In addition to these control functions, the "help" screen reminds you of the following:

BACKSPACE — This erases one space to the left of the cursor in the text. The graphic plot of the character is also erased.

TAB — The cursor moves to the right three spaces with each press. The graphic image displays TAB as a distinctive pattern.

CENTER TAB or *CTAB* — Jumps to the center of the line quickly; useful for setting up text in two columns. Its location can be altered with CTRL-C.

HORIZONTAL ARROWS — These keys move back and forth nondestructively over text. You may write over the text, but you can't insert or delete spaces.

I've bypassed some characters which cause difficulties with strings. The double quote, for example, has been changed to a harmless single quote. See others in REM statements.

Line input.

Let's return to the text screen at Line 1. The word *CONTROL* indicates the proper time to use a control option. Enter a character, and the second line disappears to keep the screen readable. *CONTROL* is replaced by *SPACES LEFT*. Control options other than help are still accessible. A few of these options will destroy existing text in a line, if used in midline.

Enter text, then end the line by pressing RETURN. The line will advance automatically if the last space is filled. A beep at space 58 signals that the line's end is near.

Either finish Line 18 or use CTRL-T to advance to the title section.

The cassette titles.

INPUT TITLES — Here, you're prompted for Title A, 26 characters maximum; then Title B, also 26 characters. These may be separate titles or one longer title. Type in the text without formatting. Each line will be centered and printed on the spine of the cassette in double-width type.

Only BACKSPACE is used here, because the lines are short. The graphic image does not indicate either centering or double-width printing. Control functions (except M) do not operate here.

Audio/computer specifications.

TAPE SPECIFICATIONS — This line resembles the other text lines, but already contains text. What you see are headings for the tape parameters. Because of limited space, we'll *type over* the headings.

While typing, watch the graphic display to check positioning. BACKSPACE and TAB will be handiest here, but all control functions are active. Using the arrow keys to position yourself over the next heading is okay. Stray characters left behind will not print.

If you press RETURN, nothing will happen. You *must* fill in the whole line. Why? Your first reflex is to press RETURN after each word. That would make editing a real chore.

The cassette number.

INPUT CASSETTE NUMBER — CASNUM$ is dimensioned for four digits and/or letters. Everyone has his or her own numbering system, so I'll explain mine briefly.

First, the number will appear on the spine of the cassette, printed in double-width type. It will be positioned to the right, on the line between the two title lines. On the same line, BOX$ is used to separate the title lines.

My numbering system.

I use a system of two letters and two numbers. The letters describe content, and the numbers index that category.

For instance, a computer tape might be CM-1 to CM99. *CM* would be *(C)*omputer, *(M)*achine language; or use *CB* for *(B)*ASIC. In music, *CW* for *(C)*ountry-*(W)*estern; or *JI* and *JV* for *(J)*azz *(I)*nstrumental or *(V)*ocal.

Each category can contain ninety-nine items, so if your collection's too large for this, you should be using Lotus 1-2-3!

One major problem is defining mixed categories. Using colored paper to separate major groups could be an effective first step. Some items of information could be deferred to the tape specifications line.

The strings.

With input complete, we advance to the menu. At this point the main string (CASS$), used for printing, is already partially filled with text transferred from LINE$ as each line was entered. Now, TITLEA$, TITLEB$ and NAME$ are centered, using various centering strings, and added to CASS$. Also, the strings defining the outline of the log for cutting and folding are added. These include BAR$, EDGE$ and FOLD$.

The menu.

The menu now becomes your main base of operations. From here, you decide whether to REVIEW your text to see if it needs EDITing. Then you PRINT it and start a NEW LOG.

REVIEW — Here you examine CASS$ in 68-character segments representing each of the thirty-one lines to be printed. You see every character in the line, not just the input text. This information will appear in a "window" within the text window. Below this is a line counter. Find a line to EDIT, make a note of its number and return to the menu by pressing START.

EDIT — First enter the line number you want to edit. This was determined by using REVIEW, the line index on the graphic screen, or by printing a test log. The text window also displays the line numbers for the titles, specs and cassette number, as a reminder.

When you enter from *1* to *18* for the line number, you return to that line, now filled with your text. The word *CONTROL* indicates that all options are active. Using the arrow keys, make your corrections. On RETURN, instead of going to the next line, you choose another line to edit—or return to the menu.

To do a major revision of several consecutive lines, use CTRL-E to turn off the edit function. Enter the starting line number. Once there, press CTRL-E and enter text normally. Ending the line will now advance you to the next. Go as far as you like; press CTRL-M to return to the menu. Most parts of the program are accessible via the menu, using EDIT, CTRL-E and CTRL-M to loop around as often as necessary.

PRINT — You may choose this option before REVIEW or EDIT. The printed log is the best reference. When you have a suitable log, you can substitute your own special paper or a color ribbon before the final printing.

I'm using formal stationery from a defunct company—medium-weight stock, linen-finish, 8½×11-inch sheet, light tan. I remove the letterhead and have enough paper to make four logs. Computer fanfold paper works fine. Heavier paper stocks make sturdier inserts and stand up to wear and tear.

Regarding colored paper, I caution you to beware of rough, fuzzy paper—like construction paper. It could cause your print head to jam. Instead of a nicely printed log, you might end up with a carelessly scrawled repair bill. If you have any doubts about the paper, don't use it. Try office and art supply stores or print shops as sources for good quality paper.

If a color ribbon is used, change it carefully, following the directions in your printer's manual.

NEW LOG — This last option clears the strings and takes you back to START. To change NAME$ or specs, you must rerun the program.

A little something extra.

On Line 8000, the variable *MIN* is set for approximately 20 minutes. The timer is set at Line 8270, checked at Line 8502 and displays the message at Line 6020. Try customizing it, to remind you to get away from the computer in time for a dental visit or mud wrestling on TV.

Printer codes.

Changing printer codes shouldn't be a problem with most printers. Here are the Prowriter codes I used, with their locations in the program:

(1) Condensed type (17 characters per inch) — The code is *CHR$(27);CHR$(81)*. Four inches times 17 char/inch=68. This is the source of the program's line length.

(2) Line spacing (19/144 inch) — The code is *CHR$(27);CHR$(84);"19"*. Thirty-one lines times 19/144 inch=43/144 inches.

That's it—4×4 inches—a near-perfect fit for the cassette shell. Find the appropriate codes in your printer manual and insert them in Line 4080, in place of the Prowriter codes.

(3) Double-width type — This is double-width "con-

densed" type, or 8½ characters per inch. The code is *CHR$(14)*. See Line 4200.

(4) Double-width off — The code is *CHR$(15)*. See Line 4300.

These last two codes are contained in subroutines, because they're used more than once. They're easier to modify if they only occur in one place. Be aware that *CHR$(14)* and *CHR$(15)* are commonly used and may have differing, conflicting meanings from one printer to another. Follow your manual closely.

These are the only printer codes I've employed. Bold face and underlining might also be used.

If your printer's condensed type mode provides a different characters-per-inch number, here's what you'll need to do. . .

Let's assume *15.3* as an example. Our goal is 4 inches, so *15.3* times *4=61.2*. Round off this number to *61*. In Line 8000, the variable *C* equals *68*. This is the length of the string segment for each line. Make *C=61*. Notice that *TXL*, the text portion of the line, equals *C-5*. CASS$ is DIMmed to CASS, which equals *C*31*.

By simply changing C to *61*, most of the other parameters are altered to fit, even in the graphic plotting. However, some lines (such as the tape spec lines) would have to be reshaped manually.

Atari control characters.

You may have noticed the frequent use of control characters in the text windows. Well, text windows need character, as well as characters. Would you want to play an Infocom game if all of the characters looked alike, talked alike and reacted alike?

Several of these characters are tricky to identify. I use CTRL-B and CTRL-V at each end of many inverse words. Occasionally, you'll see CTRL-Y (and inverse) for a slightly wider line. Most of the others used are identified in REM statements.

The rest of the program.

That's all there is! Of course, there *could* be more. In general, one copy of a log is all you want, but what if you need a temporary log for a partially filled tape or to replace one that's torn? That's right, add LOAD and SAVE to your menu.

And, since we have all the information at hand, why don't we make a label to stick onto the side of the cassette itself? When we use a cassette number, how about creating a file to tell us which number(s) have already been used? A database for the whole collection? Got any ideas? Let's hear them.

Now, I have a *huge* pile of cassettes screaming for attention. What's this, a video cassette? Hmmmn. The label is 2x3 inches. Let me see—six hours; that's three movies or. . .*seventy-two* music videos. Well, I don't jog with my VCR. How about a database?

Frank Kweder put in 35 years of commercial and news photography, using Kodak's ***Technet*** *and a computerized enlarger in the lab. He now relaxes in Florida with his 3½-year-old Atari 800.*

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor*, page 17.

Listing 1.
BASIC listing.

```
JS 5 REM :::: CASSETTE LOGWRITER ::::
EE 6 REM :::    BY FRANK KWEDER    :::
QD 7 REM ::       APRIL 1985       ::
KF 10 GOTO 8000
PA 100 POKE R82,R0:POKE R83,39:RETURN :RE
   M CLEAR MARGINS
UP 199 REM DISABLE BREAK KEY
EE 200 BK=PEEK(16)-128:IF BK<R0 THEN RETU
   RN
GT 210 POKE 16,BK:POKE 53774,BK:RETURN
NQ 300 SOUND R1,PEEK(53770)/R3+50,R10,R6:
   W=1^1^1:SOUND R1,R0,R0,R0:RETURN :REM
   ALL-PURPOSE SOUND ROUTINE
QH 599 REM SET UP TEXT WINDOW: INPUT TEXT
SR 600 POKE R82,R4:POKE R83,R36
OJ 601 IF EDIT THEN LINE=H+R1
LF 602 POKE ROW,R0:POKE CLM,R1:? " Line
   NUMber :";LINE-R1
AZ 620 TRAP 1000:IF EDIT THEN LINE$=CA5S$
   ((H+R1)*C-Z+R4,(H+R1)*C-R1)
LW 621 IF EDIT THEN POKE ROW,R2:POKE CLM,
   R4:? LINE$;:X=R1:GOTO 631
JG 622 POKE ROW,R2:POKE CLM,R4:? "-------
   ----------------------+-------------
   ------------^-----";
IT 624 COLOR R1
MF 630 X=X+R1:BIT=R0:IF X>TXL THEN GOTO 7
   70
WD 631 POKE R752,R1
XE 632 IF X=R1 THEN POKE ROW,R0:POKE CLM,
   18:? "  ^^^ CONTROL ^^^  ";:GOSUB 300
   :POKE R752,R0
YR 633 IF LINE>18 THEN GOTO 636
TM 634 IF G=R1 THEN POKE ROW,R1:POKE CLM,
   R2:? "
     ":G=R0
HM 635 IF X=R1 THEN POKE ROW,R1:POKE CLM,
   R1:? "  A:B:X  C  D,  E  H!  M  R
   T ":G=R1:REM INV. CTRL-U
UM 636 CLOSE #R1:OPEN #R1,R4,R0,"K:":GOSU
   B BREAK
BN 640 POKE R82,R4:POKE R83,R36:BIT=R0
QZ 645 TRAP 660:IF BIT=R2 THEN LINE$(X-R3
   ,X)="  "
PF 650 TRAP OFF
WB 660 IF X<R1 THEN X=R1
AQ 666 POKE ROW,R3-(X<=R33)-(X>TXL):POKE
   CLM,X+R3-(R33*(X>=R34))
VG 668 POKE R752,R0:BIT=R0
BU 670 GET #R1,CH
XD 675 IF CH<R32 THEN GOTO 800
XT 692 IF CH=R34 THEN CH=39:REM CHANGE "
   TO '
NA 694 IF CH=96 OR CH=123 OR CH=125 THEN
   660:REM NOT ALLOWED IN STRING
UI 695 IF CH>RT THEN 880
GE 696 IF CH=R126 THEN X=X-R1:COLOR R0:PL
   OT 48+X,LINE*R2+R2:CH=R32:BIT=R1:REM B
   ACK SPACE
SX 697 IF CH=R32 AND BIT THEN COLOR R0:PL
   OT LP+X,LINE*R2+R2:COLOR R1:REM ERASE
   CHARACTER
QE 710 IF CH=RT AND LINE=R27 THEN 670:REM
    FILL LINE BEFORE EXIT
MB 712 IF CH=RT THEN CLOSE #R1:GOTO 770
DG 713 IF CH=127 THEN X=X+R3:BIT=R2:POSIT
   ION 45+X,LINE*R2+R2:? #6;"223";:? "^__"
   ;:IF X>TXL-R2 THEN 770:REM TAB
SO 716 IF CH=127 THEN GOTO 645
TI 719 POKE ROW,R0:POKE CLM,R33:? "  ";:P
   OKE CLM,18:? " Spaces Left :";TXL-X;
```

```
VU 720 IF X<R1 THEN X=R1
AD 724 POKE ROW,R3-(X(=R33)-(X)TXL):POKE
   CLM,X+R3-(R33*(X)=R34))
ST 730 POKE R752,R0:? CHR$(CH);
OI 735 IF BIT THEN 640
GK 740 LINE$(X,X)=CHR$(CH)
IV 745 IF CH=R32 AND BIT=R0 THEN COLOR R3
IL 750 PLOT 48+X,LINE*R2+R2:COLOR R1
WX 760 IF X=TXL-R5 THEN SOUND R0,R20,R10,
   R6:W=1^1:SOUND R0,R0,R0,R0:REM END OF
   LINE WARNING
P5 765 GOTO 630
CK 770 REM DUMP LINE$ INTO CASS$
UA 773 IF EDIT THEN CA55$((LINE-R1)*C+R5,
   LINE*C-R1)=DUM$
IW 775 CA55$((LINE-R1)*C+5,LINE*C-R1)=LIN
   E$
GD 785 LINE$=DUM$:REM CLEAR LINE$
PL 787 IF EDIT THEN GOSUB 3000:GOTO 5030
OZ 790 GOTO 8500
ZY 799 REM CONTROL FUNCTIONS
HE 800 IF X>TXL-R1 THEN GOTO 660
TE 801 IF CH=30 THEN ? "←";:X=X-R1:GOTO 6
   60:REM <-
WO 802 IF CH=31 THEN ? "→";:X=X+R1:GOTO 6
   60:REM ->
ZE 804 IF CH=R1 THEN CA55$((LINE-R1)*C+R3
   )="A:":GOSUB 920:REM CTRL-A
FN 805 IF CH=R1 THEN COLOR R2:PLOT 46,LIN
   E*R2+R2:PLOT 47,LINE*R2+R2:GOSUB 300:G
   OSUB 1100:GOTO 636
DZ 806 IF CH=R2 THEN CA55$((LINE-R1)*C+R3
   )="B:":GOSUB 920:REM CTRL-B
AL 807 IF CH=R2 THEN COLOR R2:PLOT 46,LIN
   E*R2+R2:PLOT 47,LINE*R2+R2:GOSUB 1105:
   GOSUB 300:GOTO 636
DM 808 IF CH=R3 THEN GOSUB 910:GOTO 950:R
   EM CTRL-C
VZ 809 IF CH=8 AND X=R1 THEN GOTO 5200:RE
   M CTRL-H
NL 810 IF CH=R4 THEN LINE$=DOT$:COLOR R2:
   FOR W=LP TO LP+TXL-R1 STEP R2:PLOT W,L
   INE*R2+R2:NEXT W:COLOR R1:GOTO 770
FQ 811 REM ABOVE IS CTRL-D
AW 813 IF CH=R5 THEN EDIT=R0:GOSUB 1130:G
   OSUB 300:GOTO 660:REM CTRL-E
MB 814 IF CH=24 THEN CA55$((LINE-R1)*C+R3
   )="  ":GOSUB 1130:COLOR R0:REM CTRL-X
PC 815 IF CH=24 THEN PLOT 46,LINE*R2+R2:P
   LOT 47,LINE*R2+R2:GOSUB 300:COLOR R1:G
   OTO 636
OD 818 IF CH=13 THEN GOSUB 920:GOTO 1000:
   REM CTRL-M
FD 820 IF CH=18 AND LINE)=R2 THEN LINE=LI
   NE-R1:GOSUB 900:GOSUB 910:GOSUB 1145:G
   OTO 8510:REM CTRL-R
F5 825 IF CH=R20 THEN GOSUB 920:LINE=R19:
   CLOSE #R1:GOTO 8500:REM CTRL-T
RR 830 IF CH=R27 AND X>CTAB-R2 THEN 660
OW 832 IF CH=R27 THEN XP=X:X=CTAB:FOR W=X
   P TO X:LINE$(W,W)=CHR$(R32):NEXT W:GOS
   UB 850:REM ESCAPE KEY=CTAB
UX 834 IF CH=R27 THEN COLOR R2:PLOT 48+X,
   LINE*R2+R2:COLOR R1
XV 840 GOTO 660:REM REJECT ALL OTHER KEYS
   <32
DO 849 REM UPDATE SPACE COUNT FOR CTAB
TI 850 POKE ROW,R0:POKE CLM,R34:? "  ";:P
   OKE CLM,18:? " Spaces Left :";TXL-X;:
   RETURN
HN 880 IF CH=156 OR CH=157 OR CH=158 OR C
   H=159 OR CH=254 OR CH=255 THEN 660:REM
    NOT ALLOWED IN STRING
US 890 GOTO 696
TZ 900 COLOR R0:PLOT LP,LINE*R2+R4:DRAWTO
    LP+TXL+R1,LINE*R2+R4:RETURN :REM ERAS
   E LINE
JD 910 IF LINE)R1 THEN COLOR R0:PLOT LP,L
   INE*R2+R2:DRAWTO LP+TXL+R1,LINE*R2+R2:
   RETURN :REM ERASE LINE-1
ZK 911 RETURN
YF 920 CA55$((LINE-R1)*C+R5,LINE*C-R1)=LI
   NE$:RETURN :REM SAVE LINE$ WHILE USING
    CTRL, OPTION
BG 950 ? "┼":REM MOVE CTAB
PE 952 ? "  INPUT COLUMN NUMBER FOR
          CTAB:  Default = ";INT((T
   XL/R2)-0.3)
AL 954 TRAP 950:? "                    "
   ;:INPUT CTAB
XZ 957 IF CTAB<R20 OR CTAB>TXL-R10 THEN C
   TAB=INT((TXL/R2)-0.3):? "┼┼"
FI 960 FOR W=R1 TO R2:COLOR R0:PLOT LP+15
   ,W:DRAWTO LP+TXL,W:COLOR R2:PLOT LP-R1
   +CTAB,W:NEXT W:TRAP OFF:GOTO 8510
WO 999 REM MENU
KA 1000 SETCOLOR R2,14,R0:IN$="":POKE R75
   2,R1:GOSUB MARGIN:GOSUB 1140:TRAP OFF
DJ 1010 ? "┼";:POKE ROW,R0:POKE CLM,R0:?
   "          MENU
   ";
EC 1015 ? "     1-REVIEW          2-ED
   IT
ZZ 1020 ? "    3-PRINT            4-
   NEW LOG "
OU 1030 POKE ROW,R3:POKE CLM,R0:? "
                                  ";
JT 1040 TRAP 1050:POKE ROW,R3:POKE CLM,15
   :? "    ";:INPUT IN$:H=VAL(IN$)
UJ 1050 IF H<R1 OR H>R4 THEN 1000
TN 1060 SETCOLOR R2,R10,R0:TRAP OFF
VO 1070 ON H GOTO 2000,5000,4010,2500
NM 1080 GOTO 1000
UG 1099 REM GRAPHIC WINDOW PLOTS
WF 1100 GOSUB 1110:REM DRAW -A-
BP 1102 COLOR R2:PLOT R7,R2:PLOT R5,R7:DR
   AWTO R5,R4:DRAWTO R6,R3:DRAWTO 8,R3:PL
   OT 9,R4:DRAWTO 9,R7:PLOT R6,R6
UV 1103 DRAWTO 8,R6:PLOT R6,R4:PLOT 8,R4:
   COLOR R1:RETURN
YA 1105 GOSUB 1110:REM DRAW -B-
TV 1106 COLOR R2:PLOT R5,R2:DRAWTO R5,R7:
   DRAWTO 8,R7:PLOT 9,R6:PLOT 9,R5:PLOT R
   6,R4:DRAWTO 8,R4:PLOT 9,R3:PLOT 8,R2
SL 1107 DRAWTO R5,R2:PLOT 8,R3:PLOT 8,R5:
   PLOT 8,R6:COLOR R1:RETURN
VA 1110 COLOR R3:FOR W=R4 TO R10:PLOT W,R
   1:DRAWTO W,8:NEXT W:COLOR R1:RETURN :R
   EM DRAW WINDOW (ERASE)
AP 1120 GOSUB 1110:REM DRAW -E-
AA 1122 COLOR R2:PLOT 9,R3:PLOT 9,R2:DRAW
   TO R5,R2:DRAWTO R5,R7:DRAWTO 9,R7:PLOT
    9,R6:PLOT R6,R4:PLOT R7,R4:PLOT R6,R5
ET 1123 PLOT R7,R5:COLOR R1:RETURN
UM 1130 GOSUB 1110:REM DRAW -?-
ED 1132 COLOR R1:PLOT R6,R2:DRAWTO 9,R2:D
   RAWTO 9,R4:DRAWTO R7,R4:PLOT R7,R5:PLO
   T R7,R7:RETURN
JD 1140 GOSUB 1110:REM DRAW -M-
GQ 1142 COLOR R1:PLOT R5,R2:DRAWTO R5,R7:
   PLOT 9,R2:DRAWTO 9,R7:PLOT R7,R4:DRAWT
   O R7,R7:PLOT R6,R3:PLOT 8,R3
LW 1143 PLOT R6,R4:PLOT 8,R4:RETURN
PC 1145 GOSUB 1110:REM DRAW -R-
BA 1146 COLOR R1:PLOT R5,R7:DRAWTO R5,R2:
   DRAWTO 9,R2:DRAWTO 9,R5:DRAWTO R6,R5:P
   LOT R7,R6:PLOT 8,R7:PLOT 9,R7:RETURN
MJ 1150 GOSUB 1110:REM DRAW -P-
KK 1151 COLOR R0:PLOT R5,R7:DRAWTO R5,R2:
   DRAWTO 9,R2:DRAWTO 9,R5:DRAWTO R6,R5:R
   ETURN
PA 1199 REM TAPE SPECS
XX 1200 POKE R82,R0
NV 1202 ? "┼    DO YOU WANT TO MAKE __
   "
HW 1204 ? "     1...AN AUDIO TAPE LO
   G
IR 1206 ? "     2...A COMPUTER TAPE LO
   G"
WI 1208 TRAP 1202:? "
                    ";:INPUT LT
PX 1210 IF LT<R1 OR LT>R2 THEN 1202
JY 1220 TRAP OFF:RETURN
ZI 1250 ? "┼";:POKE 702,64:POKE 694,R0:PO
   KE R82,R0:POKE R83,R36
```

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SHIPPING INFO: Minimum $2.90 Ground, $4.75 Air. Actual Cost depends on weight. Call (503) 683-5361 for information.

WARRANTY INFO: Everything that we sell is warrantied by the manufacturer. If any item purchased from us fails to perform properly when you receive it, call us at (503) 683-5361 so that we can assist you. No returned merchandise accepted without authorization. Defective software will be replaced with another copy of the same program, otherwise, no software is returnable.

• 2 Day Air Shipping **AVAILABLE** •

CIRCLE #115 ON READER SERVICE CARD

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HK 1252 POKE ROW,R0:POKE CLM,R2:? "/ Tap
   e Specs \                          ";
RU 1253 IF LT=R1 THEN POKE ROW,R1:POKE CL
   M,R2:? "    Audio Tape: /[TYPE OVER HO
   RD5]      \";:POKE R82,R4
EL 1254 IF LT=R1 THEN POKE ROW,R2:POKE CL
   M,R4:? ".MODE...LENGTH...BRAND....TYPE
   ...BIA5...EQ...N/R....CONTENT5...";
5Z 1263 IF LT=R2 THEN POKE ROW,R1:POKE CL
   M,R2:? "    Computer: /[TYPE OVER HO
   RD5]      \";:POKE R82,R4
AW 1264 IF LT=R2 THEN POKE ROW,R2:POKE CL
   M,R4:? "..BRAND,TYPE...LENGTH...LOAD-T
   YPE...NO./PROGRAM5...CONTENT5....";
TN 1266 GOTO 624
HN 1399 REM TITLE INPUT
NU 1400 POKE 702,64:POKE 694,R0:REM UPPER
    CASE
AM 1401 IF EDIT THEN LINE=H+R1
TF 1402 IF EDIT=R0 AND TT=R1 THEN TITLEA$
   =""
VT 1403 IF EDIT=R0 AND TT=R2 THEN TITLEB$
   =""
EI 1405 IF TT=R1 THEN POKE ROW,R1:POKE CL
   M,R4:? "ß  PRINT TITLE A ■ ";TTL;" CH
   ARACTER5 "
HJ 1406 IF TT=R2 THEN POKE ROW,R1:POKE CL
   M,R4:? "ß  PRINT TITLE B ■ ";TTL;" CH
   ARACTER5 "
JG 1410 FOR W=100 TO R1 5TEP -R2*TT:50UND
    R0,W,R10,R4:NEXT W:50UND R0,R0,R0,R0
JQ 1413 IF EDIT AND TT=R1 THEN POKE ROW,R
   2:POKE CLM,R4:? TITLEA$;:X=R1:COLOR R1
   :GOTO 1435
MY 1414 IF EDIT AND TT=R2 THEN POKE ROW,R
   2:POKE CLM,R4:? TITLEB$;:X=R1:COLOR R1
   :GOTO 1435
JM 1415 POKE ROW,R2:POKE CLM,R4:? "------
   ----------------------"
MC 1420 COLOR R1
DH 1430 X=X+R1:BIT=R0:IF X>TTL THEN GOTO
   1480
AU 1435 GOSUB 1600
IP 1440 IF CH=R32 THEN COLOR R3
FB 1450 PLOT 48+X,LINE*R2+R4-R2*(TT=R2)
PV 1452 PLOT 44,42:DRAWTO LP+TXL+R1,42:PL
   OT 44,48:DRAWTO LP+TXL+R1,48
MO 1460 COLOR R1
EI 1465 IF TT=R1 THEN TITLEA$(X,X)=CHR$(C
   H)
GG 1468 IF TT=R2 THEN TITLEB$(X,X)=CHR$(C
   H)
RA 1470 GOTO 1430
RI 1480 IF EDIT THEN GOSUB 3000:TT=R0:GOT
   O 5030
5G 1490 TT=R0:GOTO 8500
WZ 1600 CLOSE #R1:OPEN #R1,R4,R0,"K:":GOS
   UB BREAK
EZ 1602 IF EDIT THEN CA55$((H+R1)*C-Z,(H+
   R1)*C-Z+TTL)=DUM$(R1,TTL)
HX 1605 POKE R752,R0:POKE R82,R2:POKE R83
   ,R36:BIT=R0
UY 1610 IF X<R1 THEN X=R1
YH 1614 POKE ROW,R2:POKE CLM,X+R3
IH 1615 GET #R1,CH
EX 1618 IF CH=13 THEN GOTO 1000
CL 1620 IF CH=R34 THEN CH=39
BV 1624 IF CH=126 THEN X=X-R1:COLOR R0:PL
   OT 48+X,LINE*R2+R2+R2*(LINE=R20):CH=R3
   2:BIT=R1:REM BACK SPACE
CT 1625 IF CH=R32 AND BIT THEN COLOR R0:P
   LOT LP+X,LINE*R2+R2+R2*(LINE=R20):COLO
   R R1:REM ERA5E
VZ 1626 IF CH=R32 AND BIT=R0 THEN COLOR R
   3:PLOT LP+X,LINE*R2+R2:COLOR R1:REM PL
   OT SPACE
NU 1628 IF (CH)=R27 AND CH(=31) OR CH=125
    OR CH=127 THEN GOTO 1615
OK 1629 IF CH=RT AND EDIT=R0 THEN CLO5E #
   R1:POP :GOTO 8500
OM 1630 IF EDIT AND CH=RT THEN CLO5E #R1:
   POP :GOTO 1480
VM 1632 IF X<R1 THEN X=R1
YM 1634 POKE ROW,R2:POKE CLM,X+R3
GK 1635 ? CHR$(CH);
UZ 1640 IF BIT THEN 1605
BA 1650 RETURN
QA 1699 REM CA55ETTE NUMBER
CL 1700 ? "ß";:POKE 702,64:POKE 694,R0:GO
   5UB MARGIN:POKE 764,255:CA5NUM$=""
KJ 1720 ? "     Enter TAPE CA55ETTE NUMBER
   [";:? "                    [4 DIGIT5]"
VT 1730 ? "   ..or a LETTER/DIGIT COMBINA
   TION";:? "                          ";
RQ 1740 INPUT CA5NUM$:IF LEN(CA5NUM$)<>4
   THEN ? "ß";:GOTO 1700
NJ 1760 ? "ß ":? ,"    [■■]";CA5NUM$;"[■■]":
   GO5UB 300:GO5UB 300:FOR W=1 TO 200:NEX
   T W
XX 1765 COLOR R1:PLOT LP+TXL-R10,45:DRAWT
   O LP+TXL-R6,45:REM PLOT #
HA 1780 ? "ß":GOSUB 3000:? ,"   5TRING5 L
   OADED ":GO5UB 300:GOTO 1000
TV 1799 REM HANDLE 5PECIAL LINES
UL 1800 IF LINE=R20 THEN POP :TT=R1:GOTO
   1400
PH 1810 IF LINE=22 THEN POP :TT=R2:GOTO 1
   400
KB 1820 IF LINE=25 OR LINE=28 THEN COLOR
   R2:PLOT LP,LINE*R2+R2:DRAWTO LP+TXL-R1
   ,LINE*R2+R2:COLOR R1
B5 1830 IF LINE=29 OR LINE=30 THEN COLOR
   R1:PLOT LP,LINE*R2+R2:DRAWTO LP+TXL-R1
   ,LINE*R2+R2
IN 1835 IF LINE=29 OR LINE=30 THEN COLOR
   R2:PLOT LP+TXL/R2-R7,LINE*R2+R2:DRAWTO
    LP+TXL/R2+R7,LINE*R2+R2
AH 1839 REM PRINT GRAPHIC REPRESENTATION
   OF TAPE 5PEC HEADING5.. 1=LETTER.. 3=5
   PACE
PR 1840 IF LINE=26 AND LT=R1 THEN POSITIO
   N LP,54
ST 1841 IF LINE=26 AND LT=R1 THEN ? #6;"3
   1111333111111333311111333331111333111133
   3113331113333311111111133"
RK 1845 IF LINE=26 AND LT=R2 THEN POSITIO
   N LP,54
TE 1846 IF LINE=26 AND LT=R2 THEN ? #6;"3
   1111131111333311111333311131111333113
   3111111113333111111333"
KL 1850 IF LINE>=21 AND LINE<=26 THEN POP
   :GOTO 8500
JW 1860 IF LINE=28 OR LINE=29 OR LINE=30
   THEN POP :GOTO 8500
BK 1870 RETURN
RO 1999 REM REVIEW
QJ 2000 POKE R752,R1:? "ß":LINE=R0:GO5UB
   3000:GO5UB 1145
KG 2005 FOR W=R0 TO R3:POKE ROW,W:POKE CL
   M,35:? "[■■■■]";:NEXT W
FM 2010 LINE=LINE+R1:IF LINE>=R32 THEN LI
   NE=R1
5T 2012 COLOR R1:POKE R82,R2:POKE R83,39
KF 2015 POKE ROW,R0:POKE CLM,R0:? "[■■ ";:
   POKE ROW,R1:POKE CLM,R0:? "■■]";
AP 2016 POKE ROW,R1:POKE CLM,R34:? " ■■"
KY 2019 POKE R83,R36
FM 2020 POKE ROW,R0:POKE CLM,R2:? CA55$((
   LINE)*C-Z,(LINE)*C);
PM 2030 POKE ROW,R2:POKE CLM,R0:? "Line
   Number: ■\/SELECT ■\/START ";
KK 2032 POKE ROW,R2:POKE CLM,14:? LINE-R1
   ;
LN 2040 POKE ROW,R3:POKE CLM,R0:? "■■■ RE
   VIEW ■<_/■ next LINE for MENU";
FW 2050 IF PEEK(53279)=R6 THEN GO5UB 1130
   :GOTO 1000
II 2060 IF PEEK(53279)<>R5 THEN 2050
OI 2070 GOTO 2010
NG 2499 REM NEW LOG
OO 2500 POKE R82,R2:POKE R83,39:POKE 702,
   64:POKE 694,R0:IN$="":GO5UB 1130
XC 2510 ? "ßß":? "      ARE YOU SURE [Y/N
   ] ■ ";:INPUT IN$
PG 2520 IF IN$<>"Y" AND IN$<>"N" THEN 251
   0
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HJ 2530 IF IN$="N" THEN 1000
XU 2540 TITLEA$="":TITLEB$="":CASNUM$="":
   CENTERA$="":CENTERB$="":CASS$=""
XW 2550 CLOSE #R4:GRAPHICS 7:GOTO 8060
IT 2999 REM FILL CASS$
XX 3000 CASS$(R1,C)=BAR$
DX 3005 REM 3010-3036: CENTER TITLES & NA
   ME
GO 3010 CENTERA$="":CENTERB$=""
SV 3011 CA=R0:CB=R0:CN=R0
EV 3015 IF LEN(TITLEA$)=TTL THEN CENTERA$
   =TITLEA$:GOTO 3025
WG 3020 CA=INT((TTL-LEN(TITLEA$))/R2+(0.5
   ))
AE 3021 CENTERA$=DUM$(R1,CA):CENTERA$(LEN
   (CENTERA$)+R1)=TITLEA$
IT 3025 IF LEN(TITLEB$)=TTL THEN CENTERB$
   =TITLEB$:GOTO 3034
XR 3030 CB=INT((TTL-LEN(TITLEB$))/R2+(0.5
   ))
HD 3032 CENTERB$=DUM$(R1,CB):CENTERB$(LEN
   (CENTERB$)+R1)=TITLEB$
ZX 3034 CN=INT((C-LEN(NAME$))/R2)
EA 3036 CNAME$(1)=" ":CNAME$(LEN(CNAME$)+
   R1)=NAME$:CNAME$(LEN(CNAME$)+R1)=" "
XW 3040 CASS$(R19*C+R1)=FOLD$
EB 3050 CASS$(23*C+R1)=FOLD$
JK 3055 CASS$(24*C+R1)=BAR$
ZM 3057 CASS$(R27*C+R1)=BAR$
OW 3060 FOR W=R1 TO 18
HK 3070 CASS$(W*C+R1)=EDGE$
CH 3080 CASS$(W*C+C)=EDGE$
LQ 3090 NEXT W
FO 3100 CASS$(R20*C+R1,R20*C+TTL)=CENTERA
   $
JC 3110 CASS$(22*C+R1,22*C+TTL)=CENTERB$
AY 3120 CASS$(28*C+R1)="[[[[[[[[[[[[[[[[
   [[[[[ FROM THE COLLECTION OF [[[[[[[[[
   [[[[[[[[[[[[[[":REM PRINTER GRAPHICS
CD 3130 CASS$(29*C+R1)=BOX$
VN 3140 CASS$(29*C+R1+CN,29*C+CN+LEN(CNAM
   E$))=CNAME$
WS 3170 REM NEXT 2 LINES USE INV. CTRL-N:
   PRINTER GRAPHICS
HD 3180 IF LT=R1 THEN CASS$(25*C+R1)="■■■
   ■ MODE ■ LENGTH ■ BRAND ■■ TYPE ■ BIAS
    ■ EQ ■ N/R ■■ CONTENTS ■■■■"
DD 3190 IF LT=R2 THEN CASS$(25*C+R1)="■■■
   ■■ BRAND,TYPE ■ LENGTH ■ LOAD-TYPE ■ N
   O./PROGRAMS ■ CONTENTS ■■■■■"
VH 3200 CASS$(21*C+R1,21*C+R4)=CASNUM$
GU 3210 CASS$(30*C+R1)=BAR$
AL 3220 RETURN
PX 3230 GOTO 3220
UO 3999 REM SET-UP PRINTER
WO 4000 ? "ß CHECK PRINTER ß":FOR W=R1 TO
    250:NEXT W
XE 4010 SETCOLOR R2,R4,R0:GOSUB 1150
HC 4012 ? "ß":? "      TO PRINT  > PRESS
   START ■■■":? "                 >"
OP 4015 ? "      TO MENU  >   PRESS OPTIO
   N ■■";
MM 4020 TRAP 4000
FD 4025 IF PEEK(53279)=R3 THEN GOTO 1000
HO 4030 IF PEEK(53279)<>R6 THEN 4020
XW 4040 GOSUB 3000
AD 4050 IF CASS$(18*C+R1,19*C)<>BAR$ THEN
    CASS$(18*C+R2,18*C+R4)="   ":REM CLEA
   R MARGIN IF LINE 18 HAS TEXT
LF 4051 REM IF NO TEXT,LINE 18=BAR$
OS 4052 IF CASS$(18*C+R4,19*C-R2)=DUM$ TH
   EN CASS$(18*C+R1)=BAR$:COLOR R3:PLOT L
   P,38:DRAWTO TXL+LP+1,38:COLOR R1:? "ß"
EB 4060 CLOSE #4:OPEN #R4,R4,R0,"P:"
NJ 4070 GOSUB 4300:TRAP 40000
QY 4080 ? #4;CHR$(27);CHR$(81);CHR$(27);C
   HR$(84);"19":REM COND. TYPE, 19/144 LI
   NE SPACE
WT 4100 FOR W=R1 TO 31:REM PRINT 31 LINES
QF 4110 IF W=21 THEN ? #R4;" ";:GOSUB 420
   0:? #R4;CASS$(W*C-Z,(W-R1)*C+TTL):GOSU
   B 4300:GOTO 4140:REM TITLE-A
LU 4120 IF W=22 THEN ? #R4;BOX$(R1,54);"
    ";:GOSUB 4200:? #R4;CASS$(W*C-Z,W*C-
   Z+R3):GOSUB 4300:GOTO 4140:REM CASS#
VJ 4130 IF W=23 THEN ? #R4;" ";:GOSUB 420
   0:? #R4;CASS$(W*C-Z,(W-R1)*C+TTL):GOSU
   B 4300:GOTO 4140:REM TITLE-B
PG 4135 ? #R4;CASS$(W*C-Z,W*C):REM ALL RE
   GULAR LINES
LE 4140 NEXT W
LP 4150 GOSUB 4300:CLOSE #R4:GOTO 1000
QM 4200 ? #R4;CHR$(14);:RETURN :REM DBL-W
   IDE ON
IK 4300 ? #R4;CHR$(15);:RETURN :REM DBL-W
   IDE OFF
PQ 4999 REM EDIT
ZI 5000 H=R0:POKE R82,R2:? "ß      ENTER L
   INE NUMBER TO EDIT      ":? " TEXT LINES
   : 1-18      TITLE-A: 20"
FL 5001 ? " CASSETTE #:  21       TITLE-B
   : 22"
RW 5002 ? "      TAPE SPECIFICATIONS: 26
   --";
QD 5003 TRAP 5006:INPUT H:GOSUB 5005:GOTO
    5006
LK 5005 POKE 702,64:POKE 694,R0:POKE R82,
   R2:POKE 764,255:RETURN
DE 5006 IF H<R1 OR H>26 THEN 5000
KA 5008 IF H=R19 OR (H)=23 AND H<=25) THE
   N ? "ß YOU CAN'T EDIT THIS LINE":FOR W
   =R1 TO 250:NEXT W:GOTO 5030
HI 5010 IF H=21 THEN ? "ß  THE CASSETTE
   NUMBER IS: ";CASNUM$;:W=1^1^1:?
QW 5012 IF H=21 THEN ? :? "  ENTER NEW NU
   MBER [4-DIGITS]";:CASNUM$="":INPUT CAS
   NUM$
KR 5013 IF H=21 THEN IF LEN(CASNUM$)>R4 T
   HEN 5010
TU 5014 IF H=21 THEN ? "ß";:? "  The new
   number is: ";CASNUM$:FOR W=R1 TO 200:N
   EXT W:GOSUB 3200:GOTO 5030
NA 5015 EDIT=R1:? "ß":X=R1:POKE 702,R0:LI
   NE=R0:LINE$=DUM$
CI 5016 IF H=R20 THEN TT=R1:GOTO 1400
SY 5018 IF H=R22 THEN TT=R2:GOTO 1400
TS 5020 GOTO 8530
UT 5030 ? :GOSUB 5005:? "ß":? " WANT TO E
   DIT ANOTHER LINE [Y/N] ";:INPUT IN$
GM 5032 POKE 764,255
PV 5035 IF IN$<>"Y" AND IN$<>"N" THEN 503
   0
RO 5036 IF IN$="Y" THEN ? "ß↑":GOTO 5000
OP 5040 TRAP OFF:EDIT=R0:GOSUB 1110:GOSUB
    1130:GOTO 1000
KA 5199 REM HELP SCREEN
QI 5200 GOSUB MARGIN:POKE R752,R1:? "ß↑"
DS 5210 GOSUB 5220:GOTO 5225
CI 5220 POKE ROW,R0:POKE CLM,R0:? "
    CONTROL & EDIT  COMMANDS      ";:RET
   URN
ND 5225 POKE ROW,R1:POKE CLM,R0:? "
   ";:GO
   SUB 5280
ZV 5230 POKE ROW,R2:POKE CLM,R2:? " TAB :
    PRESS TAB TO MOVE ■> 3 SPACES":GOSUB
   5280
JW 5232 POKE ROW,R2:POKE CLM,R2:? "
   <■  BACK-SPACE          ":GOSUB
   5280
IO 5233 POKE ROW,R2:POKE CLM,R2:? " <■ A
   ND ■>: HORIZONTAL ARROW KEYS ":GOSUB 5
   280
GI 5234 POKE ROW,R2:POKE CLM,R2:? "ESCAP
   E:     CENTER COLUMN - CTAB ":GOSUB 52
   80
VW 5235 POKE ROW,R2:POKE CLM,R2:? " CTL-A
   :    INSERTS  A:  IN MARGIN ":GOSUB 52
   80
RT 5236 POKE ROW,R2:POKE CLM,R2:? " CTL-B
   :    INSERTS  B: ":GOSUB 5280
ZL 5237 POKE ROW,R2:POKE CLM,R2:? " CTL-C
   :    ADJUSTS CTAB LOCATION ":GOSUB 528
   0
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IX 5238 POKE ROW,R2:POKE CLM,R2:? " CTL-D
   █      DRAW DOT STRING    ":GOSUB 5280
YP 5239 POKE ROW,R2:POKE CLM,R2:? " CTL-E
   █ TURN OFF EDIT FUNCTION":GOSUB 528
   0
NP 5240 POKE ROW,R2:POKE CLM,R2:? " CTL-H
   █  HELP  TO RETURN HERE ":GOSUB 528
   0
PC 5241 POKE ROW,R2:POKE CLM,R2:? " CTL-M
   █      GO TO MENU         ":GOSUB 5280
ET 5242 POKE ROW,R2:POKE CLM,R2:? " CTL-R
   █ BACK 1 LINE TO RE-WRITE LINE":GOSUB
   5280
QE 5244 POKE ROW,R2:POKE CLM,R2:? " CTL-T
   █ SKIP FORWARD TO TITLES  ":GOSUB
   5280
IT 5248 POKE ROW,R2:POKE CLM,R2:? " CTL-X
   █     DELETE  A: OR B:   ":GOSUB 5280
YS 5260 ? "K":POP :X=R0:POKE 764,255:GOTO
   600
NA 5262 POKE 53279,R3:GOTO 5286
GX 5280 POKE 764,255
QU 5285 POKE ROW,R3:POKE CLM,R0:? " OPTI
   ON to skip          press ANY key ";
YD 5286 IF PEEK(53279)=R3 THEN POP :? "K"
   :X=R0:POKE 764,255:GOTO 600
GO 5288 IF PEEK(764)=255 THEN GOTO 5285
BI 5290 RETURN
AZ 5999 REM TIMER
EW 6000 ? "K":POKE 709,14:POKE R752,R1
HX 6010 SETCOLOR R2,PEEK(53770),R0
BD 6020 ? :? "          BREAK TIME !!  "
RO 6030 FOR W=R1 TO 200:SETCOLOR R2,PEEK(
   53770),R0
YO 6035 SOUND R0,PEEK(53770),R10,R4
TQ 6040 NEXT W:? "K":POKE 710,160:POKE R1
   9,R0:POKE R20,R0:POKE 709,8
UV 6050 SOUND R0,R0,R0,R0:GOTO 8510
MY 7999 REM INITIALIZE
KQ 8000 C=68:R0=0:R1=1:R2=2:R3=3:R4=4:R5=
   5:R6=6:R7=7:R10=10:R19=19:R20=20:R27=2
   7:R32=32:R33=33:R34=R33+R1:R36=R34+R2
RD 8002 R40=40:R82=82:R83=R82+R1:R126=126
   :R752=752:CASS=C*31:Z=C-R1:MIN=R20:MAR
   GIN=100:TXL=C-R5:TTL=26:LP=49:RT=155
YQ 8005 DIM BAR$(C),FOLD$(C),EDGE$(R1),IN
   $(R1),CASS$(CASS),TITLEA$(TTL),TITLEB$
   (TTL),LINE$(TXL),DOT$(C-8),BOX$(C)
LQ 8010 DIM CENTERA$(TTL),CENTERB$(TTL),C
   ASNUM$(R4),NAME$(R32),CNAME$(R32),PR$(
   15):OFF=40000:PR$="PROWRITER 8510"
AL 8011 REM 8012-8018: INV. CHARACTERS FO
   R PRINTER GRAPHICS
FR 8012 BAR$="█":BAR$(C)="█":BAR$(R2)=BAR
   $:REM INV, CTRL-N
IR 8013 EDGE$=BAR$(R1,R1)
XI 8014 FOLD$="█":FOLD$(C)="█":FOLD$(R2)=
   FOLD$
LO 8015 LINE$=" ":LINE$(TXL)=" ":LINE$(R2
   )=LINE$
YH 8016 BOX$="█":BOX$(C)="█":BOX$(R2)=BOX
   $
IK 8018 DOT$="█":DOT$(C-8)="█":DOT$(R2)=D
   OT$
FJ 8020 DIM DUM$(TXL):DUM$=LINE$
RR 8025 GOTO 9100
FP 8030 POKE 709,R0:POKE 710,8:POKE 708,2
   45
PE 8035 ? "K":? "    ENTER YOUR NAME AS YO
   U WANT IT TO       APPEAR ON THE PRINT
   ED CASSETTE LOG."
OV 8036 ? " ____◣";
UL 8040 POKE 702,64:POKE 694,R0
XV 8045 INPUT NAME$
NU 8050 IF LEN(NAME$)>30 THEN ? "K":? "
   NAME IS TOO LONG":FOR W=R1 TO 400:NEXT
    W:GOTO 8035
YZ 8055 GOSUB 1200
FV 8060 GOSUB MARGIN:REM BEGIN INPUT
LL 8065 LINE=R1:ROW=656:CLM=ROW+R1:BREAK=
   200:EDIT=R0:TT=R0
TX 8085 CASS$=CHR$(R32):CASS$(CASS)=CHR$(
   R32):CASS$(R2)=CASS$
KV 8090 CASS$(18*C+R1)=BAR$
HY 8099 REM DRAW LOG SHEET
EH 8100 GRAPHICS R7:COLOR R2:SETCOLOR R2,
   R10,R0:SETCOLOR R1,R0,8:SETCOLOR R4,R0
   ,R4:SETCOLOR R0,12,R6:REM SCREEN COLOR
DF 8110 PLOT 43,R4:DRAWTO LP+TXL+R2,R4:DR
   AWTO LP+TXL+R2,64:DRAWTO 43,64:DRAWTO
   43,R4
OK 8115 REM PLOT FOLD LINES
NC 8120 PLOT 43,42:DRAWTO LP+TXL+R1,42:PL
   OT 43,48:DRAWTO LP+TXL+R1,48
FS 8130 CTAB=INT((TXL/2)-0.3):PLOT LP+CTA
   B-R1,R1:PLOT LP+CTAB-R1,R2
QN 8135 REM PLOT LINE# GRAPH
XF 8140 FOR W=14 TO R34 STEP R10:PLOT 41,
   W:PLOT R40,W:NEXT W
HQ 8145 FOR W=R6 TO R40 STEP R2:PLOT 42,W
   :NEXT W:PLOT 37,12:DRAWTO 35,12:DRAWTO
    35,14:DRAWTO 37,14
BJ 8150 DRAWTO 37,16:DRAWTO 35,16
EA 8155 FOR W=R33 TO 37 STEP R2:FOR W1=R0
    TO R10 STEP R10:PLOT W,22+W1:DRAWTO W
   ,26+W1:PLOT R36,22+W1:PLOT R36,26+W1
BU 8160 NEXT W1:NEXT W
OO 8165 PLOT R36,R34:COLOR R0:PLOT 37,R33
   :PLOT 35,35:COLOR R2:PLOT R40,R6:PLOT
   41,R6:PLOT R36,R4:DRAWTO R36,8
ZQ 8170 GOSUB 1130
JV 8200 POKE ROW,R0:POKE CLM,R0:? " AUDI
   OPHILE ◢ CASSETTE ◢ COMPUTER  ";:P
   OKE R82,R0:POKE R752,R1
JC 8210 POKE ROW,R1:POKE CLM,R0:? "
        LOG-WRITER ◣         FILE  ";
MT 8220 POKE ROW,R2:POKE CLM,R0:? "
   |▼|                     ▼|       ";
ZP 8230 POKE ROW,R3:POKE CLM,R0:? "
             •START                 ";
UD 8260 IF PEEK(53279)<>R6 THEN 8260
MK 8270 POKE R19,R0:POKE R20,R0:REM SET T
   IMER
ON 8499 REM START NEW LINE
TE 8500 LINE=LINE+R1
DF 8502 IF PEEK(R19)>=MIN*14 THEN GOSUB 3
   00:GOSUB 300:GOSUB 6000:REM CHECK TIME
   R
PO 8510 X=R0:POKE 702,R0:? "K":REM USE LO
   WER CASE TYPE
ZN 8520 IF LINE<=R1 THEN LINE=R2
MO 8530 COLOR R1
MS 8531 IF EDIT THEN GOSUB 1120
FY 8540 IF LINE>30 THEN GOTO 1700
OB 8545 IF EDIT AND LINE=R27 THEN 8570
HB 8550 IF EDIT=R0 AND LINE=R27 THEN GOTO
    1250
ZS 8560 IF EDIT=R0 THEN GOSUB 1800
SP 8570 FOR W=R10 TO 100 STEP R10:SOUND R
   0,W,12,R6:NEXT W:SOUND R0,R0,R0,R0
QK 8580 GOTO 600
VC 9099 REM TITLE SCREEN
SE 9100 GRAPHICS R1:? #R6;"K":FK=R1
JB 9102 POKE 709,160:POKE 710,24:POKE 752
   ,R1
QH 9104 GOSUB MARGIN
WO 9110 POSITION R0,R10:? #R6;"__________
   ";
ML 9112 POSITION R3,12:? #R6;"THE PRINT S
   HOP"
EH 9113 POSITION 8,14:? #R6;"for"
ZC 9114 POSITION R6,16:? #R6;"CASSETTE"
AX 9116 POSITION R4,18:? #R6;"collections
   "
ZR 9117 POSITION R0,19:? #R6;"__________
   _________";
WI 9118 ? :? "    THIS UTILITY IS SET UP F
   OR A      ◣"
SM 9120 ? "      ";PR$;" PRINTER.       ◢
   ";
AL 9130 FOR J=R0 TO R10 STEP R10
VZ 9132 FK=FK+R1:IF FK=R6 THEN GOSUB 9170
   :GRAPHICS R0:GOTO 8060
OA 9134 FOR JJ=-R6 TO 9
RO 9138 IF JJ>R3 THEN SETCOLOR R3,9,R6
AM 9140 IF JJ<-R3 THEN SETCOLOR R3,ABS(JJ
```

```
   )/R2+R2,ABS(JJ)
KC 9142 IF J=R0 THEN POSITION J+R1,ABS(JJ
   ):? #R6;"PROGRAMS!":GOSUB 9160
KJ 9146 IF J=R10 THEN POSITION J,ABS(JJ):
   ? #R6;" & MUSIC ":GOSUB 9160
IY 9148 IF JJ=R0 AND J=R10 THEN POSITION
   J+8,ABS(JJ):POKE 710,14:? #R6;" ":GOS
   UB 9160:POSITION J+8,ABS(JJ):? #R6
YC 9150 SETCOLOR R0,PEEK(53770),8
HW 9152 IF J=R0 THEN POSITION J,ABS(JJ):?
    #R6;" cassette "
RP 9154 IF J=R10 THEN POSITION J,ABS(JJ):
   ? #R6;"logwriter "
JF 9156 NEXT JJ:W=1^1:NEXT J
UC 9158 GOTO 9130
NX 9160 SOUND R0,ABS(FK*JJ)+FK*11,R10,ABS
   (JJ+R4):SOUND R1,(R40*FK),R10,ABS(JJ)+
   R6
FM 9166 IF PEEK(710)=14 THEN SOUND R2,R6,
   14,R10:FOR W=R1 TO 5:NEXT W:SOUND R2,R
   0,R0,R0
VE 9168 POKE 710,24:RETURN
HO 9170 FOR T=R0 TO R4
HQ 9172 COLOR 61:PLOT R1,T:DRAWTO 18,T:PL
   OT R1,T+R6:DRAWTO 18,T+R6
EX 9174 PLOT R1,T+R10:DRAWTO 18,T+R10
LJ 9176 NEXT T
OZ 9177 SOUND R0,R0,R0,R0:SOUND R1,R0,R0,
   R0
CX 9178 COLOR R32:PLOT R4,R1:DRAWTO 15,R1
   :PLOT R3,R2:DRAWTO R6,R2:PLOT 13,R2:DR
   AWTO 16,R2:PLOT R3,R3:DRAWTO R6,R3
UL 9180 PLOT 13,R3:DRAWTO 16,R3:POSITION
   R2,R4:? #R6;"  /\  ":POSITION 12,R4:?
   #R6;"  /\  "
EA 9182 POSITION R3,12:? #R6;"the print s
   hop"
GC 9183 POSITION R2,R6:? #R6;"  \/  ":POS
   ITION 12,R6:? #R6;"  \/  "
EI 9184 POSITION R2,R7:? #R6;"       =BY=
   "
UD 9185 POSITION R3,9:? #R6;" FRANK=KWEDE
   R "
LW 9186 COLOR R32:PLOT R3,8:DRAWTO R6,8:P
   LOT 13,8:DRAWTO 16,8
FR 9188 PLOT R4,R10:PLOT R5,R10:PLOT 14,R
   10:PLOT 15,R10
ZV 9195 POSITION 8,14:? #R6;"FOR="
PF 9200 POSITION R6,16:? #R6;"cassette"
AB 9210 POSITION R4,18:? #R6;"collections
   !"
PP 9220 POSITION R6,R1:? #R6;"
RY 9240 GOTO 8030
```

M/L Editor

For use in machine language entry

by Clayton Walnum

M/L Editor provides an easy method to enter our machine language listings. It won't allow you to skip lines or enter bad data. For convenience, you may enter listings in multiple sittings. When you're through typing a listing with **M/L Editor**, you'll have a complete, runnable object file on your disk.

There is one hitch: it's for disk users only. My apologies to those with cassette systems.

Listing 1 is **M/L Editor**'s BASIC listing. Type it in and, when it's free of typos, save a copy to disk, then run it.

On a first run, you'll be asked if you're starting a new listing or continuing from a previously saved point. Press *S* to start, or *C* to continue.

You'll then be asked for a filename. If you're starting a new listing, type in the filename you want to save the program under, then press RETURN. If there's already a file by that name on the disk, you'll be asked if you wish to delete it. Press *Y* to delete the file, or *N* to enter a new filename.

If you're continuing a file, type in the name you gave the file when you started it. If the program can't find the file, you'll get an error message and be prompted for another filename. Otherwise, **M/L Editor** will calculate where you left off, then go on to the data entry screen.

Each machine language program in **ANALOG Computing** is represented by a list of BASIC data statements. Every line contains 16 bytes, plus a checksum. Only the numbers following the word *DATA* need be considered.

M/L Editor will display, at the top of the screen, the number of the line you're currently working on. As you go through the line, you'll be prompted for each entry. Simply type the number and press RETURN. If you press RETURN without a number, the default is the last value entered.

This feature provides a quick way to type in lines with repetitions of the same number. As an added convenience, the editor will not respond to the letter keys (except *Q*, for "quit"). You must either enter a number or press RETURN.

When you finish a line, **M/L Editor** will compare the entries' checksum with the magazine's checksum. If they match, the screen will clear, and you may go on to the next line.

If the checksums *don't* match, you'll hear a buzzing sound. The screen will turn red, and the cursor will be placed back at the first byte of data. Compare the magazine listing byte by byte with your entries. If a number's correct, press RETURN.

If you find an error, make the correction. When all data's valid, the screen will return to grey, and you'll be allowed begin the next line.

Make sure you leave your disk in the drive while typing. The data is saved continuously.

You may stop at any time (except when you have a red screen) by entering the letter *Q* for byte #1. The file will be closed, and the program will return you to BASIC. When you've completed a file, exit **M/L Editor** in the same way.

When you've finished typing a program, the file you've created will be ready to run. In most cases, it should be loaded from DOS via the L option. Some programs may have special loading instructions; be sure to check the program's article.

If you want the program to run automatically when you boot the disk, simply name the file AUTORUN.SYS (make sure you have DOS on the disk).

That's **M/L Editor**. Use it in good health.

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor*, page 17.

Listing 1.
BASIC listing.

```
AZ 10 DIM BF(16),N$(4),A$(1),B$(1),F$(15)
   ,F1$(15)
BN 20 LINE=1000:RETRN=155:BACKSP=126:CHKS
   UM=0:EDIT=0
GO 30 GOSUB 450:POSITION 10,6:? "Start or
    Continue? ";:GOSUB 500:? CHR$(A)
ZG 40 POSITION 10 8:? "FILENAME";:INPUT F
   $:POKE 752,1:? " "
FE 50 IF LEN(F$)<3 THEN POSITION 20,10:?
   "  ";:GOTO 40
NF 60 IF F$(1,2)<>"D:" THEN F1$="D:":F1$(
   3)=F$:GOTO 80
KL 70 F1$=F$
TN 80 IF CHR$(A)="S" THEN 120
FD 90 TRAP 430:OPEN #2,4,0,F1$:TRAP 110
HQ 100 FOR X=1 TO 16:GET #2,A:NEXT X:LINE
   =LINE+10:GOTO 100
WM 110 CLOSE #2:OPEN #2,9,0,F1$:GOTO 170
VT 120 TRAP 160:OPEN #2,4,0,F1$:GOSUB 440
   :POSITION 10,10:? "FILE ALREADY EXISTS
   !!":POKE 752,0
ZU 130 POSITION 10,12:? "ERASE IT? ";:GOS
   UB 500:POKE 752,1:? CHR$(A)
VH 140 IF CHR$(A)="N" OR CHR$(A)="n" THEN
    CLOSE #2:GOTO 30
QG 150 IF CHR$(A)<>"Y" AND CHR$(A)<>"y" T
   HEN 130
BH 160 CLOSE #2:OPEN #2,8,0,F1$
IE 170 GOSUB 450:POSITION 10,1:? "NOW ON
   LINE: ";LINE:CHKSUM=0
GH 180 L1=3:FOR X=1 TO 16:POSITION 13*(X<
   10)+12*(X>9),X+2:POKE 752,0:? "BYTE #"
   ;X;": ";:GOSUB 310
KH 190 IF EDIT AND L=0 THEN BYTE=BF(X):GO
   TO 210
FY 200 BYTE=VAL(N$)
BU 210 POSITION 22,X+2:? BYTE;"  "
YZ 220 BF(X)=BYTE:CHKSUM=CHKSUM+BYTE*X:IF
    CHKSUM>9999 THEN CHKSUM=CHKSUM-10000
MS 230 NEXT X:CHKSUM=CHKSUM+LINE:IF CHKSU
   M>9999 THEN CHKSUM=CHKSUM-10000
IG 240 POSITION 12,X+2:POKE 752,0:? "CHEC
   KSUM: ";:L1=4:GOSUB 310
EW 250 IF EDIT AND L=0 THEN 270
QM 260 C=VAL(N$)
SY 270 POSITION 22,X+2:? C;"   "
IL 280 IF C=CHKSUM THEN 300
DI 290 GOSUB 440:EDIT=1:CHKSUM=0:GOTO 180
LW 300 FOR X=1 TO 16:PUT #2,BF(X):NEXT X:
   LINE=LINE+10:EDIT=0:GOTO 170
FV 310 L=0
LG 320 GOSUB 500:IF A=ASC("Q") AND X=1 AN
   D  NOT EDIT THEN 420
PO 330 IF A<>RETRN AND A<>BACKSP AND (A<4
   8 OR A>57) THEN 320
TD 335 IF A=RETRN AND L=0 AND X>1 THEN 35
   0
JR 340 IF ((A=RETRN AND  NOT EDIT) OR A=B
   ACKSP) AND L=0 THEN 320
DW 350 IF A=RETRN THEN POKE 752,1:? " ":R
   ETURN
GG 360 IF A<>BACKSP THEN 400
SA 370 IF L>1 THEN N$=N$(1,L-1):GOTO 390
AS 380 N$=""
RE 390 ? CHR$(BACKSP);:L=L-1:GOTO 320
BB 400 L=L+1:IF L>L1 THEN A=RETRN:GOTO 35
   0
WX 410 N$(L)=CHR$(A):? CHR$(A);:GOTO 320
KN 420 GRAPHICS 0:END
YT 430 GOSUB 440:POSITION 10,10:? "NO SUC
   H FILE!":FOR X=1 TO 1000:NEXT X:CLOSE
   #2:GOTO 30
FD 440 POKE 710,48:SOUND 0,100,12,8:FOR X
   =1 TO 50:NEXT X:SOUND 0,0,0,0:RETURN
MY 450 GRAPHICS 23:POKE 16,112:POKE 53774
   ,112:POKE 559,0:POKE 710,4
XR 460 DL=PEEK(560)+256*PEEK(561)+4:POKE
   DL-1,70:POKE DL+2,6
HW 470 FOR X=3 TO 39 STEP 2:POKE DL+X,2:N
   EXT X:FOR X=4 TO 40 STEP 2:POKE DL+X,0
   :NEXT X
ZW 480 POKE DL+41,65:POKE DL+42,PEEK(560)
   :POKE DL+43,PEEK(561):POKE 87,0
AC 490 POSITION 2,0:? "analog ml editor":
   POKE 559,34:RETURN
WZ 500 OPEN #1,4,0,"K:":GET #1,A:CLOSE #1
   :RETURN
```

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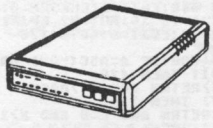

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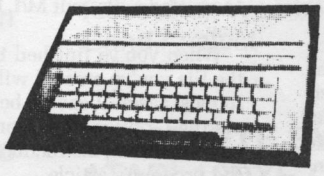

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Bits & Pieces

A hardware utility series

by Lee S. Brilliant, M. D.

So far in **Bits 'n Pieces**, we've covered how a microprocessor functions and how joystick ports can be used to detect the state of events outside the computer itself. This month we'll turn the tables and see how your Atari can begin to *control* the outside world, not just sense it.

To do this, we need an "output port." Inside the Atari is an itegrated circuit numbered 6520, also called the PIA or Peripheral Interface Adapter. The IA contains two 8-bit input/output (I/O) ports and two control registers. Associated with the PIA are two ICs, which monitor the address bus. Whenever an address between 54016 and 54271 is called, they alert the PIA to "come on-line."

When selected, the PIA monitors only the first two address lines, so that it responds to every fourth address within the 54016 to 54271 range. The address *00110011* has the same low two bits as *00000011*, and the PIA responds identically to either, so PEEK 54020 is the same as PEEK 54016.

It's really a shame that better address decoding wasn't included. Had it been, 252 bytes in this section could be dedicated to external devices on the new XL/XE parallel bus, instead of the complex system now necessary. Oh well, nothing like wishful thinking.

Memory addresses 54016 and 54017 are called "port A" and "port B," respectively. On the XL/XE computers, port B controls memory banks. POKEing here can disrupt operation of the computer so thoroughly that even a RESET won't recover it.

In the 400/800 computers, port B goes to joysticks 3 and 4. What's said about port A above applies to port B on these models. The connection is straightforward: pin 1 of plug 1 controls bit 1 of port A. Pin 2 controls bit 2, and so on. As you learned last month, you can see the results of activity on these pins by PEEKing 54016.

The real secret to the 6520 chip is memory location 54018, or "port A control." Each bit controls a specific function. When bit 2 (4 in decimal) is set to *0*, then writing to port A can alter the port's function from input to output.

In this condition, a *0* written to a bit in port A sets it to input, but a *1* sets it to output. Examine this listing:

```
10 P=PEEK(54018):REM SAVE CONTROL SETT
INGS FOR LATER
20 POKE 54018,P-4:REM SETS BIT #2 TO 0
30 POKE 54016,255:REM SETS ALL 8 BITS
TO OUTPUT
40 POKE 54018,P:REM RESTORE PORT CONTR
OL
```

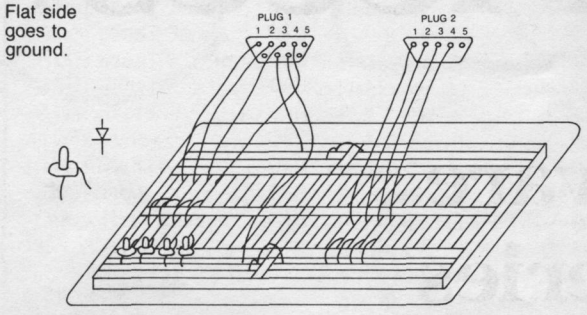
Now, instead of PEEKing inputs from the joysticks, we can control the voltage on the joystick pins by POKEing to 54016. A *0* puts all pins to logic 0, a *255* sets them all to *1*, while *85* turns on every other pin.

If Line 30 read *POKE 54016,15 (00001111)*, then the first four pins of port A would be outputs, and the last four inputs. Joystick 1 would be outs and stick 2 would be ins. Note the reverse relationship between binary numbers and joystick pins. Now, a

00000001 (1 binary) POKEd into 54016 turns on the pins in the 1000/0000 order, where the *1* is on and *0* is off.

Breadboards.

Let's put this theory to the test on our reusable circuit breadboard. Set it up as in Figures 1 and 2.



LEDs — Radio Shack #276-1622

Figure 1.

Now, add these lines to Listing 1 and run it:

```
100 N=1:GOSUB 1000
110 N=2:GOSUB 1000
120 N=4:GOSUB 1000
130 N=8:GOSUB 1000
140 GOTO 100
1000 POKE 54016,N
1020 FOR DELAY=1 TO 500:NEXT DELAY:RET
URN
```

If done correctly, you'll see the four Light Emitting Diodes (LEDs) blink sequentially. If not, check the wiring and try reversing the LEDs. Now, add the following line:

```
1010 HINIBBLE=INT(PEEK(54016)/16)*16:?
 HINIBBLE
```

This is the same formula as that for most significant byte, except you use *16* instead of *256*. While this program is running, connect and disconnect the jumpers on the section attached to joystick 2.

You'll see the reflection of the jumpers on-screen while the LEDs continue to blink. This simple system demonstrates true simultaneous input and output, and gives a simple example of what can be done. (Examples of how input and output combinations are used can be found in **Low Cost Printer Interface, ANALOG Computing**'s issue 16 and **Cheep Talk**, issue 29.)

Devices.

Okay. What can we do with our newfound power? Inputs can be any switch (as discussed last month), while the output lines can be connected to many different kinds of devices (several examples of which are shown at the end of this article). They're simple and safe—if built as shown.

You can control lamps, motors, stereos, TVs, alarm bells, sirens, beepers, and so on. However, the amount of power available to run these devices is limited to about 10 milliamperes (.01 amperes) from each joystick pin.

The little beeper shown in Figure 3 works just fine, but most other devices need more power. Pin 7 carries +5 volts at 50 milliamperes. Figure 2a shows direct connection of loads to joystick pins, while 2b shows how you can run one load at a time, at up to 50 milliamps per load.

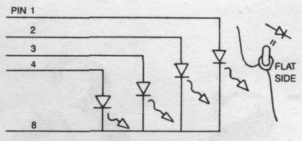


Figure 2a.
Each pin can run one 10-milliamp load. LEDs: Radio Shack #276-1622.

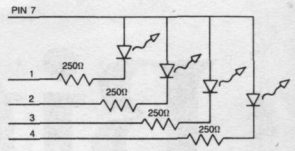
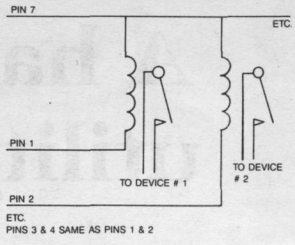


Figure 2b.
One or more loads up to a total of 50 milliamps. Resistors: Radio Shack #271-1314.



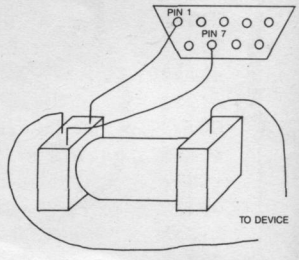


Figure 2c.
Radio Shack #275-232 relay. Up to three at once can be energized. Each relay can turn up to 1-ampere plug-in devices.

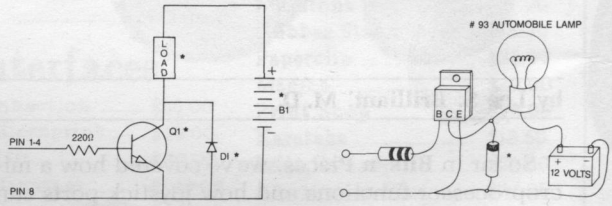


Figure 2d.

Q1 = Radio Shack #276-2017 handles up to 3 amperes.
Load = Any load up to 3 amps, up to 40 volts.
B1 = Battery.
D1 = Radio Shack #276-1103 needed only if load is a coil, such as a 12-volt relay or solenoid (Radio Shack #275-218).

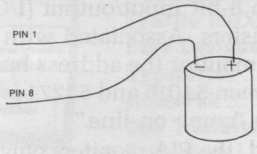


Figure 3.
This little beeper can be placed even a great distance from the computer.

This works because a logic gate at 0 output is almost a short circuit to ground and presents little resistance to electrical current. In this arrangement, the device turns on by POKEing its bit with a *0* instead of a *1*. In other words, the output is inverted.

You can extend the driving power by providing an outside power source. An easy source to find and use is a 12-volt lantern battery (see figure 2c). Connect the – (negative) terminal to pin 8 or ground, but *never* connect the + (positive) terminal to pin 7, only to the device to be controlled.

Circuit 2d will drive loads with higher current needs

without inversion. You should limit the external voltage to 12 volts, and the choice of Q1 depends on the current rating of the load device. *Do not* hook into a plug-in device or anything which has high voltage, unless you're sure it's *completely* isolated electrically from the wall current! If the device has a small plug-in-the-wall power supply, it's usually safe to use with your Atari.

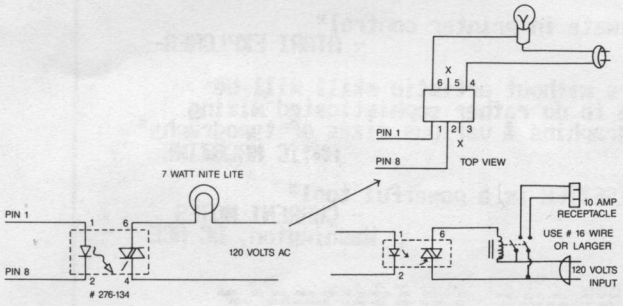


Figure 4.
Optic TRIAC output #276-134. Substitute Radio Shack #275-217 10-amp relay for a super high-power controller.

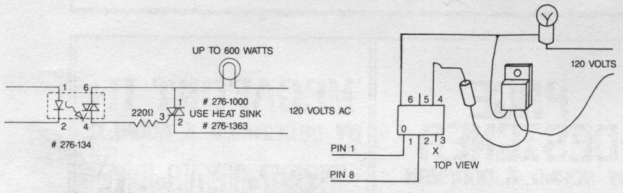
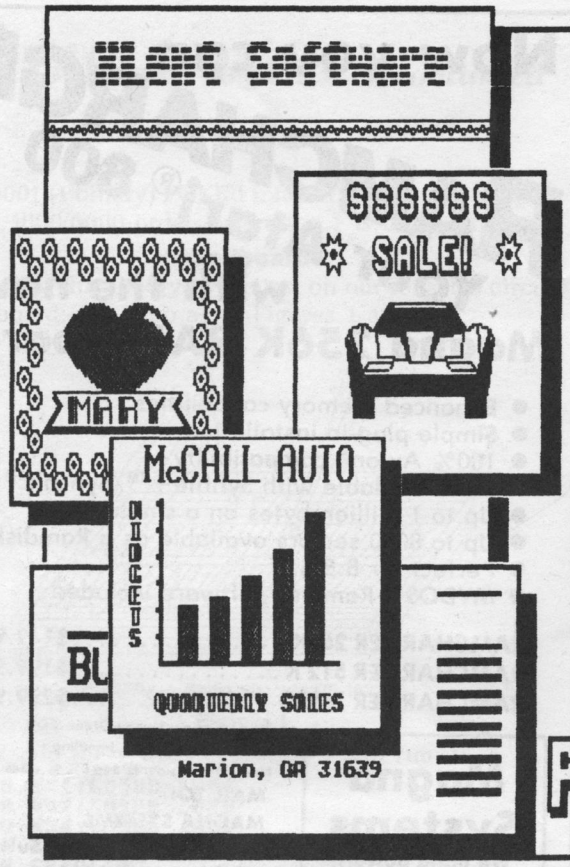


Figure 5.
Opto TRIAC high-power lamp driver (600 watts).

The interfaces shown in Figures 4 and 5 provide over 1000 volts isolation and can be safely used with devices that plug into the wall. This is accomplished with "opto-isolators"—an LED encapsulated with a light-sensitive switch, so there's no electrical connection between the input and output. The TRIAC in Figure 5 requires a heat sink (Radio Shack #276-1363) to keep it from overheating with full loads.

One last precaution: devices that plug in should be built into a box, to prevent you from touching places you shouldn't. If you feel uncomfortable soldering or wiring yourself, ask around users' groups or high school electronic shops to find someone who can help you.

Now that you can both detect and control things in the real world, you have new horizons for your Atari. Be creative. If you come up with something great, please drop me a line in care of **ANALOG Computing**. I'd like to know what others do with their computers.



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ISSUE 4
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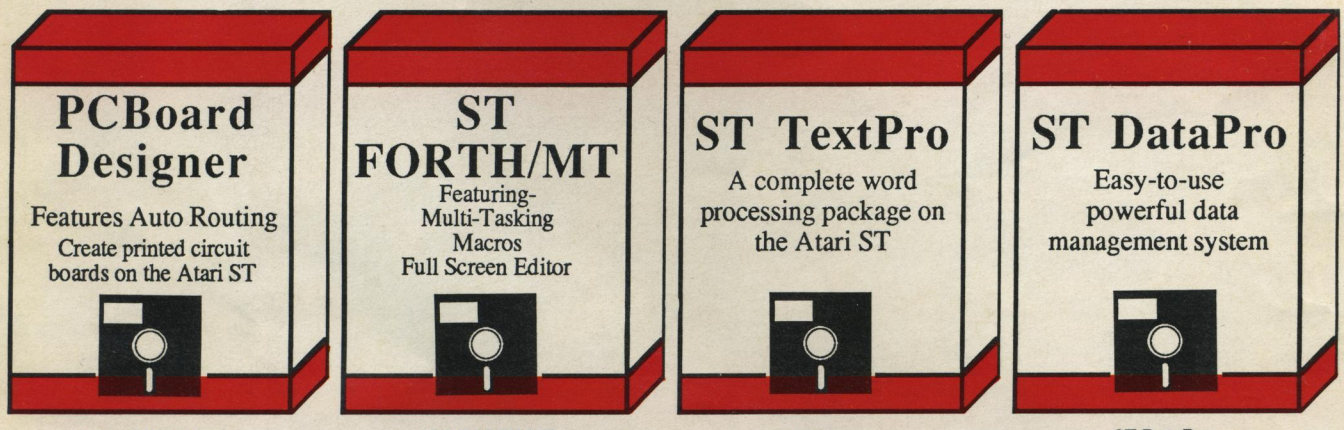

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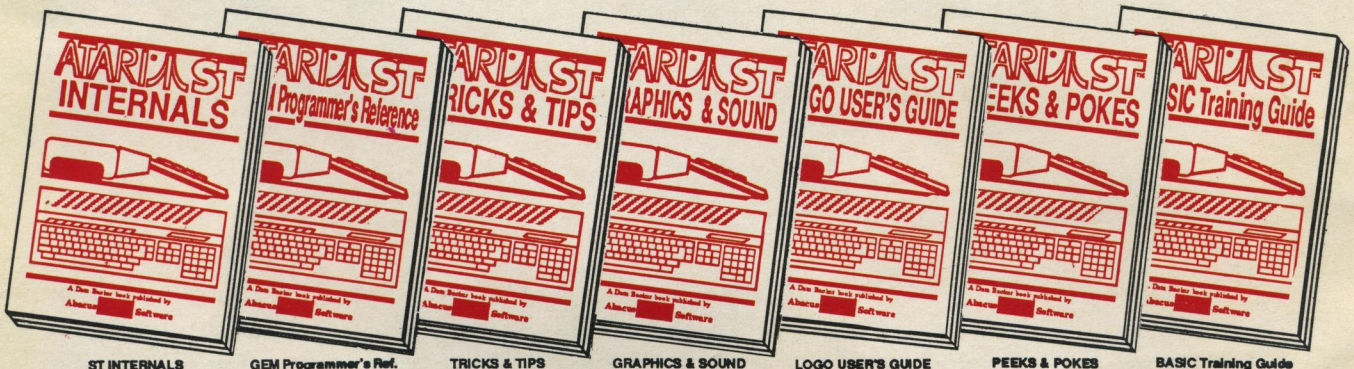

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ST·LOG

THE ATARI ST OPERATOR'S MAGAZINE

ISSUE 4
JULY 1986

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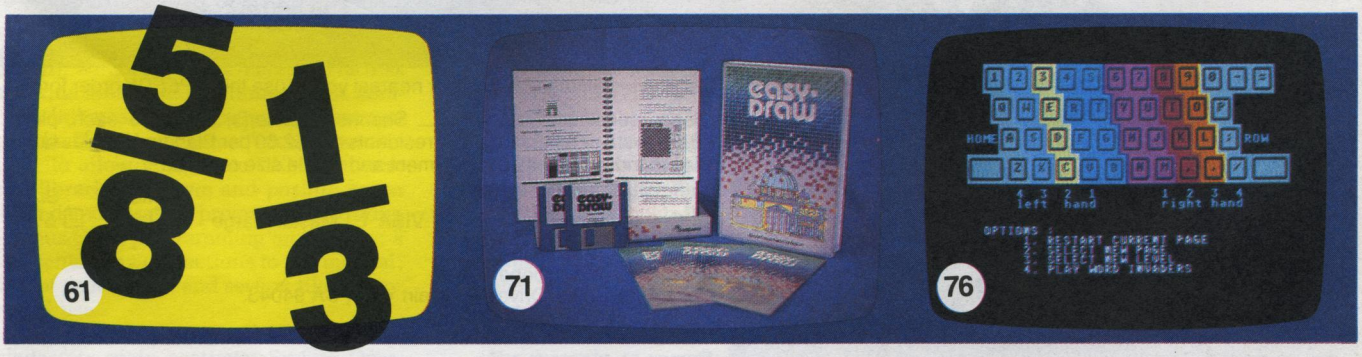

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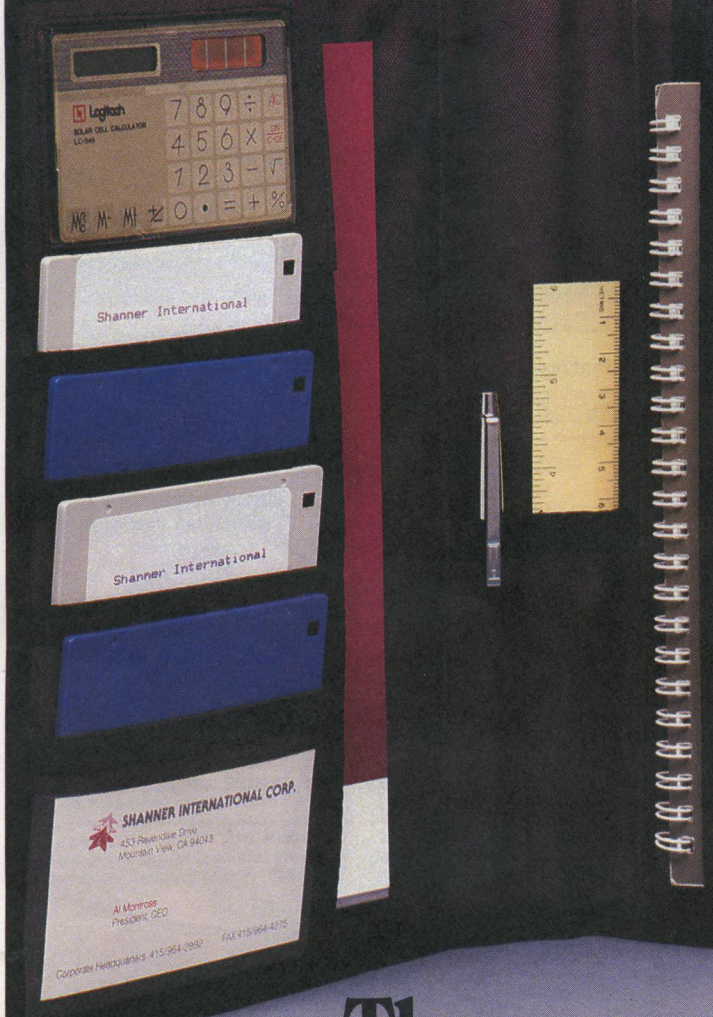

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by Douglas Weir

Often, choosing a compiler isn't simply a matter of deciding which high-level language you like best. Other considerations —ease of use, quality of documentation and (of course) price—can be just as important as the language definition. I think this was the biggest reason for the great success of Borland's **Turbo Pascal** for the IBM PC.

Many programmers who might otherwise have preferred another language to Pascal were so attracted by **Turbo**'s convenient integration of edit, compile and run functions that they chose **Turbo Pascal**. And, compared to the other professional-quality compilers available at the time, **Turbo** was cheap. Now, Atari ST owners can enjoy practically all these features, plus some, in OSS's new **Personal Pascal**.

Personal Pascal comes complete on one 3½-inch, single-sided disk (not copy protected), with a 280-page manual. The disk contains four main programs (editor, compiler, linker, and a program to oversee and call the first three); three "include" source files, to allow you to use GEM routines; two libraries (*pasgem* and *paslib*); seven short demonstration programs illustrating various GEM programming techniques; a file containing corrections to the manual; a brief general file; and several files for internal use.

The manual is very well written. It includes six main sections: System Overview, Editor Reference, Compiler Reference, Linker Reference, GEM/Pascal Library and Language Reference. Its GEM section serves as a semi-tutorial introduction to both GEM and the Pascal implementation. A couple of appendices provide a list of compile-time error messages and ASCII codes. My one complaint is that there's no index.

If you haven't yet programmed under GEM and want to learn, the GEM/Pascal Library section should be one of the most useful parts of the package. **Personal Pascal** comes with a large library of external procedures and functions, which you can include in programs and use to access most GEM features.

GEM is a very complex system, and the **Personal Pascal** manual not only provides detailed explanations of all its GEM routines, it also prefaces each subsection with a very helpful overview of what's going on in GEM, why certain procedures are necessary, and so on.

This is especially helpful as you're learning about GEM's event-management system —how it handles user communication with an application program through the mouse and keyboard, and how the application must receive and respond to the GEM messages.

You get an additional bonus when you access GEM through **Personal Pascal**. In many cases, if you're programming at the "lowest" GEM level (in C or assembly language), you must call several functions just to get one thing done. **Personal Pascal** often simplifies this process for you.

For example, to specify how the interiors of graphics objects are filled, you must call (in C) both *vsf_interior()* and *vsf_style()*. In **Personal Pascal** this becomes one procedure call, *Paint_Style*. Granted, you'll lose some flexibility with this approach, but in most cases you probably won't need it.

I should make one thing clear: at present, not all of the GEM calls are implemented as **Personal Pascal** library routines. For example, the raster operations *vro_cpyform()*, *vr_trnfm()*, etc.) are one group of functions not directly accessible. However, you can perform just about anything you'd normally want through Pascal procedure or function calls—including windowing, using dialog and alert boxes, using the mouse (and changing its form, if you want), graphics, menus, window text style, and so on. There are about ninety routines in all, and the people at OSS say there are more to come. However, since you can easily link to assembly language object files, you're not limited to what **Personal Pascal** can "officially" do.

I found the editor fine for writing source code. It's a stripped-down, full-screen editor which doesn't use any GEM features. You can get a quick reference screen of the available commands by pressing the HELP key. Cursor movement can be controlled either with the cursor keys or with a series of CTRL-key sequences (the latter is a subset of the **Wordstar** system).

To load or save files, exit from the editor, etc., the function keys are used. You get only the eighty characters per line that you see on-screen. If you start inserting text at the beginning of an existing line and the previous text is "bumped" up to the

right edge of the screen, it refuses to move any further, so you can't insert any more text (until you hit RETURN, of course).

The **Personal Pascal** system is controlled from a standard desktop-like screen (the manual calls this level of the system the "Manager"). The drop-down menus at the top bar give you access to (besides, of course, the installed desk accessories) all the separate features of the system. There are two menu titles: Options, which allows you to specify certain linker and compiler options or to save the current options selected; and File, which contains the Edit, Compile, Link and Run Program items.

If the compiler detects an error in your source code, it will display a message box with an error number and a "plain English" description of the error. You decide whether you want to ignore the error and continue the compilation, cancel the compilation, or go straight back to the editor.

If you choose the last, and have enabled the debug option in the compiler, you'll be returned to the editor with the cursor marking where the error was detected, and a line of text at the top of the screen will describe the error. As soon as you press any key, the descriptive line disappears, and you can resume editing. Several compiler options are available.

The *.o* files generated by the compiler are compatible with the Link68 linker provided in the Atari Developer's Kit. At present there's no facility included in the package to obtain assembly language output from Pascal source files. According to OSS, this is a low priority. I for one would like to see such a feature.

Assuming that no errors are detected during compilation, the program can be linked. If an "undefined symbol" error occurs, an alert box will display the symbol and let you decide whether to continue the link or stop. I had some trouble with the continue option in my copy of the program: in most cases when I selected it, for a split-second the screen would display a four-mushroom system error message (illegal 68000 instruction) and return me to the top level of **Personal Pascal**. I've been told by OSS that they're looking into this problem, and I would expect it to be corrected in the next release (which is due in April, or perhaps sooner).

It took me about 68 seconds to compile and link a tiny Pascal program that prints *hello world* to the screen. This compares with about 2 minutes, 47 seconds to compile and link a similar C program using the Atari Developer's Kit (and that doesn't include the time taken to switch disks and type in command names). Of the 68 seconds, 25 were spent in loading the compiler, about 2 or 3 in loading the linker. Obviously, these times will be greatly reduced with a ramdisk or a hard disk.

What's perhaps more remarkable is that the resulting Pascal program (compiled and linked as a TOS application) was 2240 bytes long, while the C version (no GEM calls) was 6971 bytes long. (I used *puts()* and not *printf()* to reduce the program's size.)

I don't know whether all non-GEM programs will compare the same way in their compactness of code, but I should point out that GEM-intensive programs will probably be bigger in **Personal Pascal** as opposed to C, since (as mentioned above) **Personal Pascal** tends to build "higher-level" constructs to manage all the primitive routines that one calls explicitly in C.

I wrote a Pascal version of the Sample.c program included with the Developer's Kit, and the resulting program was a little bigger (about 600 bytes) than the C version. Nevertheless, it's obvious that you can go through the compile and link phases much more quickly and conveniently with **Personal Pascal**. For many applications, this alone would be enough to make me choose it over C.

Once you've compiled and linked your program, you can run it from the **Personal Pascal** system by selecting the "run program" item from the File menu. If the program's running as a TOS application, **Personal Pascal** will insert a *hit any key to continue* message just before it ends, and wait for a keypress before exiting. This can be very handy (it doesn't happen when the program is run from the OS).

If you get a run-time error (I got most of mine as I was debugging a linked-list program using pointers), you'll see an alert box announcing the error with an ABORT button. When you click on the button, a second box will appear, giving the error's location in the program in the form of the source code line number and the hex value of the program counter.

Note that you must have enabled the debug option in the compiler to get this information. If the program was running as a TOS application, this information is simply printed on-screen and a *hit any key to continue* message is displayed. In any case, you end up in the top level of the **Personal Pascal** system.

There are a few minor problems. First, the compiler and the linker give you the option (via a button in the message boxes displayed while operating) of cancelling the compilation or link. This works during a link, but the compiler ignores all cancel requests.

Second, if you get a compile-time error and select the return-to-edit option, then (after editing) exit the editor by any means other than the automatic save-and-compile option (key F9), from then on the item selector box for the editor will display two or three groups of meaningless codes instead of the current selected filename. You can't backspace to enter a new filename if this happens, although you can select any pre-existing filename (the name still won't be correctly displayed in the box, but it will be loaded).

The only way out seems to be to reboot, since exiting, running another program, and re-entering **Personal Pascal** still won't fix things. Both these bugs will be fixed in the new release, according to OSS. In the meantime, they can easily be worked around.

This is a complete Pascal; nothing has been left out. I've tested the implementation of pointers, sets, records, arrays, files and strings (yes, there are strings)—and have found nothing lacking. The one exception concerns the use of disk files. This release of **Personal Pascal**will allow you to use the built-in *read*, *readln*, *write* and *writeln* procedures only with the standard files *input* and *output*.

This means that, when you use a disk file, you must write your own versions of these procedures, by making calls to the primitive Pascal procedures *get* and *put*. For example, to read from a file you call testfile, you would declare something like the following:

```
procedure f_read(var testfile:   item_file;
                 var item:       item_type);
begin
    item := testfile^;
    get(testfile)
    end;
```

where *item_file* and *item_type* are type declarations you've made at the top of your program. (Note that **Personal Pascal**, like many Pascal implementations, requires that formal parameters to procedures and functions have predeclared types—e.g., you wouldn't be able to have:

```
var testfile: file of item;
```

in the parameter declaration of *f_read* above). The next release will let you use *read*, etc., with any file (which is the way it should be).

It's nice to see, by the way, that file buffer pointers are implemented exactly as in the standard Pascal definition. This makes it easy to do things like take a look at the next character in a text file, without altering the values of the *eof* or *eoln* functions.

Personal Pascal also includes many useful extensions to "standard" Pascal. I've already mentioned the numerous GEM routines. Other extensions include *byte* and *long_integer* types, strings, bit-manipulation operators (like those in C), an otherwise option for case statements, and a loop statement that tests its exit condition(s) anywhere you want in the middle of a loop.

Also included are special language directives. These are appended to the top line of a function or procedure declaration (like the "forward" directive in standard Pascal). They allow you to tell **Personal Pascal** that a declaration is "external" (contained in another object file), a call to a C module, or a BIOS, extended BIOS or GEMDOS call.

The directives all work as described, except that when you link to assembly lan-

guage modules you must declare the labels referenced from Pascal as external (*.globl* in AS68) in the assembly source file. These external labels must be all capital letters in the assembly source file. To use C routines, just code and compile the function(s) you reference in Pascal (leave *main()* empty or omit it). To link the files together, you need a command line similar to the following:

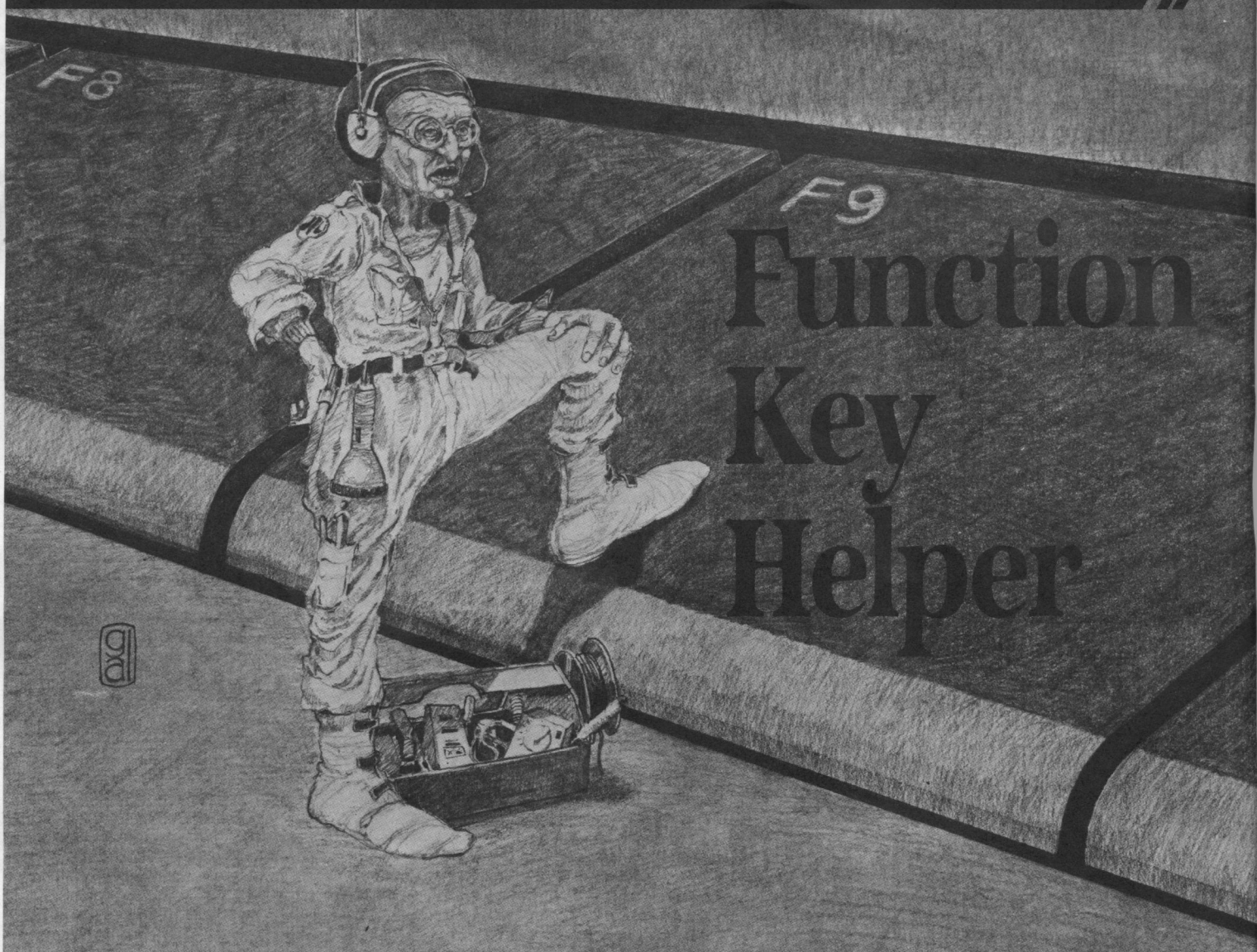
```
link68 [u] pn.68k=pn,cn,paslib,gemstart,gemlib,libf,osbind
```

where *pn* is the *.o* filename of the Pascal program, and *cn* is the *.o* filename of the C routine(s). (If you leave *main()* out of your C file, ignore the linker's complaint about *__main* being undefined.) Because the file information for standard input and output is filled in by some run-time startup code at the beginning of a normal C program, you can't use C functions (like *puts()*, *printf()*, etc.) that use these file pointers. You *can* use all the other functions, including those that create and use disk files. Also note that you can use C routines in a TOS application, but not under GEM (because both the Pascal and the C routines want to open a virtual workstation). I am indebted to Bill Wilkinson of OSS for much of the information included in this paragraph.

There are many miscellaneous extras. These include a set of routines that give a TOS application access to the parameters passed on its command line (to use these routines—*cmd_args*, *cmd_getarg* and *option*—you must specify *paslib* as an additional link file as a linker option, even though it's automatically read once by the linker. This is a bug which will be fixed in the next release). A procedure "chain" lets you execute another program and return to the caller afterward. However, note that you must set aside some memory with either the *S* or the *U* compiler directive to do this, and reserving too much or too little memory can be equally disastrous.

The function *filename* will tell you if a string is a valid TOS filename or not. To use it, you must link to *paslib* a second time, just as with the command line routines mentioned above. The procedure *io_check* and the function *io_result* allow you to suppress run-time supervision of i/o operations by **Personal Pascal** and do the checking yourself. However, you must explicitly declare these two routines in your program as "external," in order to use them (they'll then be linked into *paslib* by the linker). I understand that this won't be necessary after the next release. Finally, the function *sizeof* acts just like its C namesake: it will return the size (in bytes) of any data type (and this includes structured types).

I would recommend this package to anyone. Its documentation sets a (much-needed) new standard among ST/GEM tools. Ideally, I prefer C to Pascal, but Pascal's much more elaborate error-checking makes it a better learning language than C, and **Personal Pascal**'s extensions and extra features eliminate many of my complaints about Pascal as a language. If you were to buy **Personal Pascal** and two of the new ST books just published by Abacus (*ST Internals* and the *GEM Programmer's Reference*) you'd have more than enough to start serious GEM programming projects. If you're looking for a compiled language for your ST, you should look seriously at **Personal Pascal**.



Function Key Helper

by Matthew J.W. Ratcliff

There are two philosophies on the control of special functions in computer applications these days. The IBM PC uses ten function keys, while the Macintosh uses a mouse. Atari gave us both with the 520ST.

Most software "ported" over to the ST from the IBM realm uses function keys. Atari's **ST-Writer** and ST-BASIC use function keys, while the graphics drawing programs **DEGAS** and **NEO-Chrome** primarily use mouse controls.

I hate function keys myself. Every time you boot a different program, your function keys are redefined. I just can't memorize them all. The GEM operating system interface, **NEO-Chrome** and **DEGAS** have proven mouse control can be elegant, simple to use and complete. But, due primarily to the immense popularity of the IBM PC, we must deal with annoying function key controls, as software continues to be ported over from the IBM world.

As a matter of fact, there's a big business in function key templates for the IBM PC. I wrote **Function Key Helper** (**FKH** from here on) to alleviate the problem of having to memorize function keys for the ST. See the sample templates on the next page for **ST-Writer** and ST-BASIC.

How to use the program.

FKH makes it easy to create, update and print function key templates for your ST software. You can edit for SHIFT, CONTROL and ALTERNATE definitions, as well. The editor of **FKH** allows you to enter up to five words of eleven characters (maximum) as a description, for each type of function keypress.

The template may be saved to or loaded from disk. This comes in handy with software allowing for user-programmable macro functions, such as **ST-TERM**. You may not need to define all function keypresses (i.e., function and SHIFT-function, but not CONTROL or ALTERNATE).

When the template is printed on your Epson, Gemini, or compatible printer, you have the option of suppressing empty key sets. They may be printed, however, so you can pencil in additions later.

A template works best if rubber cemented to a piece of

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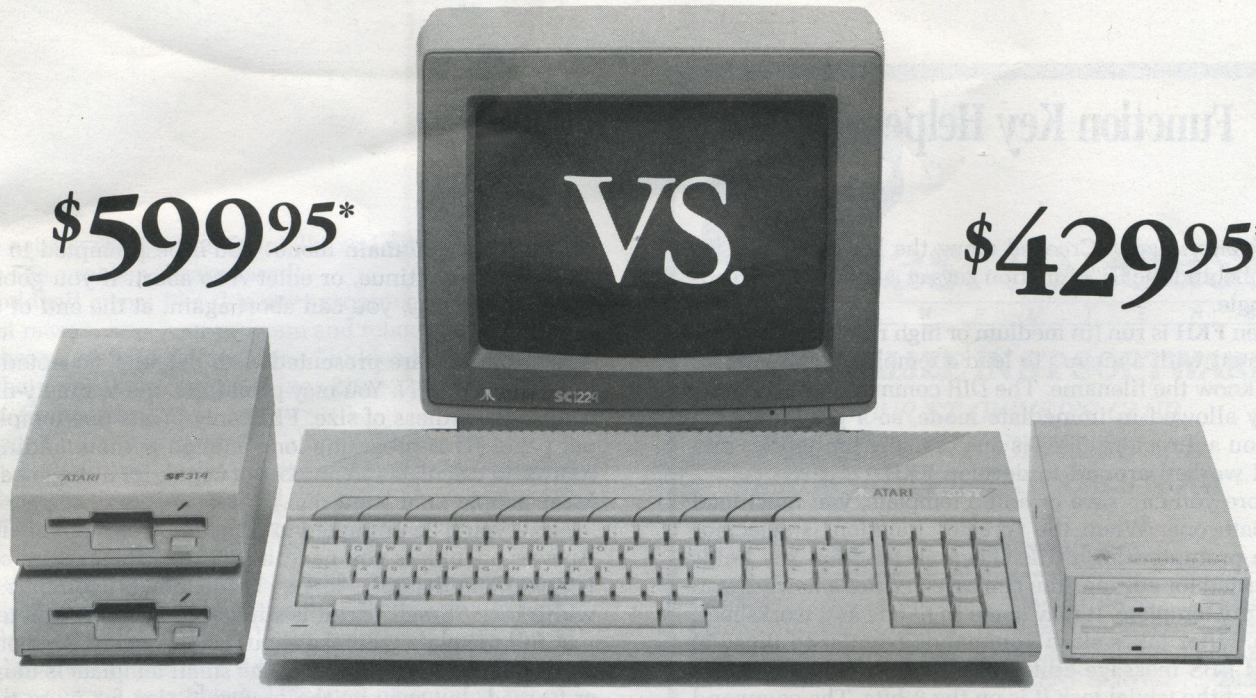

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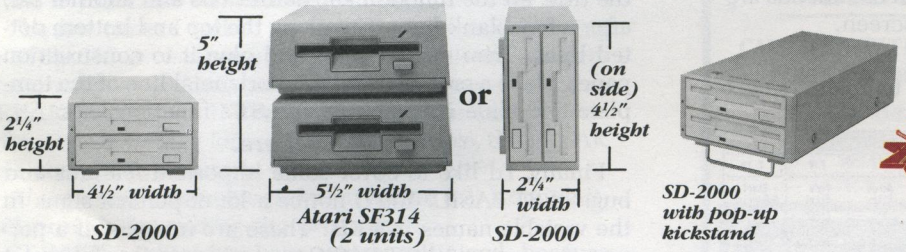

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construction paper. Creased along the last line, it'll slip neatly behind the ST's function keys at a comfortable reading angle.

When **FKH** is run (in medium or high resolution), you're presented with a menu. To load a template, you must already know the filename. The *DIR* command of ST-BASIC is only allowed in immediate mode, so a program can't give you a directory. This is one of many limitations and bugs I worked around to develop **FKH**.

Before you can save or edit a template, you must load or create one. When the "create" function is selected, you're prompted for a title. Then all function key fields are created for editing. You can save or print a newly created empty template. It may come in handy as a worksheet.

The editor takes slash commands (similar to those of FoReM BBS message editor). Full-screen editing on the ST is not the trivial task it is on the 8-bits. The command editor was easier to create, and is still fairly easy to use.

You start out editing descriptions for function key F-1. Just type the descriptions and press RETURN on each line. The */F* command will skip you forward to the next set, SHIFT function keys. The */B* will back up one set.

If a word description is already defined, it's displayed to the left of your edit window. A */C* will clear out the current word, if you wish to delete it. If no changes to the word are desired, press the RETURN key to move on.

Pressing RETURN on the last description line will move you to the next function key in the current set, or continue with the next set if function number 10 was the last edited. The */N* will move you to the next function key (from, say, F-1 to F-2). A */P* will back up to the previous function key edited.

The */G* command is used to "goto" a particular key within the current set. The */G* should be immediately followed, with no space, by the number of the key (1 through 10) you wish to edit next.

You may move */Up* or */Down* the word list for the current function key, too. Pressing RETURN past the last function key edit (ALT-F-10) or the */E* exit command will RETURN control to the main menu. Slash commands are displayed at the bottom of the editing screen.

Printing the template.

Once you've edited and saved your template, select "print" from the main menu. You'll be prompted to hit RETURN to continue, or enter *A* to abort. If you goofed up along the way, you can abort again, at the end of the set-up.

Your options are presented with defaults, accepted by pressing RETURN. You may print from one to ninety-nine copies. Regardless of size, **FKH** only prints one template per page. (This program's long enough *without* adding a routine to calculate the number of copies for a single page. Most people only want one.)

Next, you'll be prompted to print empty function fields. Answer no, unless you need it as a worksheet. Print size is next. The default, "large," is full height, compressed width text. "Small" print is superscript, half-height text.

A full template will take about half a page in large print and a quarter page in small. The small template is tougher to read, but may be the preferred size for more than two sets of function key descriptions. If you select large, you'll be asked for double strike (small is always double strike). If your ribbon is wearing thin, or you want a quality print to photocopy, double strike is preferable.

Finally, you're prompted to see that the printer is ready to go, then press RETURN.

##ST-Writer Function Keys##

F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	F 9	F 10
Goto End of Text	Goto End of Line	Case Toggle	Set Tab Stop	Block Delete	Search Foreward	Replace with Query	Merge File at Cursor	Form Print Blank Mark	Start Subscript or End Superscript
sF 1	sF 2	sF 3	sF 4	sF 5	sF 6	sF 7	sF 8	sF 9	sF 10
Goto Top of Text	Goto Start of Line	Toggle Underline	Clear Tab Stop	Text Block Marker	Search in Reverse	Global Replace	Save Marked Text Block	Elongated Print Toggle	Start Superscript End Subscript

##ST-BASIC Edit Functions##

F 1	F 2	F 3	F 4	F 5	F 6	F 7	F 8	F 9	F 10
Insert Space	Delete Character	Insert Line	Delete Line	Page Up	Page Down	Load Text	Save Text	New Buffer	Exit Editor

Figure 1. — Sample templates.

Printer controls.

A few pointers on the printer controls are in order here. To fit all the information on an 80-column printer, the compressed print mode is always set in Line 1990 (even compressed superscript). Unidirectional printing is selected in Line 2000, to ensure proper alignment of the columns.

In bidirectional printing, there's always a ½-dot difference in print directions. This isn't noticeable in most text, but would be in this application.

Lines 2020 and 2030 set superscript and 5/72 line spacing for small print. Line 2050 sets ⅛ line spacing for large print, and 2060 sets double strike if enabled.

Lines 2070-2090 print a series of numbers across the top of the page. This will be handy for reference, especially while debugging your entries.

Your template begins with a horizontal bar, followed by the title, all the function key definitions and another bar, after a few blank lines. Cut along the top and bottom dotted lines. Trim off the sides and glue it to construction paper. Make a crease at the last horizontal line of the template and slide it in behind the ST's function keys.

Almost there.

Finally, I'd like to cover some important features and bugs of ST-BASIC. You'll notice a lot of percent signs in the variable names in **FKH**. These are integers. If a percent sign isn't used, ST-BASIC treats them as floating point numbers. Always use integers where applicable. It's more efficient in terms of memory (not that we're going to run out) and makes for *faster* running code.

While testing **FKH**, I'd sometimes get garbage in the title string or some of the description strings, for no apparent reason. This happened a lot during development of the program, but has not cropped up in the final version.

I do know, though, that the problems were not due to bugs in **FKH**. When the title string kept getting goofed up, I started studying the program listing. It didn't seem

to be getting changed accidentally, so I rebooted the system. The problem disappeared!

If oddball errors like this start cropping up for no apparent reason, save your program and reboot the machine. Another problem to look out for—"hidden keywords." Notice that I use the string fc$ (Lines 2190-2220) in the program. Originally, it was fnc$.

Every time the program hit a line with the fnc$ string name, I got errors. I haven't found any fnc$ or fnc reserved words in the ST-BASIC manual, however. (Apparently, ST-BASIC thought I was referring to an undefined function. See DEF FN in the manual.)

Notice, when loading a file in **FKH**, that I open the file for input, close it and open it again, before actually reading the file. Editor Clay Walnum pointed this fix out to me. Apparently, the first time a file is opened, the file pointers can get scrambled. The open-close-open procedure seems to work fine.

You don't want to use the *a$ = input$(1)* command to grab a single key from the keyboard. It works, but, whenever that statement is executed, the screens are flipped from the output screen to the command screen and back.

This is extremely annoying. That's why I use *inputs* throughout **FKH**. If you do use the single key grab command, you should note one particular bug that took me a while to discover. Try the following:

```
10 a$=input$(1)
20 if a$="" then ? "Return only":end
30 ? "You pressed ";a$;" length of ";l
en(a$):end
```

If you just press RETURN, the program will end at Line 30, not 20 as expected. And you'll notice that a$ contains one character, a carriage return. A print asc(a$) would return a *13*, however, the LEN function would return a *0*. Watch out for this one, if you use it with disk I/O.

There seems to be no way to read the ST keyboard on the fly without VDI or machine language USR calls. The INP *-4*, keyboard status check, doesn't work at all. It always returns a *16*, not a *0* or *-1* as expected. The INP *-2*, console status check, works at random for the keyboard (even if you close windows not in use).

The few times I locked up the ST while programming in ST-BASIC were when attempting to break out of a program with a CTRL-C or CTRL-G keypress. Selecting BREAK from the pull-down menu had the same effect. Often, while waiting for an input, for example, the BREAK was completely ignored.

Always save a valuable program before test running it, and provide for exiting the program.

ST-BASIC's editor has been widely criticized, because it's cumbersome to use. Always POKE SYSTAB+2,33 before editing your program. Then your text will turn into boldface, not ghost characters, when you edit a line. If you hate the editor *that* much, use **ST-Writer**. Even that won't be simple.

The older Ataris used a nonstandard carriage return character, ASCII 155. The ST has the standard ASCII 13, except for **ST-Writer!** It uses ASCII *0*s for carriage return markers.

You can load an ST-BASIC program into **ST-Writer**. You'll

// Function Key Helper *continued*

be informed that it's "converting" a non-**ST-Writer** file as it loads. Once in memory, you can edit to your heart's content. When finished, *do not* save the file, however. You must print it to a disk file.

It would be wise to set the left margin (^L at the top of the file) to *1* and the right margin to *80* (or, possibly, *120*), to prevent **ST-Writer** from parsing any of your program lines into shorter ones.

You may wish to make a test print to the screen before printing to disk. I even created a huge update file for **FKH** with **ST-Writer**, printed it to disk and merged it with an earlier version of **FKH** in ST-BASIC.

In the "conversion" process, you lose the default control codes line of **ST-Writer**. Setting the margins is most important.

You may wish to add a header and use **ST-Writer** to print your listings for you. It works fine!

One final note: never, never *ever* close all your ST-BASIC windows, from program control or with the mouse. If you do, the ST will be hopelessly locked up and you must reboot.

If you're wondering if ST-BASIC is bug-ridden, the answer is *yes*. However, it's still quite functional—and a very fast BASIC (when run, not for program development and debugging). Once the bugs are documented and understood, you can program around them. . .as you can see with **FKH**. Total computer lockup from ST-BASIC was a rarity, and I found program editing with **ST-Writer** made ST-BASIC programming much easier.

Matthew Ratcliff is an electrical engineer in St. Louis, Missouri. When not using his spare time to write articles, he's president of ACE St. Louis and a remote SYSOP on Gateway City BBS, (314) 647-3290.

Listing 1.
BASIC listing.

```
10 dim F$(10,5),sF$(10,5),cF$(10,5),aF
$(10,5),wF$(10,5)
20 er$="New Run":file$="":width lprint
 132
30 openw 2:fullw 2:created%=0
40 clearw 2:poke systab+2,33:' For ST-
BASIC Edit Mode
50 gotoxy 0,0:? "    Function Key Help
er"
60 ? "    (c) ANALOG Computing"
70 ? "    by Matthew Ratcliff"
80 ? er$;chr$(7):close
90 ? "L)oad function help template."
100 ? "C)reate new function helper."
110 ? "E)dit function key definitions.
"
120 ? "S)ave template."
130 ? "P)rint function helper."
140 ? "Q)uit program."
150 ?:? "Press letter key & [RETURN] "
;:input a$
160 a%=asc(a$):if a%>96 then a%=a%-32:
' Adjust for lower case
170 if a%<>81 then 200:' Quit
180 ?:? "Quit now. Are you sure (Y/N)
?"
190 input a$:if a$="Y" or a$="y" then
close:end
200 if a%<>76 then 390:' Load Template
210 ? "Filename of template to load ?"
220 input file$:if file$="" then 40:'
Return only aborts
230 on error goto 240:open "I",#1,file
$:goto 260
240 if err=62 then 380
250 er$="Filename Error!":goto 40
260 close #1:open "I",#1,file$
270 f%=1:input #1,ttl$:? "Loading ";tt
l$
280 for i%=1 to 10
290 for j%=1 to 5
300 on f% goto 310,320,330,340
310 input #1,F$(i%,j%):goto 350
320 input #1,sF$(i%,j%):goto 350
330 input #1,cF$(i%,j%):goto 350
340 input #1,aF$(i%,j%)
350 next j%
360 next i%
370 f%=f%+1:if f%<5 then 280
380 close #1:created%=1:er$="Load Comp
lete":goto 40
390 if a%<>67 then 540:' Create
```

```
400 ? "* Create New Function Template
*"
410 ? "Input help template title,"
420 ? "(press [RETURN] only to abort)
?"
430 input a$:if a$="" then er$="No Cre
ate":goto 40
440 ttl$=a$:? "Working...":created%=1
450 for j%=1 to 5
460 for i%=1 to 10
470 F$(i%,j%)="\":' Backslash indicate
s empty field
480 sF$(i%,j%)="\"
490 cF$(i%,j%)="\"
500 aF$(i%,j%)="\"
510 next i%
520 next j%
530 er$="Create Complete - Ready to Ed
it":goto 40
540 if a%<>69 then 1300:' Edit now
550 if created%=0 then er$="Must C)rea
te or L)oad first!":goto 40
560 clearw 2:gotoxy 1,8:? "----------
--------------------------"
570 ? "Enter /F to skip to next Functi
on set, /B to backup."
580 ? "Enter /C to Clear current word.
"
590 ? "Press [RETURN] only to keep wor
d and continue."
600 ? "Enter /N for Next function key.
"
610 ? "Enter /Gnn, where nn is a # 1-1
0, to goto key."
620 ? "Enter /P for Previous function
key."
630 ? "Enter /U to move Up to previous
 Word."
640 ? "Enter /D to move Down to next W
ord (wraparound)."
650 ? "Enter /E to Exit edit mode to M
enu.";
660 fn%=1:ky%=1:' Function set #, key
descr #
670 gotoxy 2,0:? ttl$:' Show name of f
unction helper in edit mode
680 gotoxy 5,1:? "Editing: ";
690 on fn% goto 700,710,720,730
700 ? "         ";:goto 740
710 ? "    shift";:goto 740
720 ? "  control";:goto 740
730 ? "alternate";
740 ? "-Function Key # ";
750 gosub 2670
760 gotoxy 40,1:? ky%;"    "
770 gotoxy 3,2:? "# : word"
780 for w%=1 to 5
790 gotoxy 2,w%+2:? w%;":";:a%=0
800 if wF$(ky%,w%)<>"\" then ? wF$(ky%
,w%);:a%=len(wF$(ky%,w%))
810 ? space$(12-a%);"|";space$(14);"|"
820 next w%
830 w%=1:' Now Editing, W% = word coun
t
840 gosub 2870:gotoxy 17,2+w%
850 input a$:a%=0:if len(a$)>1 then a%
=asc(mid$(a$,2,1)):c$=left$(a$,1)
860 if a%>96 then a%=a%-32:' Lower Cas
e Fix
870 if len(a$)<>0 then 950:' Return on
ly handler
880 w%=w%+1:gosub 2870:' Next Word
890 if w%<6 then 840
900 ky%=ky%+1:' Next Function key
910 if ky%<11 then 760
920 ky%=1:gosub 2540:fn%=fn%+1
930 if fn%<5 then 680
940 er$="Completed Edit":goto 40
950 if c$<>"/" then 1280
960 if a%<>70 then 980:' F)oreward = n
ext set
970 goto 920
980 if a%<>71 then 1050:' G)oto functi
on key
990 if len(a$)<3 then ky%=1:goto 760
1000 b%=asc(mid$(a$,3,1))-48
1010 if (b%>0 and b%<10 and len(a$)=3)
 then ky%=b%:goto 760
1020 if b%<1 then ky%=1:goto 760
1030 if b%>9 then ky%=10:goto 760
1040 if len(a$)>3 then ky%=10:goto 760
1050 if a%<>67 then 1070:' C)lear Word
1060 wF$(ky%,w%)="\":goto 840
1070 if a%<>66 then 1110:' B)ackup = l
ast set
1080 gosub 2540
1090 fn%=fn%-1:if fn%<0 then fn%=4
1100 ky%=1:goto 680
1110 if a%<>78 then 1150:' N)ext Key
1120 ky%=ky%+1
1130 if ky%<11 then 760
1140 goto 920
1150 if a%<>80 then 1190:' P)revous ke
y
1160 ky%=ky%-1
1170 if ky%>0 then 760
1180 ky%=10:goto 760
1190 if a%<>85 then 1220:' U)p a word
1200 w%=w%-1:if w%<1 then w%=5
```

```
1210 goto 840
1220 if a%<>68 then 1250:' D)own one w
ord
1230 w%=w%+1:if w%<6 then 840
1240 w%=1:goto 840
1250 if a%<>69 then ? chr$(7):goto 760
:' E)xit to menu
1260 gosub 2540
1270 er$="Exit Edit Mode":goto 40
1280 if len(a$)>11 then ? chr$(7):a$=l
eft$(a$,11)
1290 wF$(ky%,w%)=a$:goto 880
1300 if a%<>83 then 1640:' Save Templa
te
1310 if created%=0 then er$="No File t
o Save!":goto 40
1320 ? "Save template. Press [RETURN]
to continue,"
1330 ? "or input 'A' to abort save fun
ction ?";input a$
1340 if a$="A" or a$="a" then er$="No
Save":goto 40
1350 if len(ttl$)=0 then 1380
1360 ? "Current template title is:":?
ttl$
1370 ? "Press [RETURN] only to keep sa
me name."
1380 ? "Input new title:":input a$:if
len(a$)=0 then 1400
1390 ttl$=a$
1400 if len(ttl$)=0 then ? "Must have
a title";chr$(7):goto 1320
1410 if len(file$)=0  then 1440
1420 ? "Current disk filename is: ";fi
le$
1430 ? "Press [RETURN] only to keep sa
me name."
1440 ? "Input template filename: ";:in
put a$:if len(a$)=0 then 1460
1450 file$=a$
1460 if len(file$)=0 then ? "Must have
 filename!";chr$(7):goto 1440
1470 on error goto 1490
1480 open "O",#1,file$:goto 1500
1490 er$="Disk Error During Save!":got
o 40
1500 ? #1,ttl$
1510 f%=1
1520 for i%=1 to 10
1530 for j%=1 to 5
1540 on f% goto 1550,1560,1570,1580
1550 ? #1, F$(i%,j%);:goto 1590
1560 ? #1,sF$(i%,j%);:goto 1590
1570 ? #1,cF$(i%,j%);:goto 1590
1580 ? #1,aF$(i%,j%);
1590 if j%<5 then ? #1,","; else ?#1
1600 next j%:next i%
1610 f%=f%+1:if f%<5 then 1520
1620 close #1
1630 er$="Function Help Template Saved
":goto 40
1640 if a%<>80 then er$="Invalid Key C
ommand":goto 40
1650 if created% then clearw 2:gotoxy
4,0:goto 1670
1660 er$="Must C)reate & E)dit or L)oa
d first!":goto 40
1670 ? "** Print Template ";ttl$;" **"
:?:? "Press [RETURN] to continue,"
1680 ? "or [A] and [RETURN] to abort "
;:input a$
1690 if len(a$)<>0 then er$="No Print!
":goto 40
1700 empty%=0:' Don't print empty func
tion definitions
1710 small%=0:' Use large compressed p
rint, not small superscript
1720 cop%=1:' # of copies
1730 dbl%=0:' Double Strike for large.
 Default off
1740 input "# of copies (default=1) ",
a$
1750 if len(a$)=0 then 1770
1760 on error goto 1740:cop%=val(a$):i
f cop%<1 or cop%>99 then 1740
1770 ? "Print empty function fields (Y
/N, default N) ?"
1780 input "(i.e. all 10 keys for a fu
nction are not defined) ";a$
1790 if len(a$)=0 or a$="N" or a$="n"
then 1820
1800 if a$="y" or a$="Y" then empty%=1
:goto 1820
1810 ? "What?";chr$(7):goto 1770
1820 ? "(S)mall print (1/4 page max he
ight) or"
1830 input "(L)arge print (1/2 page ma
x, default) ",a$
1840 if len(a$)=0 then 1860
1850 if a$="s" or a$="S" then small%=1
1860 if small%=1 then dbl%=0:goto 1910
:' Small always double strike
1870 input "Double strike for large pr
int (Y/N, default N) ",a$
1880 if len(a$)=0 or a$="n" or a$="N"
then 1910
1890 if a$="Y" or a$="y" then dbl%=1:g
oto 1910
1900 ? "What?";chr$(7):goto 1870
1910 ? "Be sure printer is ready and O
N LINE!"
1920 ? "Then press [RETURN] to continu
e,"
1930 ? "or enter [A] to abort if you h
ave changed your mind ";
1940 input a$
1950 if len(a$)=0 then 1980
1960 if a$="a" or a$="A" then er$="No
Print":goto 40
1970 ? "What?";chr$(7):goto 1910
1980 for q%=1 to cop%
1990 lprint chr$(12);chr$(27);"@":' se
t top of form and
2000 ' reset all old printer setups. O
nly 1 template per page
2010 lprint chr$(15):' Always compress
ed print
2020 lprint chr$(27);"U";chr$(1):' Set
 unidirectional for vert allignment
2030 if small%=0 then 2070
2040 lprint chr$(27);"S";chr$(0):' Set
 Superscript mode for SMALL
2050 lprint chr$(27);"A";chr$(5):' 5/7
2 line spacing for SMALL
2060 goto 2090
2070 lprint chr$(27);"0":' Set 1/8" li
ne spacing for LARGE print
2080 if dbl%=1 then lprint chr$(27);"G
":' double strike
2090 for i%=1 to 12
2100 lprint "0123456789";:' For refere
nce
2110 next i%
2120 lprint:lprint:lprint
2130 a%=len(ttl$)
2140 b%=int((120.0-a%)/2.0)-2
2150 gosub 2820
2160 lprint space$(b%);"**";ttl$;"**"
2170 gosub 2780:' Horizontal BAR
2180 fn%=1:' First function key set
2190 gosub 2670:' Diagnose function se
t empty, setup wF$
2200 on fn% goto 2210,2220,2230,2240
2210 fc$=" F":goto 2250
```

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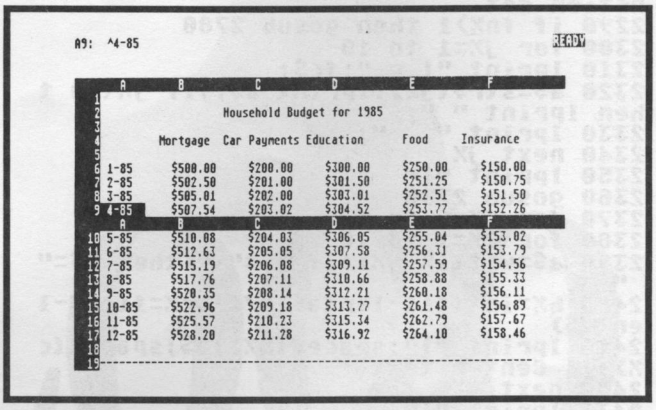
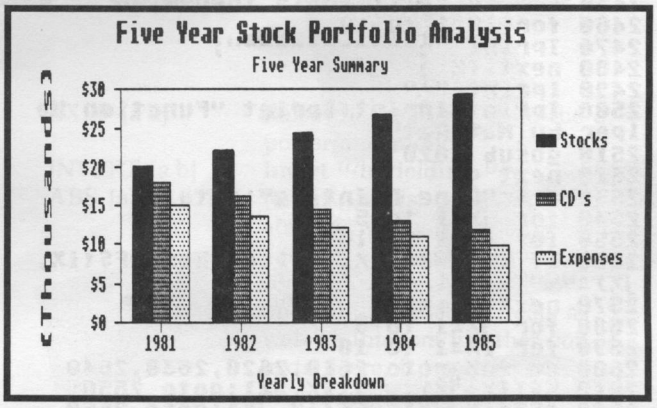


Integrated Spreadsheet Power



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SYSTEM REQUIREMENTS: Amiga with 512K; One disk drive; Monochrome or color monitor; Works with printers supported by the Workbench.

Function Key Helper *continued*

```
2220 fc$="sF":goto 2250
2230 fc$="cF":goto 2250
2240 fc$="aF"
2250 if empty%=1 then 2290
2260 if tempty%=0 then 2290
2270 fn%=fn%+1:if fn%<5 then 2190
2280 goto 2460:' Done printing this fu
nction set
2290 if fn%>1 then gosub 2780
2300 for j%=1 to 10
2310 lprint "|    ";fc$;
2320 a$=str$(j%):lprint a$;:if j%<10 t
hen lprint " ";
2330 lprint "   ";
2340 next j%
2350 lprint "|"
2360 gosub 2780
2370 for j%=1 to 5
2380 for i%=1 to 10
2390 a$=wF$(i%,j%):if a$="\" then a$="
 "
2400 b%=int((11-len(a$))/2):c%=11-b%-l
en(a$)
2410 lprint "|";space$(b%);a$;space$(c
%);:' Center text
2420 next i%
2430 lprint "|"
2440 next j%
2450 fn%=fn%+1:if fn%<5 then 2190
2460 for i%=1 to 10
2470 lprint "------------";
2480 next i%
2490 lprint "-"
2500 lprint:lprint:lprint "Function He
lper by Mat*Rat"
2510 gosub 2820
2520 next q%
2530 er$="Done Printing":goto 40
2540 for j%=1 to 5
2550 for i%=1 to 10
2560 if len(wF$(i%,j%))=0 then wF$(i%,
j%)="\"
2570 next i%:next j%
2580 for j%=1 to 5
2590 for i%=1 to 10
2600 on fn% goto 2610,2620,2630,2640
2610 F$(i%,j%)=wF$(i%,j%):goto 2650
2620 sF$(i%,j%)=wF$(i%,j%):goto 2650
2630 cF$(i%,j%)=wF$(i%,j%):goto 2650
2640 aF$(i%,j%)=wF$(i%,j%)
2650 next i%:next j%
2660 return
2670 tempty%=1
2680 for j%=1 to 5
2690 for i%=1 to 10
2700 on fn% goto 2710,2720,2730,2740
2710 wF$(i%,j%)= F$(i%,j%):goto 2750
2720 wF$(i%,j%)=sF$(i%,j%):goto 2750
2730 wF$(i%,j%)=cF$(i%,j%):goto 2750
2740 wF$(i%,j%)=aF$(i%,j%)
2750 if wF$(i%,j%)<>"\" then tempty%=0
2760 next i%:next j%
2770 return
2780 for temp%=1 to 10
2790 lprint "|-----------";
2800 next temp%
2810 lprint "|":return
2820 for tmp%=1 to 10
2830 lprint "------------";:' Horizont
al Stripe
2840 next tmp%:' for cutting on the 'd
otted' line
2850 lprint "-"
2860 return
2870 for tmp%=1 to 5:' Update Edit Win
dow
2880 gotoxy 2,tmp%+2:? tmp%;":";:c%=0
2890 if wF$(ky%,tmp%)="\" then 2910
2900 ? wf$(ky%,tmp%);:c%=len(wf$(ky%,t
mp%))
2910 ? space$(12-c%);"|";space$(14);"|
          "
2920 next tmp%
2930 return
```

ST-CHECKSUM DATA.

(see page 77ST)

```
 10 data  598, 557, 793, 687, 5, 66, 6
22, 522, 51, 25, 3926
 110 data  541, 600, 53, 398, 45, 265,
 390, 698, 703, 619, 4312
 210 data  307, 239, 934, 489, 955, 51
1, 222, 962, 930, 240, 5789
 310 data  574, 603, 558, 479, 395, 39
6, 66, 967, 535, 223, 4796
 410 data  883, 922, 607, 789, 922, 96
0, 420, 884, 839, 808, 8034
 510 data  385, 390, 645, 835, 64, 764
, 795, 222, 74, 136, 4310
 610 data  849, 955, 582, 233, 956, 45
2, 278, 906, 342, 551, 6104
 710 data  238, 651, 702, 499, 682, 75
, 367, 950, 667, 172, 5003
 810 data  511, 422, 817, 547, 184, 46
, 853, 351, 369, 288, 4388
 910 data  429, 537, 443, 876, 613, 45
5, 432, 255, 203, 887, 5130
 1010 data  465, 759, 905, 325, 330, 3
67, 138, 641, 897, 120, 4947
 1110 data  64, 599, 510, 430, 541, 60
7, 311, 242, 97, 345, 3746
 1210 data  429, 825, 264, 46, 82, 645
, 523, 556, 232, 592, 4194
 1310 data  164, 60, 322, 184, 268, 63
1, 310, 538, 369, 511, 3357
 1410 data  374, 510, 309, 402, 404, 1
48, 731, 559, 351, 462, 4250
 1510 data  874, 0, 911, 641, 93, 247,
 200, 940, 790, 523, 5219
 1610 data  235, 408, 547, 402, 123, 9
05, 51, 801, 962, 93, 4527
 1710 data  730, 872, 358, 585, 959, 9
31, 635, 471, 157, 765, 6463
 1810 data  740, 966, 830, 960, 564, 2
28, 85, 222, 457, 743, 5795
 1910 data  283, 536, 524, 468, 972, 3
60, 739, 391, 440, 920, 5633
 2010 data  964, 429, 849, 365, 521, 5
70, 794, 821, 738, 45, 6096
 2110 data  670, 801, 426, 211, 152, 1
43, 53, 756, 545, 609, 4366
 2210 data  946, 998, 983, 594, 979, 2
01, 690, 2, 369, 735, 6497
 2310 data  18, 623, 293, 680, 210, 16
2, 606, 740, 134, 554, 4020
 2410 data  534, 680, 211, 683, 694, 7
41, 255, 686, 138, 530, 5152
 2510 data  160, 691, 462, 609, 743, 8
47, 69, 613, 747, 657, 5598
 2610 data  303, 832, 801, 254, 70, 87
3, 184, 616, 750, 669, 5352
 2710 data  758, 842, 827, 279, 873, 7
4, 877, 440, 345, 342, 5657
 2810 data  734, 883, 25, 615, 146, 87
9, 522, 374, 953, 319, 5450
 2910 data  961, 223, 879, 2063
```

FRACTIONS USING LOGO

by F. Neil Simms

Occasionally you may have run into situations where you wished you could solve mathematical problems using fractions, rather than their floating point equivalents. For example, consider the following equation:

```
7/8 - 3/10 = (7*10-8*3)/(8*10) = 46/80 = 23/40
```

Using your calculator, you would arrive at an answer of 0.575, which is not too obviously equal to 23/40. Of course, you could work out the answer by hand, as above, but for complex fractions and expressions, this can become quite tedious and error prone. What's needed is a set of procedures for performing operations on fractions.

Logo is an ideal language for implementing such a scheme. It allows us to create commands which can be executed either directly or from within other procedures, plus giving the crucial ability to pass parameters.

Our first task is to define a format for representing fractions in list notation. The most obvious answer is to represent a/b by the list [a b], where a and b are integers. Next, we must decide what procedures we need to manipulate the fractions. A description of the procedures included here follows. (Note: a, b, c and d must be integers unless otherwise indicated.)

ADDF [a b] [c d]	Add the fractions and reduce.
SUBF [a b] [c d]	Subtract the second fraction from the first and reduce.
MULF [a b] [c d]	Multiply the two fractions and reduce.
DIVF [a b] [c d]	Divide the first fraction by the second and reduce.
EXPF [a b] c	Raise the fraction a/b to the c power and reduce.
INVERT [a b]	Invert a/b yielding b/a.
ABS [a b c . . .]	Return the list containing the absolute values of a, b, c, etc. (This is a general purpose routine; you may use it to operate upon lists of reals as well as integers in other contexts. Here, it operates only on integer pairs.)
REDUCE [a b]	Return the list comprised of a and b, after dividing each by their greatest common divisor.

The following auxiliary procedures are also required.

DIVISOR [a b]	Return an integer which is the greatest common divisor of positive integers a and b (employs a variation of Euclid's algorithm).
REDUCE2 [a b]	Perform actual reduction after REDUCE checks for errors and prepares fraction.
ADDFRACS [a b] [c d]	Add the fractions yielding [ad + bc bd].
MULFRACS [a b] [c d]	Multiply the fractions yielding [ac bd].
EXPONENTIATE [a b] c	Perform exponentiation after EXPF checks for errors and adjusts for exponent sign.

Note that DIVISOR could have been written much more elegantly using recursion, but certain input fractions

// Fractions *continued*

would cause so many recursive calls that an *OUT OF SPACE* error would result. The iterative version presented here uses a fixed amount of space while executing and is also considerably faster than its recursive equivalent.

To appreciate the power of these procedures, type in the following example:

```
ADDF [7 8] DIVF [-2158 3237] EXPF [3 2] -2
```

which is equivalent to:

```
(7/8) + (-2158/3237) / ((3/2)^-2)
```

You should get back [-5 8] for an answer. Throw in some even nastier fractions, and it will become apparent that what's nearly impossible to solve by hand is a trivial problem using the computer.

F. Neil Simms has his M.S. degree in Computer Science and is a software designer for a research firm in Raleigh, North Carolina.

> ***Attention:*** **In this listing, the exclamation points at the end of program lines shouldn't be typed in. They are there to indicate that the statement wraps around to the next line.**

Listing 1.
Logo listing.

```
TO POWER :X :N
IF (:N = 0) [OP 1] [OP PRODUCT :X PO!
WER :X :N - 1]
END

TO ADDF :X :Y
OP REDUCE ADDFRACS :X :Y
END

TO SUBF :X :Y
OP ADDF :X LIST (PRODUCT -1 FIRST :Y!
) LAST :Y
END

TO MULF :X :Y
OP REDUCE MULFRACS :X :Y
END

TO DIVF :X :Y
OP MULF :X INVERT :Y
END

TO EXPF :Y :EXP
IF NOT (((ROUND :EXP) - :EXP) = 0) [!
PR [Exponent must be an integer] STO!
P]
IF :EXP = 0 [OP [1 1] STOP]
IF :EXP < 0 [MAKE "Y INVERT :Y OP RE!
DUCE EXPONENTIATE :Y (PRODUCT -1 :EX!
P)] [OP REDUCE EXPONENTIATE :Y :EXP]
END

TO INVERT :X
IF ABS (FIRST :X) = 0 [PR [Error: De!
nominator will = 0] THROW "TOPLEVEL]
OP LIST LAST :X FIRST :X
END

TO ABSL :X
OP IF EMPTYP :X [:X] [IF (FIRST :X) !
< 0 [FPUT (PRODUCT -1 FIRST :X) ABSL!
 BF :X] [FPUT FIRST :X ABSL BF :X]]
END

TO REDUCE :X
IF ABS (LAST :X) = 0 [PR [Error: Den!
ominator = 0] OP "STOP]
IF ABS (FIRST :X) = 0 [OP [0 0] STOP!
]
IF (LAST :X) < 0 [OP REDUCE2 LIST (P!
RODUCT -1 FIRST :X) (PRODUCT -1 LAST!
 :X) STOP]
OP REDUCE2 :X
END

TO DIVISOR :X
MAKE "F FIRST :X
MAKE "L LAST :X
IF :F = 0 [OP :L STOP]
REPEAT 9999 [REPEAT 9999 [IF :F = :L!
 [OP :F STOP] [IF :F > :L [MAKE "F :!
F - :L] [MAKE "L :L - :F]]]]
END

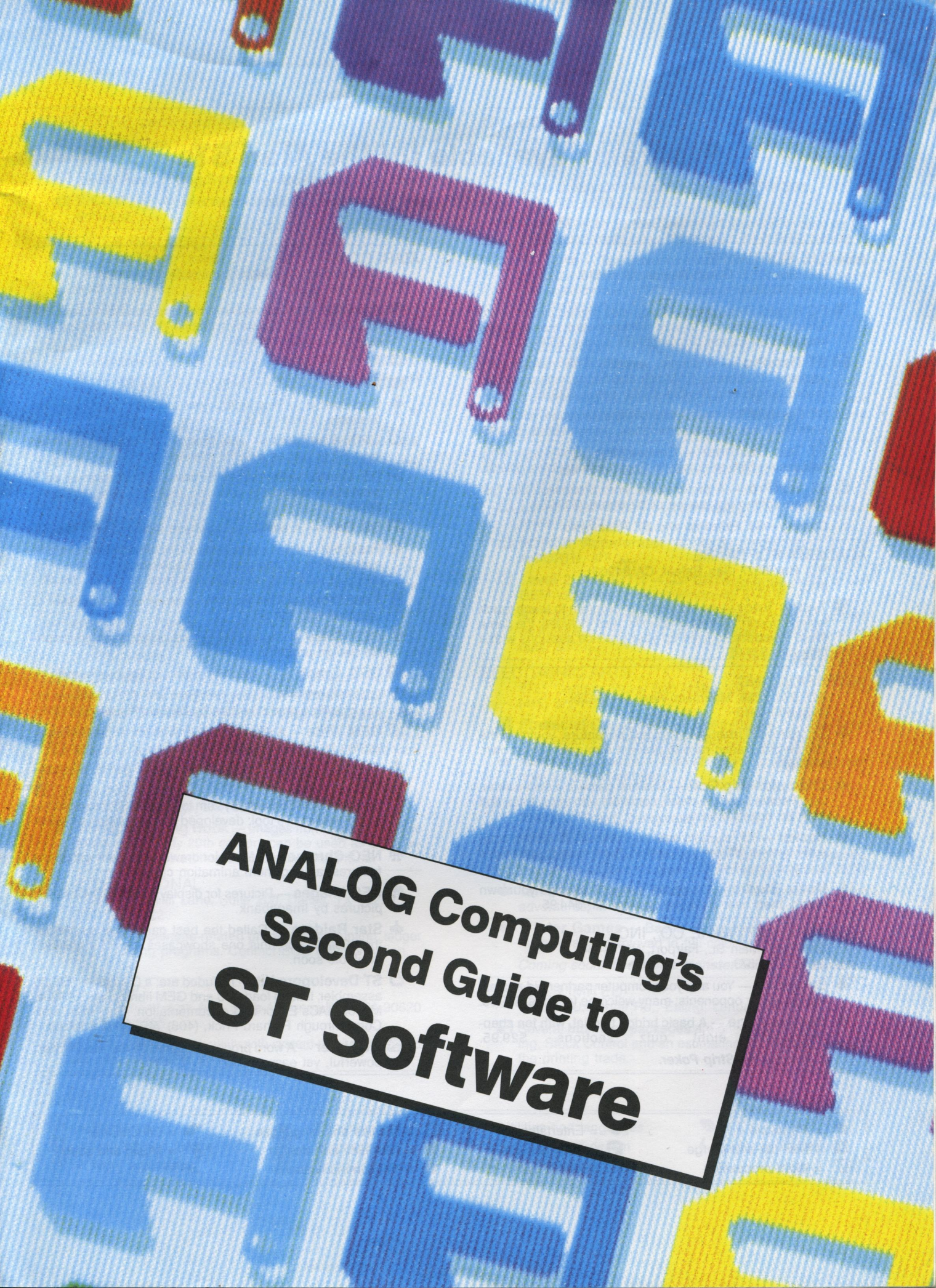
TO REDUCE2 :X
OP LIST (FIRST :X) / (DIVISOR ABSL :!
X) (LAST :X) / (DIVISOR ABSL :X)
END

TO ADDFRACS :X :Y
OP LIST (SUM (PRODUCT FIRST :X LAST !
:Y) (PRODUCT LAST :X FIRST :Y)) (PRO!
DUCT LAST :X LAST :Y)
END

TO MULFRACS :X :Y
OP LIST (PRODUCT FIRST :X FIRST :Y) !
(PRODUCT LAST :X LAST :Y)
END

TO EXPONENTIATE :X :EXP
OP IF :EXP = 1 [:X] [EXPONENTIATE (M!
ULF :X :Y) (:EXP - 1)]
END
```

●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HippoSpell — A spelling checker for Atari's **ST Writer** and Mirage Concepts' **Express**. $39.95.

Hippo ST Disk Utilities — Several disk utilities allow the user to recover lost or deleted files. Also includes a sector editor and other features. $49.95.

HippoWord — A mouse-based word processor with column editing, multiple fonts, bold face, left and right justification, and the ability to link up with **HippoConcept** and **HippoSpell**, for $89.95. Additional fonts are $39.95 each.

HITECH

Imported from the U.K.

Dev-Pac — An assembler/editor with a "front panel" debugger and screen editor. $79.95.

INFOCOM

125 CambridgePark Drive, Cambridge, MA 02140
(800) 448-8822

Interactive fiction — The Infocom line: **Ballyhoo, Cutthroats, Deadline, Enchanter, Fooblitzky, The Hitchhiker's Guide to the Galaxy, Infidel, A Mind Forever Voyaging, Planetfall, Seastalker, Sorcerer, Spellbreaker, Starcross, Suspected, Suspended, Trinity, Wishbringer, The Witness,** and **Zork I, II & III.** Prices vary.

INSOFT, CORP.

1834 Beacon Street, Suite 1, Brookline, MA 02146
(617) 739-9012

Graphics Tool Box — Allows drawing in 2-D and 3-D, along with object rotation and zooming. $59.00.

Graphic Work Station — 2-D and 3-D construction and display.

Math Tool Box — Programs cover vector arithmetic, statistical functions, curve fitting, matrix arithmetic and more. $59.00.

Searching and Sorting Tool — Several utilities include a quicksort, file merge and string array search. $59.00.

LIONHEART

P.O. Box 379, Alburg, VT 05440
(514) 933-4918

Many advanced packages in machine language: **Business Statistics, Sales and Market Forecast, Experimental Statistics, Multivariate Analysis, Quality Control & Industrial Experiments, Pert and Critical Path Technolo-**

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LIONHEART *continued*

gies, Forecasting and Time-Series, Decision Analysis Techniques, and **Linear & Non-linear Programming and Optimization.** The manuals resemble books, filled with practical examples and illustrations. Prices vary.

MARK OF THE UNICORN
222 Third Street, Cambridge, MA 02142
(617) 576-2760

The Final Word — An advanced word processor with over 100 formatting commands and the ability to set up your document exactly the way you want. $145.00.

Hex — The first ST strategy game provides interesting graphics and pits player against computer. Also makes excellent use of the ST's mouse. $39.95.

Mince — A text editor primarily for developers. $179.00.

PC/Inter Comm — An advanced telecommunications package that emulates a VT100 terminal and incorporates a multitude of features, plus a 135-page manual. $125.00.

MARK WILLIAMS COMPANY
1430 W. Wrightwood Avenue, Chicago, IL 60614
(312) 472-6659

Let's Write — A powerful word processor designed for ease of use, yet packed with features, including: a text formatter that will set up files to your preference, a spelling checker, a MicroEMACS full-screen editor, the KERMIT telecommunications program, and more. $79.95.

Coming soon is a ***C-compiler****.*

MARTIN CONSULTING
94 Macalester Bay, Winnipeg, Manitoba
Canada, R3T 2X5
(204) 269-3234

Entertainment Jackpot — Checkers, Casino, Mansion, 3-D Tic-Tac-Toe and Backgammon are only a few of the fourteen programs in this set. $34.95.

Life Organizer — Nine programs include labels, spreadsheet and interest projector. $34.95.

MEGAMAX, INC.
Box 851521, Richardson, TX 75085
(214) 987-4931

Megamax C — This version of C boasts many powerful features.

METACOMCO/TENCHSTAR, INC.
5353 Scotts Valley Drive, Scotts Valley, CA 95060
(408) 438-7201

Macro Assembler — This package also includes a screen editor and linker. Macro expansions, fully formatted listings and outputs in TOS object module format code are among the features.

MICHTRON
576 S. Telegraph, Pontiac, MI 48053
(313) 334-5700

Animator — Animates **DEGAS** or **NEO-Chrome** pictures. $49.95.

MICHTRON *continued*

Cards — Solitaire, Poker Squares, Cribbage, Black Jack and Klondike are on one disk for $39.95.

Calendar — Keep track—within GEM's environment—of dates, appointments, or messages. $29.95.

Cornerman — An electronic notepad, calculator, phone and address book, plus. $49.95.

DFT — This Direct File Transfer program allows you to move anything between your ST and IBM. $49.95.

DOS Shell — Similar to MS DOS for the IBM, this program eases the boredom of repetitious routines. $39.95.

Easy Record — Assists the C programmer with file control and data handling. $79.95.

Echo — This environmental controller uses your computer to control the on/off functions of lights or appliances in your home. $39.95.

Flipside — An Othello-type game. You can play against the computer in any one of six skill levels, or you may choose to pit your skills against another humanoid player. $39.95.

Gold Runner — A fast-paced, arcade-style game. You explore underground mines in search of gold, while avoiding traps and guards. $39.95.

Kissed — Multiple pass breakpoints, screen isolation, dynamic relocation and more. $39.95.

Lands of Havoc — Take on the role of Sador, reptile warrior, to liberate the countryside from the Dark Lords. $29.95.

Major Motion — You're in the driver's seat of MM1 (the army's latest terrain assault vehicle) and under attack. Will you survive till help arrives? $39.95.

M-Copy — Duplicates MichTron's own disks by copying only sectors that must be copied. $79.95.

M-Disk — A RAMdisk for the ST. $39.95.

Mi-Term — Smart terminal software provides twenty-six user-definable keys, XMODEM and ASCII file transfer, printer echo, and more for $79.95.

MichTron BBS — A multi-featured BBS with sixteen special interest groups; supports most file transfer methods and includes E-Mail functions. $49.95.

MichTron Utilities — Restore deleted files, inspect data, perform sector-by-sector copies, and more. $59.95.

Mi-Dupe — Back up your program or data disks. $29.95.

Mighty Mail — A GEM-compatible mail list program, including sorting. $59.95.

Mission Mouse — An arcade-style game. $39.95.

Mudpies — In this game, you eat junk food to stay alive, fending off clowns with mud pies. $39.95.

Personal Money Manager — This database tracks your personal finances. $49.95.

Softspool — A printer RAM buffer for $39.95.

Time Bandit — One- or two-player game; you use time gates to visit more than twenty different areas, with over twenty levels each. $49.95.

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MICROPROSE
120 Lakefront Drive, Hunt Valley, MD 21030
(301) 667-1151

Silent Service and **Gun Ship** are among this company's excellent products to be released for the ST.

MICRO-W DISTRIBUTING, INC.
1342B Route 23, Butler, NJ 07405
(201) 838-9027

MIDI-Magic — Plug your ST into a MIDI-compatible synthesizer using the supplied cord and play some fantastic music; software and six songs included. $49.95.

MIGRAPH, INC.
720 S. 333rd Street, Suite 201, Federal Way, WA 98003
(206) 838-4677

Easy-Draw — Create your own 3-D illustrations or business graphics with this powerful program. $99.95.

DraWrite — An integrated text/drawing processor.

MIND MINE
13256 NE 20th Street, Suite 4 (Northrup Bldg.)
Bellevue, WA 98005
(206) 641-6138

mt-FORTH-83 — The standard, with complete GEMDOS file I/O systems, graphics, sound, mouse words, MIDI and clock I/O words, DEBUG package, and more. $49.95.

An **extension to the Atari Developer's Kit** is also available, allowing the development of complete window/desktop applications, for $59.95.

MIRAGE CONCEPTS
4055 W. Shaw #108, Fresno, CA 93711
(209) 227-8369

Express — Letter processor, mail list and simplified telecommunications software, all in one package. $49.95.

Holmes & Duckworth FORTH — Based on FORTH-83, allows access to all ST memory and GEM commands; includes ST graphics, MIDI and printer commands, along with floating point or integer math. $49.95.

Holmes & Duckworth H&D Base — A database management system with on-screen help files, ability to sort any field to any level, compatible dBASE II command files, and much more. $99.95.

Holmes & Duckworth Tool Box — These disk utilities include deleted file recovery, memory editor and sector editor. $39.95.

MONARCH DEVELOPMENT CO.
3927 Fisher Road NE, Salem, OR 97305

Shape and Icon Editor (SHICED) — Design and use your own icons in ST programs.

OMNITREND
8 Huckleberry Lane, West Simsbury, CT 06092
(203) 658-6917

Universe II — Three-disk game based on the Atari 400/800 text adventure; extensive documentation. $69.95.

OPTIMIZED SYSTEMS SOFTWARE (OSS)
1221-B Kentwood Avenue, San Jose, CA 95129
(408) 446-3099

Personal Diskit — A disk utilities package for programmers. $39.95.

Personal Pascal — ISO Pascal with UCSD enhancements. $74.95.

Personal Prolog — A new language for the ST, complete with debugging, optimizer and GEM compatibility. $74.95.

THE OTHER VALLEY SOFTWARE
976 W. Foothill Blvd., Suite 490, Claremont, CA 91711
(714) 980-0440

Monkey Business — A **Donkey Kong** clone; one version for color, one for monochrome. $24.95.

Delta Patrol — An arcade game on the lines of **Defender**; color or monochrome. $24.95.

OXXI, INC.
3428 Falcon Avenue, Long Beach, CA 90807
(213) 427-2080

dbOne — A database management system; indexing of files by any field, full search and other features. $99.00.

Coming soon: ***Word Whiz****, a word processor.*

PENGUIN/POLARWARE SOFTWARE
2600 Keslinger Road, P.O. Box 311, Geneva, IL 60134
(312) 232-1984

The Coveted Mirror — Evil King Voar has taken control of Starbury and its residents; it's up to you to stop him. Part of the "Comprehend" series. $39.95.

Crimson Crown — A sequel to **Transylvania**, this adventure features graphics; it's also one of the "Comprehend" series. $39.95.

Frank and Ernest — A comic strip graphics adventure. $39.95.

Oo-Topos — A science fiction adventure, featuring graphics and a large vocabulary. $39.95.

Sword of Kadash — A fantasy adventure of over 200 rooms, each with its own puzzles. $39.95.

Transylvania — An enhanced version of the original; a vocabulary of over 1000 words, four times the text and a more complex storyline, plus graphics. $39.95.

PHILON
641 Avenue of the Americas, New York, NY 10011
(212) 807-0303

Programming languages — FAST/C, FAST/PASCAL, FAST/FORTRAN, FAST/BASIC-M, FAST/RPG, FAST/COBOL and a compiled BASIC. Prices to be announced.

PROGRESSIVE COMPUTER APPLICATIONS
2002 McAuliffe Drive, Rockville, MD 20851
(301) 340-8398

The Graphic Artist — A Computer-Aided Design package with business graphics and "typesetting" capabilities. Simple data file manipulations, word processor and spreadsheet functions are built-in. $495.95.

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PROGRESSIVE COMPUTER *continued*

FiG-GAL — Designed for use with **Graphic Artist**, to simplify commands and add programming functions. $245.00.

PROSPERO SOFTWARE
190 Castelnau, London SW13 9DH, U.K.
01-741 8531

Pro Fortran — A high-level programming language on which you can recompile existing mini- and mainframe software to run on the ST. $149.00.

Also available: ***ISO Pascal compiler.***

PRYORITY SOFTWARE
635 S. Sanborn, Suite 22, Salinas, CA 93901
(408) 757-0125

Forbidden Quest — Sci-fi text adventure. $39.95.

PSYGNOSIS LIMITED
1st Floor, Port of Liverpool Bldg., Pier Head
Liverpool L3 1BY, U.K.

Brataccas — This game puts you right into the comic story/graphic line—your chance to be a hero. $39.95.

QUACK COMPUTER CO.
10 Freshman Lane, Stony Brook, NY 1170
(516) 689-8738

Squeeg — Squeeze graphics files by as much as 90%; compress text and programs, too. $24.95.

QUANTUM MICROSYSTEMS, INC. (QMI)
P.O. Box 179, Liverpool, NY 13088
(315) 451-7747

ST Talk — A terminal program with XMODEM compatibility, capture buffer and more. $17.95.

QUICKVIEW SYSTEMS
146 Main Street, Suite 404, Los Altos, CA 94022
(415) 965-0327

Zoomracks — An integrated database, card file, word processor and project organizer. $79.95.

REGENT SOFTWARE
7131 Owenmouth, Suite 45A, Canoga Park, CA 91303
(818) 883-0951

Regent Word — **AtariWriter**-like word processor. $49.95.

Regent Spell — Looks for typos in word processing files, using a dictionary with over 30,000 words. $49.95.

SHANNER INTERNATIONAL CORP.
453 Ravendale Drive, Mountain View, CA 94030
(415) 964-2992

VIP Professional and a **4-color printer** are available, along with **The Shanner Planner**, a storage system for disks and other items.

SIERRA
P.O. Box 485, Coarsegold, CA 93614
(209) 683-6858

Black Cauldron — Graphics adventure based on the Disney film.

SIERRA *continued*

King's Quest II: Romancing the Throne — A 3-D animated adventure game. $49.95.

Ultima II: Revenge of the Enchantress — Graphics adventure game of large scope, where you travel through space and time. $59.95.

Winnie the Pooh in the Hundred Acre Wood — An adventure game with excellent graphics. $24.95.

SOFTECHNICS
12/13 Henrietta Street, Covent Garden
London WC2E 8LH, U.K.

Rhythm — Desk accessory combining features of a small spreadsheet with a very powerful calculator. $34.95.

SOFT LOGIK CORP.
4129 Old Baumgartner Street, St. Louis, MO 63129
(314) 894-8608

Electro Calendar — An organizational tool to print any month as a calendar, with built-in notepad and message features. $39.95.

Electro Solitaire & 21 — Solitaire and blackjack, featuring mouse manipulation of cards; use in all three graphics modes, with crisp colors in low and medium. $19.95.

LogiKhron Clock Card — Cartridge provides a real-time clock, for up-to-the-second time and date; built-in battery backup is handy for programs like **Electro-Calendar**. Approximately $49.95.

The Study Guide — An educational tool where you enter the information you need to learn, whereupon the computer organizes it into true/false, multiple choice and fill-in-the-blank segments. $39.95.

SOFTWORKS LIMITED
2944 North Broadway, Chicago, IL 60657
(312) 975-4030

Softworks BASIC — Consists of a compiler, runtime package and support library; features include calling up machine language routines, advanced data structures and superior string manipulation. $79.00

SOLAR POWERED SOFTWARE
1807 N. Evergreen, Chandler, AZ 85224

Soladisk v1.2 — An assembly language program to set up RAMdisk memory space, with the ability to transfer data at over 10-million bits/second. $20.00.

SOLID APPLICATIONS, INC.
1333 Moon Drive, Yardley, PA 19067
(215) 736-2449

DISKMENU — An archive and backup utility to provide user-programmable function key support for custom applications. $29.95.

PCalc — A printing calculator or desk accessory to record calculations performed on disk or printer, using keyboard or the mouse; may be used with **STKey**. $29.95.

PCommand — An interface to TOS to provide PCDOS-compatible command and batch file facility. $39.95.

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SOLID APPLICATIONS, INC. *continued*

STKey — Memory resident to yield user-programmable function key support, even within an application. $29.95.

SPECTRUM HOLOBYTE
1050 Walnut, Suite 325, Boulder, CO 80302
(303) 443-0191

Gato — 3-D Gato-class submarine warfare. About $49.95.

SPINNAKER/TELLARIUM
1 Kendall Square, Cambridge, MA 02139
(617) 494-1200

Amazon — A text adventure game.

Dragon World — Text adventure based on the science fiction novel.

Fahrenheit 451 — Follow Ray Bradbury's novel and film in this text adventure. $49.95.

Homework Helper/Math — Provides assistance to high school students. $49.95.

Homework Helper/Writing — More help for students. $49.95.

Nine Princes of Amber — A text adventure based on the Roger Zelazny novels. $49.95.

Perry Mason: The Case of the Mandarin Murder — A mystery text adventure. $49.95.

SST SYSTEMS
3456 Willis Drive, Box 2315, Titusville, FL 32781
(305) 269-0063

CHAT — A telecommunications program loaded with features at an inexpensive price; present owners can upgrade to the latest version by contacting SST. $19.95.

SWR — BBS software.

SUBLOGIC CORP.
713 Edgebrook Drive, Champaign, IL 61820
(800) 637-4983

Flight Simulator — The advanced flight simulator now takes advantage of ST speed and graphics.

Jet — In the works: high-performance jet simulation.

TALENT COMPUTER SYSTEMS
Curran Building, 101 St. James Road
Glasgow, Scotland G4 ONS, U.K.

RAM Disk & Print Spooler — Divert some ST memory to be used as a RAMdisk or printer buffer.

Talisman — This GEM-integrated data management system can process and link data from several files.

West and ZKUL — **West**'s text adventure pits you against notorious bank robbers in the Old West; **ZKUL**, against wizards, traps and mazes. $24.95 each.

TDI SOFTWARE, INC.
10410 Markinson Road, Dallas, TX 75238
(214) 340-4942

Andra — *Document processor for laser printers and FX-80 compatibles. Price to be announced.*

TDI SOFTWARE INC. *continued*

Modula-2 — An extended and enhanced version of Pascal with important modifications. $79.95.

UCSD Pascal — A complete Pascal with an industry standard operating system. $79.95.

UNISON WORLD INC.
2150 Shattuck Avenue, Suite 902, Berkeley, CA 94704
(415) 848-6666

PrintMaster — Create your own cards, calendars, etc., with over 100 graphics, borders, fonts and styles. $39.95.

PrintMaster Art Gallery I — More than 100 pictures and graphics to be used with **PrintMaster**. $29.95.

VIP TECHNOLOGIES
453 Ravendale Dr., Suite 1, Mountain View, CA 94043
(805) 968-4045

VIP Professional — 1-2-3-style package follows the keystrokes, applications and templates of the original. $180.00. The **Lite** version is available—less features for $100.00.

WINDHAM CLASSICS
One Kendall Square, Cambridge, MA 02139
(617) 494-1200

Treasure Island — This text adventure follows the characters in Robert Louis Stevenson's book.

Wizard of Oz — Take part in the L. Frank Baum story.

WORD OF GOD COMMUNICATION
68 Long Court, Thousand Oaks, CA 91360
(805) 495-4441

Comword — Multi-windows display (cross-referenced) ten Bible research functions, including the King James version, Strong's Concordance Reference System, an integrated Greek and Hebrew dictionary, and more; the 9.3 megabytes require a hard disk. Sold as a monochrome ST package with Haba 10-megabyte hard disk for $1995.00; software alone $495.00.

XLENT SOFTWARE
P.O. Box 5228, Springfield, VA 22150

Typesetter ST — Create high-resolution forms, labels, signs, letterheads, and more in this ST version. $39.95.

Megafont ST — A fast program lister, capable of special characters in many sizes and shapes. $39.95.

RubberStamp — Create pictures, icons, or text; a large variety of options. $39.95.

*Coming soon: **Music Box**, a MIDI product.*

This listing was effective as of April 21, 1986. **ANALOG Computing** may not be held responsible for changes made by manufacturers, such as price, content or availability. For a listing of products received in our offices after this list was compiled, see the following page.

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ST Software — Update List

Programs received after April 21, 1986

BLUE MOON SOFTWARE
13322 W. 105th, Lenexa, KS 66215

- **Macrodesk** — GEM desktop accessory featuring a digital calculator, electronic card file, alarm clock and message base. $29.95.
- **Macromath** — Performs many functions, including octal-binary conversion and statistical analysis. $32.95.
- **Macromanager** — **Macrodesk** with enhancements like a weekly planner. $39.95.

CHERRY SOFTWARE
3415 East 5th, Dayton, OH 45403
(513) 252-5616

- **ST-Scrunch** — Transfer a bootable disk or separate files over the phone, or ease the storage of infrequently used disks. $14.95.

CLASSIC IMAGE
(formerly Extended Software; see regular listing)
510 Rhode Island Avenue, Cherry Hill, NJ 08002
(609) 667-2526

- **Diablo** — Strategy and arcade-style action are combined in this original game, complete with graphics and sound. $29.95.
- **Disk Library** — File, categorize, search and cross reference your disk files. $49.95.

COMPUTER PALACE
2160 W. 11th Avenue, Eugene, OR 97402
(503) 683-5361

- **Help Calc ST** — For **VIP Professional** users: 2-key macro for common functions; eases use of graph and copy functions and more. $24.95.
- **Helpmate ST** — A 4-function, 10-key calculator, appointment calendar, telephone/name index with phone dialer and alarm. $39.95.
- **Inventory Master ST** — Inventory control with multi-report generation and the ability to signal when stocks are low. $179.95.
- **ST Calc** — A low-memory-consuming spreadsheet with on-line help and no commands to memorize. $49.95.

INTERACTIVE MICROSYSTEMS
P.O. Box 1188, Canyon Country, CA 91351-2600
(805) 298-7357

- **Disk Mod** — Easily modify data stored on a standard ST disk. $21.50.

SOLAR POWERED SOFTWARE
(See regular listing for other products)
1807 N. Evergreen, Chandler, AZ 85224

- **Solapak v1.0** — All the features of **Soladisk** and **Solasave**, plus a print spooler. $30.00.
- **Solasave v1.2** — Prevents phosphor burn-in on your ST monitor, by shutting down your screen when temporarily inactive. $25.00.

VERSASOFT CORP.
723 Seawood Way, San Jose, CA 95120
(408) 268-6033

- **dB MAN** — Db II and III compatible database. $149.95 (only $99.95 until 7/1/86).

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C-MANSHIP

by Clayton Walnum

This month, as I promised, we'll get busy designing our own input routines. We're no longer going to suffer with the limitations of such library routines as scanf(). And, to add a little spice to the proceedings, how about learning a little about disk file handling?

First, though, I've got a letter I thought was worth passing on. James Hague writes:

> ...you mentioned that braces are not necessary if a single statement follows an if...else, while, or for. It's worth noting in your column that the single statement may be an entire if...else, for, or while construct. For example:

```
while (!y)
   if (x==4)
      for (i=0; i<10; ++i);
```

Jim is absolutely correct. Even though the above seems to be many statements, it's considered only one. We could have even added a brace to the for statement and followed it with as many substatements as we wished—and it would still be a single while statement. Thanks, Jim.

Moving along.

Listing 1 is this month's sample program. Type it in and compile it. If you need help, see the sidebar at the end of this article. The program is an embarrassingly simple text editor. When you run it, you'll be asked for a filename. If the filename you enter already exists on the disk, you'll be asked if you wish to delete it. If you answer *Y*, the file will be deleted and a new one created. Any other response will let you select a different name.

The text is entered one line at a time. When you reach the right margin (medium resolution), press RETURN for the next line. If you try to type beyond the right margin, the program will automatically terminate the line. You'd be wise to avoid this, since the last character you typed will be lost. You should also check each line for typos before pressing RETURN. There are no editing features.

Press CTRL-Z (that's the CONTROL key and the *Z* simultaneously) to close the file. You may then print or view the text from the GEM desktop, by double-clicking the file you created.

The innards.

There's nothing fancy going on in this program—a couple of new functions to learn and, most importantly, a new method for accepting input. No more scanf() or gets(). From now on, every key will be under our control.

First take a look at the #define statements at the top of the program. MAX is the length limit for each line. RETURN, BACKSP, and CTRL-Z are the ASCII values for some of the keys we'll be checking for in our input routine. Don't pay any attention to NOFILE right now; we'll get to that later. Notice, also, that here we're declaring an integer variable, code. Since it's defined outside of any function, it's a global variable—one we may access from anywhere in the program.

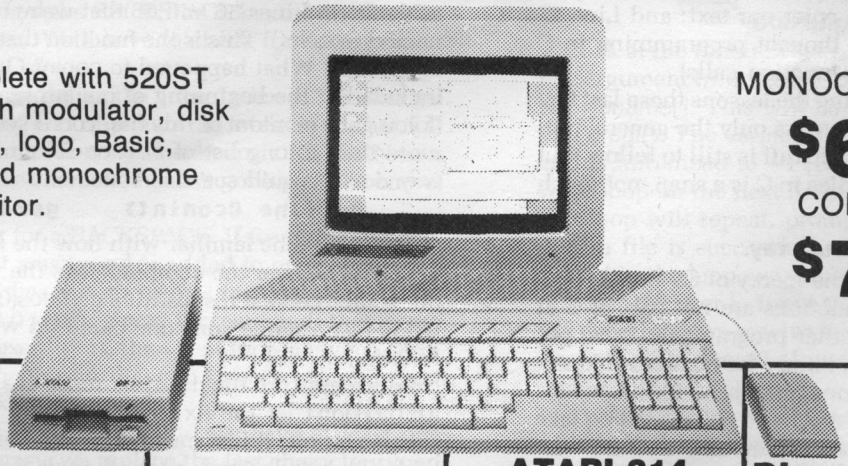
If you look at the function main(), you'll see that we've declared two character arrays, filename[] and text[]. The first will hold the name of the disk file we'll be working with; the second will store each line of text as it's typed.

The body of main() consists of only three statements. These represent the activities we must complete to create

ATARI SPECTACULAR

ATARI 520ST SYSTEM PACKAGE

Comes complete with 520ST computer with modulator, disk drive, mouse, logo, Basic, 1st Word, and monochrome or color monitor.



MONOCHROME SYSTEM
$649.00
COLOR SYSTEM
$799.00

SUPRA DISK
10 Meg HARD DRIVE
$669.00

SUPRA MODEM
MODEL 1200ST $159.00

ATARI 314
1 Meg Double Sided DISK DRIVE
$219.00

ANCHOR 520
Direct Connect MODEM
300/1200 Baud
$129.00

— PRINTERS —

CITIZEN
MSP-10 (80 col.)..... $279.00
MSP-15 (132 col.)..... $389.00
MSP-20 (80 col.)..... $349.00
MSP-25 (132 col.)..... $509.00

C.ITOH
Prowriter 7500..... $179.00
Prowriter 1550P..... $349.00
Starwriter 10-30..... $399.00

EPSON
Homewriter 10, LX80..... CALL
FX85, FX286, RX100..... CALL
SQ2000, HI80, HS80, AP80..... CALL
LQ800, LQ1000..... CALL

JUKI
6000 Letter Quality..... CALL
6100 Letter Quality..... CALL
6200 Letter Quality..... CALL
6300 Letter Quality..... CALL
6500 Letter Quality..... CALL
5510 Dot Matrix..... CALL
5510 Color..... CALL

OKIDATA
182, 183, 192, 193, 2410, 84..... CALL

LEGEND
808 Dot Matrix 100 cps..... $179.00
1080 Dot Matrix 100 cps..... $259.00
1380 Dot Matrix 130 cps..... $289.00
1385 Dot matrix 165 cps..... $339.00

NEC
3000 Series..... $799.00
8000 Series..... $1099.00
ELF 360..... $449.00
Pinwriter 560..... $999.00

PANASONIC
KX1091..... $259.00
KX1092..... $389.00
KX1093..... $479.00

TOSHIBA
P321 (80 column)..... $499.00
P341 (132 column)..... $799.00
P351 (132 column)..... $1069.00

STAR
SB/SD/SG/SR Series..... CALL
Powertype Letter Quality..... CALL

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our text file. The function call at Line 13 will open our file; Line 14 will allow us to enter our text; and Line 15 will close the file. And you thought programming in C would be tough. Only three function calls!

Well, if you've been following the lessons these last few months, you're aware that main() is only the general outline of the program; the trickier stuff is still to follow. But don't get panicky. Handling files in C is a snap, not much tougher than in BASIC.

Doing it our way.

In the past, we've been at the mercy of C's built-in I/O functions. Actually, these functions are not part of C at all. They're small routines other programmers have put together, then gathered into a library for our convenience. It's nice to have these functions lying around in case we need them, but there's always a price to pay when you take a shortcut. The price is a loss of flexibility.

If we use library functions like scanf() and gets(), we have to follow the rules somebody else made up. Frequently, these rules will be at odds with what we wish to accomplish. The solution? Write our own input routines, using our own set of rules.

This might sound a bit scary, but, depending on how fancy you want to get, there's really nothing to it. For our simple text editor, we don't need to convert strings to decimal values, or perform any of the other tricks a complete input routine must be capable of. All we have to do is let the user type in one character after another, terminating his line with a RETURN.

In Listing 1, down near the bottom, you'll see a function called get_str(). This is our input routine. The body of the function is only sixteen lines long—a veritable piece of cake. As you can see by the function declaration, get_str() receives one argument from the calling function: the address of the character array where we wish the string stored.

We start off at Line 55 by initializing p, our array index, to *0*. Then, in order to slip neatly into the while loop at Line 56, we get our first character from the console, utilizing one of the GEMDOS functions, conin (console in).

Huh?

What's all this GEMDOS stuff? The ST's operating system (OS) is called TOS, right? It even says so right there on my old boot disk. *T-O-S.*

Well, TOS is an incredibly complex animal, made up of two main parts: the BIOS (Basic Input/Output System) and GEMDOS (actually, there's also the XBIOS, but that's just an extension of the BIOS). The BIOS is the lowest level in the OS, and handles all the ST's primary input/output functions.

You can think of the BIOS as the software that runs the hardware, the meat in the sandwich between GEMDOS and all those data buses and microchips. GEMDOS provides the programmer with convenient access to the BIOS.

GEMDOS supplies over fifty functions, of which conin is function number one. In upcoming installments of **C-manship**, we'll be exploring GEMDOS in more depth. For now, we're only concerned with conin.

Back to the proceedings.

Notice in Lines 56 and 66 that we're calling a function named Cconin(). This is the function that will get us those keystrokes. What happened to conin? One of the files we included at the beginning of our program was osbind.h. If you get a printout of this file, you'll see that it's nothing more than a long list of #define statements. About halfway down, you'll see this statement:

```
#define Cconin()    gemdos(0x1)
```

You should be familiar with how the #define statement works. Wherever the compiler sees the word Cconin() in our source code, it'll substitute gemdos(0x1). The word conin is just a name someone came up with for GEMDOS function 1.

To access this function we must use the call gemdos (0x1). (Don't let the *0x* in front of the function number throw you off. It just means the number should be interpreted as hexidecimal, rather than decimal.) Using names like Cconin() for GEMDOS functions reminds us of what the function does. We could have put the call gemdos(0x1) directly into our source code and not bothered with including osbind.h.

The secret life of conin.

In order to use conin effectively, we have to know exactly what it does. If you look at Line 56, you see that the function call appears to be the same as any other we've used. The value returned by Cconin() is placed into the integer variable code, right? Well...sort of.

Conin() actually returns a long word, 32 bits of information we must sort out. The ASCII code of the key pressed is stored in the low byte of the low word, and the scan code of the key pressed is stored in the low byte of the high word.

Hmmm. . .I think I feel a diagram coming on. Yep. Figure 1 illustrates what we get from Cconin() if we press the *A* key. The ASCII for *A* is *65* (41 hex), or, in binary, *01000001*. See it in the rightmost byte?

The scan code for the *A* key is *29* (1D hex). In binary, this would be *00011101*. There it is in the high word. The scan code indicates only what key has been pressed. You'll get the same scan code whether or not you're typing an upper- or lowercase letter.

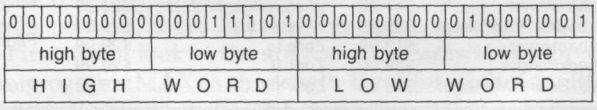

Figure 1.

For the moment, we won't be doing anything with the scan codes. These are necessary for keys that don't have an ASCII value, like the function keys. Since code in Line 56 is an integer, all we get is the low word of Cconin()'s RETURN, or the ASCII value of the key pressed.

A bit of construction.

We now have all the information we need to build our own string input routine. The function get_str() begins on Line 51. All this function does is get characters one by one and place them in successive bytes of the character array. There's a small complication, however. Several

keys have special functions. RETURN ends a line; CTRL-Z closes the file; and the BACKSPACE key allows the user to correct mistakes. We'll have to check for these keys as the user types.

At Line 55, we initialize the array index p. We then get our first character, and slip into the while loop that follows. The loop conditionally checks for a RETURN or a CTRL-Z, and makes sure we haven't gone past the end of our array.

Line 58 checks for a BACKSPACE. If we didn't get one, the character that was typed is added to our array text[]. Line 59 accomplishes this, as well as incrementing the index p (notice that p is being post-incremented; that is, the array is first indexed by p, then p is incremented). Program execution then drops down to Line 66, where we get our next keystroke.

If a BACKSPACE is entered and we have at least one character in the array, we replace the last character typed with a null (Line 62). We also have to adjust the screen display. This is done in Lines 63 and 64. Since the cursor was moved on top of the last character in the line when the BACKSPACE was typed, all we have to do is print a space (Line 63), then place the cursor back in its proper position by printing a BACKSPACE to the screen (Line 64).

Sooner or later, the user will type a RETURN to end a line, or a CTRL-Z to close the file, at which point we exit get_str().

Disk files.

Fortunately for us struggling programmers, the makers of the C compiler have supplied many functions for handling disk files. Four of these functions concern us at the moment. They are: open(), creat(), write() and close().

The function open() opens a file already in existence. It requires two arguments: the address of the filename and the type of access required. The latter may be one of three values: *0* (read only), *1* (write only), or *2* (read and write).

The open() function also returns a value. If it encounters an error and fails to open the file (the file didn't exist), it'll return a *-1*. Now you know why I defined NOFILE at the top of the program equal to this value. If the file is opened successfully, the function will return a file descriptor. We'll use this number whenever we wish to access the file.

The function creat() starts a new file and also requires two arguments: the address of the filename and a dummy value. If, when you call this function, the file you wish to start already exists on the disk, the file's pointer will be moved to the beginning of the file, effectively deleting it. Just like open(), a *-1* is returned in the case of an error, or a file descriptor if successful.

The function write() saves data to a file. It requires three arguments: the file descriptor, the buffer starting address (where the data is stored) and the number of bytes to write. A successful write will return a value equal to the number of bytes actually written. Otherwise, a *-1*, indicating an error, will be returned.

The function close() closes a file and requires the file descriptor as its argument. If the file is closed successfully, a *0* will be returned. An unsuccessful close, meaning you used an unknown file descriptor, will yield a *-1*.

Starting our file.

Look at the function start_file() in Listing 1. It receives one argument from main(), the address of the character array filename[]. This will be the first argument for open() and creat(). The variable file will hold our file descriptor and is initialized to *-1* (Line 21), so we can get into the while loop on the next line. As long as file is equal to *-1*, this loop will repeat, prompting the user for a filename until a file is successfully created.

Within the loop, we print a prompt, then call get_str() to allow the user to input the filename. At Line 25, if the file descriptor we receive from open() equals *-1*, then we know the file doesn't already exist, so we go ahead and create it (Line 26).

If we get a value other than *-1*, it means there's already a file by that name on the disk, and the program continues at Line 27. Here we reinitialize the file to *-1*, then ask the user if he wants to delete the file. If he answers yes, the old file becomes the new file (Line 31), otherwise the loop repeats, asking for another filename.

Writing our file.

Now, let's study the function get_text() in Listing 1. You should have little difficulty figuring it out.

First we prompt the user to input his text, then we initialize code (the global variable that'll contain the ASCII value of each keystroke) to *0*. We then call get_str(), to get the first line of text. This function will return the number of characters typed.

In Lines 46 and 47, a carriage return and a null are added to the string (otherwise, when we try to print the file, the lines will be concatenated). Finally, in Line 48, we write the text to disk.

We repeat the while loop until code equals *26* (a CTRL-Z), at which point the function terminates, and the file is closed at Line 15.

Simple, but cute.

So there you have it. There's not much to this program, but it can be useful for creating small README.DOC files for your disks. It's certainly easier than loading up a full-fledged word processor when all you want to do is type in a couple of lines. Maybe you could use it to type a short note to the struggling author of **C-manship**.

Listing 1.
C listing.

```
#include <stdio.h>
#include <osbind.h>

#define RETURN 13
#define BACKSP 8
#define MAX 78
#define NOFILE -1
#define CTRL_Z 26

int code;

main()
{
   char filename[15], text[MAX];
   int file;
```

```
    file = start_file(filename);
    get_text(file, text);
    close(file);
}

start_file(filename)
char filename[];
{
    int file, ch;

    file = NOFILE;
    while (file == NOFILE) {
        printf("\nFilename: ");
        get_str(filename, 14);
        if ( ( file = open(filename,2) ) == NOFILE )
            file = creat(filename, 0);
        else {
            file = NOFILE;
            printf("File already exists!  Delete it? ");
            if ( (ch = getchar() ) == 'Y' || ch == 'y' )
                file = creat(filename, 0);
        }
    }
    printf("\n");
    return(file);
}

get_text(file, text)
int file;
char text[];
{
    int p;

    printf("Type your message:\n\n");
    code = 0;
    while (code != CTRL_Z) {
        p = get_str(text);
        text[p++] = '\n';
        text[p] = '\0';
        write(file, text, p);
    }
}

get_str(text)
char text[];
{
    int p;

    p = 0;
    code = Cconin();
    while (code != RETURN && code != CTRL_Z && p <= MAX) {
        if (code != BACKSP) {
            text[p++] = code;
        }
        else if (p > 0) {
            text[--p] = '\0';
            putchar(' ');
            putchar(BACKSP);
        }
        code = Cconin();
    }
    printf("\n");
    return(p);
}
```

C-manship Compiler Tutorial.

All the program listings in **C-manship** were written using the ST Developers Kit from Atari. Many of you who've recently received this package may be a little confused as to how to compile and run the programs (I know I was). For those nodding their heads in agreement, I've put together this quickie tutorial.

The first thing you must do is create the proper batch files for both the compiler and linker. LOAD your text editor and type the following exactly as it appears here:

```
cp68 %1.c %1.i
c068 %1.i %1.1 %1.2 %1.3 -f
rm %1.i
c168 %1.1 %1.2 %1.s
rm %1.1
rm %1.2
as68 -f -l -u %1.s
rm %1.s
wait.prg
```

When you're sure you've typed it correctly, SAVE it to your compiler disk under the name CC.BAT.

Now clear the previous text from memory and type in this batch file:

```
link68 [u] %1.68k=gemstart,%1,gemlib,libf,osbind
relmod %1 %1.tos
rm %1.68K
wait
```

Check your typing well, then SAVE it to your linker disk under the name LINK.BAT.

Now you're ready to compile any of the listings from **C-manship**. We'll use Listing 1 from this installment as an example.

Single-drive compilation.

(1) Use your text editor to type in Listing 1, then SAVE a copy of this—under the name INPUT.C—to both your compiler disk and a backup disk.

(2) Place the compiler disk in your drive and double click the drive A icon.

(3) Double click the BATCH.TTP program, and enter *CC INPUT* into the parameter window, concluding the entry by pressing RETURN.

(4) After the compiler has finished, there should be a file named INPUT.0 on your compiler disk. Copy this file to your linker disk.

(5) Place the linker disk in your drive and double click the drive A icon.

(6) Double click the file BATCH.TTP, and enter *LINK INPUT* into the parameter window.

(7) When the linker has finished, the file INPUT.TOS should be on the disk. This is the executable version of the program. To RUN it, simply give it a double click.

Two-drive compilation.

(1) Use your text editor to type in Listing 1, then SAVE it to disk under the name INPUT.C.

(2) Place your compiler disk in drive A and your source disk (the one you saved the program to) in drive B.

(3) Double click the drive A icon.

(4) Double click the BATCH.TTP program, and enter *CC B:INPUT* into the parameter window, concluding the entry by pressing RETURN.

(5) When the compiler has finished, replace the disk in drive A with your linker disk.

(6) Double click the drive A icon.

(7) Double click the BATCH.TTP program and enter *LINK B:INPUT* into the parameter window.

(8) When the linking is complete, your source disk will contain the file INPUT.TOS. This is the executable version of the program. RUN it by giving it a double click.

The above instructions will work with all the C program listings presented thus far in **C-manship**. Only the filenames you use must be changed.

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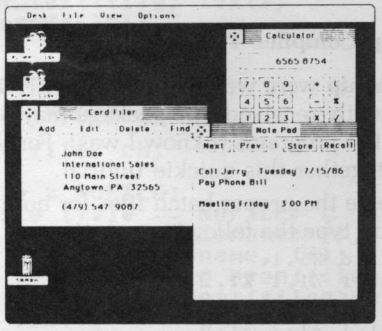

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Pascal and Modula-2 source code are nearly identical. Modula-2 should be thought of as an enhancement to Pascal (they were both designed by Professor Niklaus Wirth).

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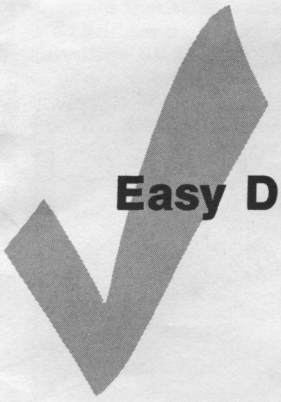

Easy Draw

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by Arthur Leyenberger

Digital Research's Graphics Environment Manager (otherwise known as GEM) is unquestionably an easy-to-use interface. From the time Atari first announced the ST and GEM, in January 1985, users looked forward to having GEM-based software for the computer. Unfortunately, the majority of ST software has—so far— failed to live up to its promise.

From a user's point of view, there are two levels of GEM software. What I call GEM software are programs that take advantage of the icons, drop-down menus and mousing capabilities of the computer. Output is typically self-contained within the application program, and the programmer has complete freedom to do what he or she likes.

"True-GEM" software describes programs using the *entire* Digital Research GEM system. This includes relinquishing output control to GEM, using all the built-in overhead of GEM, and resembling the version of the system designed for the IBM PC and compatibles.

MichTron's **Mi-Term**, Haba's **Habawriter** and Atari's **1st Word** are all GEM programs. **Easy Draw** from Migraph is the first true-GEM program for the Atari ST. That's reason to both rejoice and curse, as you'll see.

Easy Draw is a new, professional drawing program for the ST. It's billed as a professional program because it provides the user with much more power than conventional painting programs like **DEGAS** and **NEO-Chrome**.

In those pixel-oriented programs, you actually control the pixels on-screen. Each thing you paint obliterates everything it covers, because an individual pixel can only be on or off.

In a drawing program, you create figures or elements, each with its own "layer." Thus, elements can be stacked on top of one another, much as you would stack sheets of paper. So, even though one element covers another, it merely blocks the previous occupant.

Because they're separate entities, the elements can be made transparent. In this way, the "hidden" elements can show through. They may be grouped together with other elements to form new pieces, or they may be moved, copied and ungrouped.

Another distinction between painting and drawing programs is in their structure. **Easy Draw** presents a drawing surface very much like a drafting table with graph paper as an integral part of it. The size of the graph's squares can easily be changed as needed, for finer or coarser measurements.

This grid does more than just show relative position. As a central part of the structure, its markings govern the movement, sizing and control of the elements.

Still another difference between the two types of programs is the size of the files they'll create. A program like **DEGAS** in its high-resolution mode requires 32-thousand-plus bytes to store the screen image. Regardless of whether a **DEGAS** picture is simple (even a single dot) or complex, the same size file is required to store it.

A drawing program like **Easy Draw** doesn't require a fixed-length file. The file's size depends on the number of elements in the drawing. The more complex the drawing, the more elements it has, and the larger its file.

The amount of available RAM also has an impact on the size of the drawings. Using a 520ST with TOS on ROM, approximately two thousand separate elements can be created. A 1-megabyte ST, either a 1040 or an upgraded 520, can contain about twelve thousand elements.

Easy Draw provides a variety of drawing tools, to create geometric shapes (squares, rectangles, circles, wedges, ellipses, arcs, straight lines and free-hand lines). The program also has a text feature, to add titles, labels, notes and legends to your drawings. In addition, thirty-nine predefined patterns plus a make-pattern option are available.

Using **Easy Draw** to create a computerized drawing is as simple as following a few steps, then repeating the process. Once the program is run, you're given a drawing screen with ten drop-down menu labels on the top line. To the left of the drawing screen are two icons: a clipboard for copying figures and a trash can for deleting.

Pressing the right mouse button displays a pop-up menu, from which you choose one of twelve drawing tools. A figure is drawn with the left mouse button, positioned with the mouse, then pasted down by pressing the right button. After drawing, you can add or change the color and pattern, or alter the line width and style to suit your purpose. That's all there is to it.

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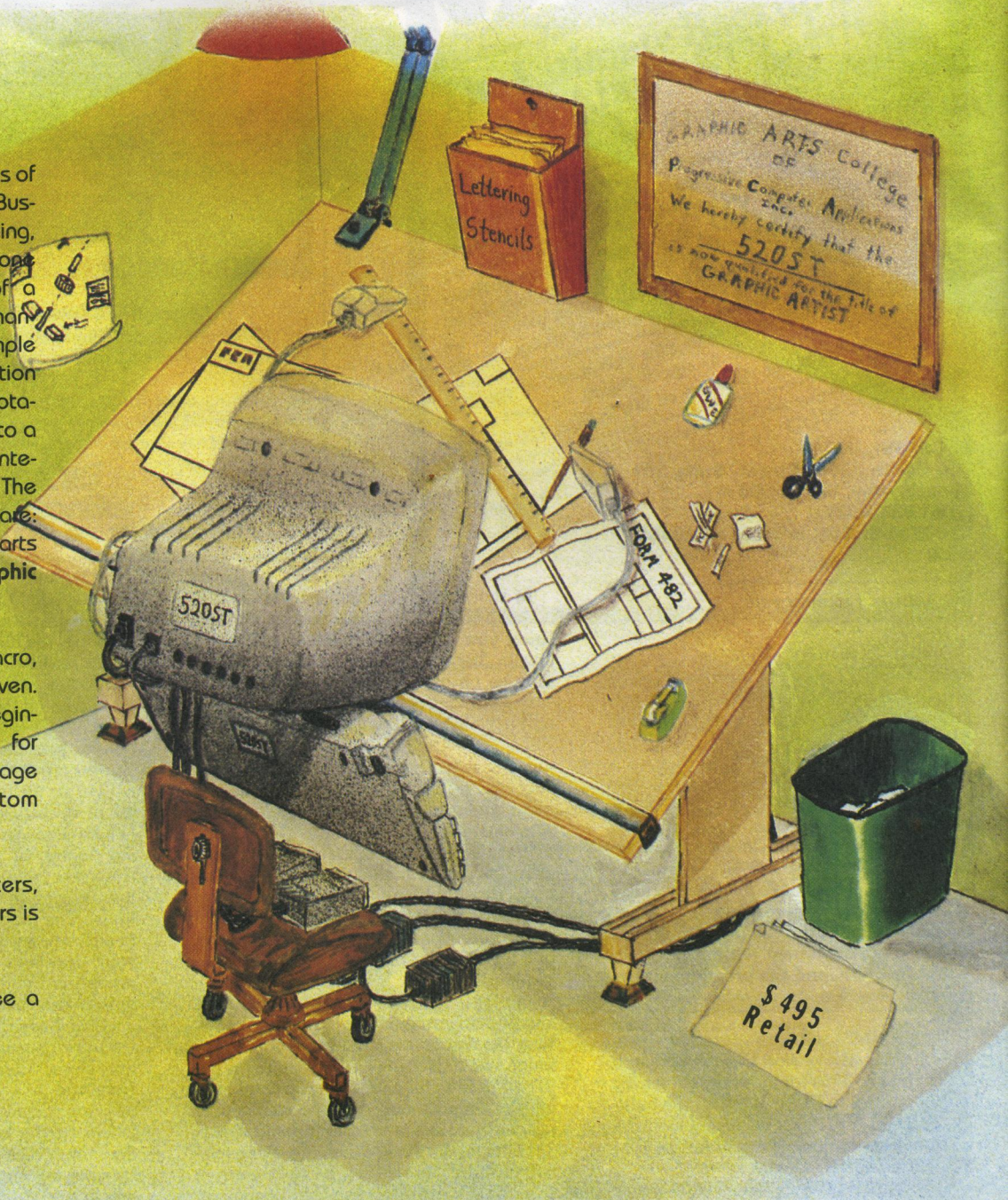

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screen, you can manipulate one, several or all of them. Whenever figures are selected, a highlight box appears around them, to indicate that whatever manipulations you do will be performed on them.

Easy Draw uses the standard GEM window, which can be sized or scrolled vertically and horizontally. In addition, a second window can be opened. From this, you can cut and paste figures, or compare an original drawing with a modified version.

While drawing, you can select the "zoom" function to expand a part of the drawing to fill the whole window. Other such functions include: full page, which shows how the drawing will look on the page; normal, to return to the standard view; and last, which lets you go back to the previous view—before you zoomed in on an area.

Figures can be rotated 90 degrees at a time, shadowed to add a three-dimensional look, placed in front or in back of another figure, or grouped together. A number of alignment options allow figures or text to be left- or right-justified and centered vertically or horizontally within another figure.

Text can be entered in four heights (10, 14, 18 and 36 points) and can be displayed as bold, light, italic, outlined, or underlined. It's as easy to modify existing text as it is to initially place it on the drawing.

For several months, I've been a heavy user of GEM Draw on an IBM-compatible computer. It's proven a workhorse for me, but there *are* times when I wish it had a few more features. **Easy Draw** has a number of features that GEM Draw doesn't.

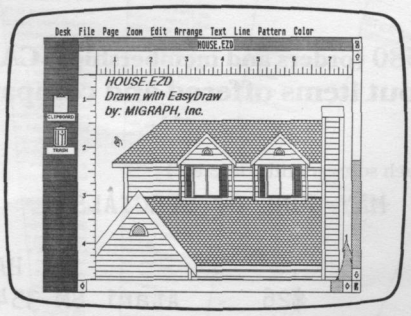
GEM Draw provides only one command to change both the size and shape of a figure. Often, when I want to proportionally enlarge or reduce a whole figure, I accidentally stretch it—and lose the original shape. One of the greatest improvements **Easy Draw** has over GEM Draw is the provision of two commands for sizing and stretching. There's no way to ruin the shape of an element while trying to size it.

Easy Draw has a number of other advantages over GEM Draw, including: figure rotation, the ability to let a user define a pattern, a user-changeable arc angle and the ability to merge two drawings. Further, the program always tells you the number of figures available. You *know* how much room you have left.

Easy Draw is not copy-protected, so you can make backups and not have to worry about trashing your only copy of the master disk. Please don't abuse this by giving or receiving copies of the program. You'd be helping to jeopardize the entire ST software market.

Although **Easy Draw** isn't protected, it's difficult (if not impossible) to use the program on a hard disk. All the files can be transferred to a hard disk, but the program always looks to drive A for the various GEM files needed to begin. So running it on a hard disk won't speed things up.

Further, the program is so large that, on a stock 520ST with TOS in ROM, you can't have any desktop accessories except the control panel (a 1040ST would make use of **Easy Draw** much easier). This makes it



Easy Draw.

a hassle—you must eliminate any accessories from the hard disk before you run the program.

Another negative aspect is a result of the full use of GEM. Two copies of each drawing are stored on disk, because GEM expects files for output to be in a certain format. Those with a *.GEM* extension are output files, whereas *.EZD* files are editable. You can't edit *.GEM* files or print *.EZD* files. *(However, see the addendum, below.)*

GEM Draw uses *.GEM* files. On the PC, only one file is needed; it can be edited or printed. Unfortunately, GEM Draw's files can't be manipulated by **Easy Draw**.

A problem **Easy Draw** shares with GEM Draw is the inability to abort printing once started. Both programs use the GEM output routines created by Digital Research.

Overall, **Easy Draw** is an easy, fun-to-use, versatile drawing program, allowing you to create drawings primarily with geometric shapes. But it is by no means limited to squares and circles.

With some creative thinking, you can make outlines, sample forms, vugraphs and flowcharts. Of course, you can use it to produce organizational charts, office furniture arrangements, architectural elevations and floor plans.

Easy Draw is truly a professional program, limited only by your own imagination. Once you have it, you'll continue to find uses for it. If you need this kind of capability, it may be worth buying an ST just to be able to use **Easy Draw**.

---

*Here's some updated information I recently received from Kevin Mitchell, President of Migraph. If you use **Easy Draw** now, or are thinking about getting it, I believe you'll be as excited as I am.*

As described above, **Easy Draw** has been using a dual file format (extensions *EZD* and *GEM*) for drawing and print files. As of July 1, version 1.1 of **Easy Draw** will no longer use this dual file format. That means you'll be able to fit more drawings on each disk, because files aren't duplicated; and—get this—there will be compatibility with GEM Draw files, produced on an IBM PC or compatible.

The compatibility will go both ways. A file you create with **Easy Draw** on an Atari ST can be transferred to an MS-DOS computer, and will load correctly into GEM Draw on that machine. Now I'll be able to create drawings with Easy Draw and transfer the files to my PC at work.

Another item Kevin mentioned was that **Easy Draw** now supports the Gemini 10X printer. The obvious question at this point is: how do I get the new program if I already own **Easy Draw**?

The answer's simple: Migraph will be making a conversion program available. It will modify the existing version of **Easy Draw**, allowing it to use the Gemini printer. This will be freely available on CompuServe and BBSs, and through user groups across the country.

This goes for the conversion program *only*, not **Easy Draw** itself. Selling, giving or receiving a copy of **Easy Draw** is illegal, immoral and could jeopardize the ST's software market.

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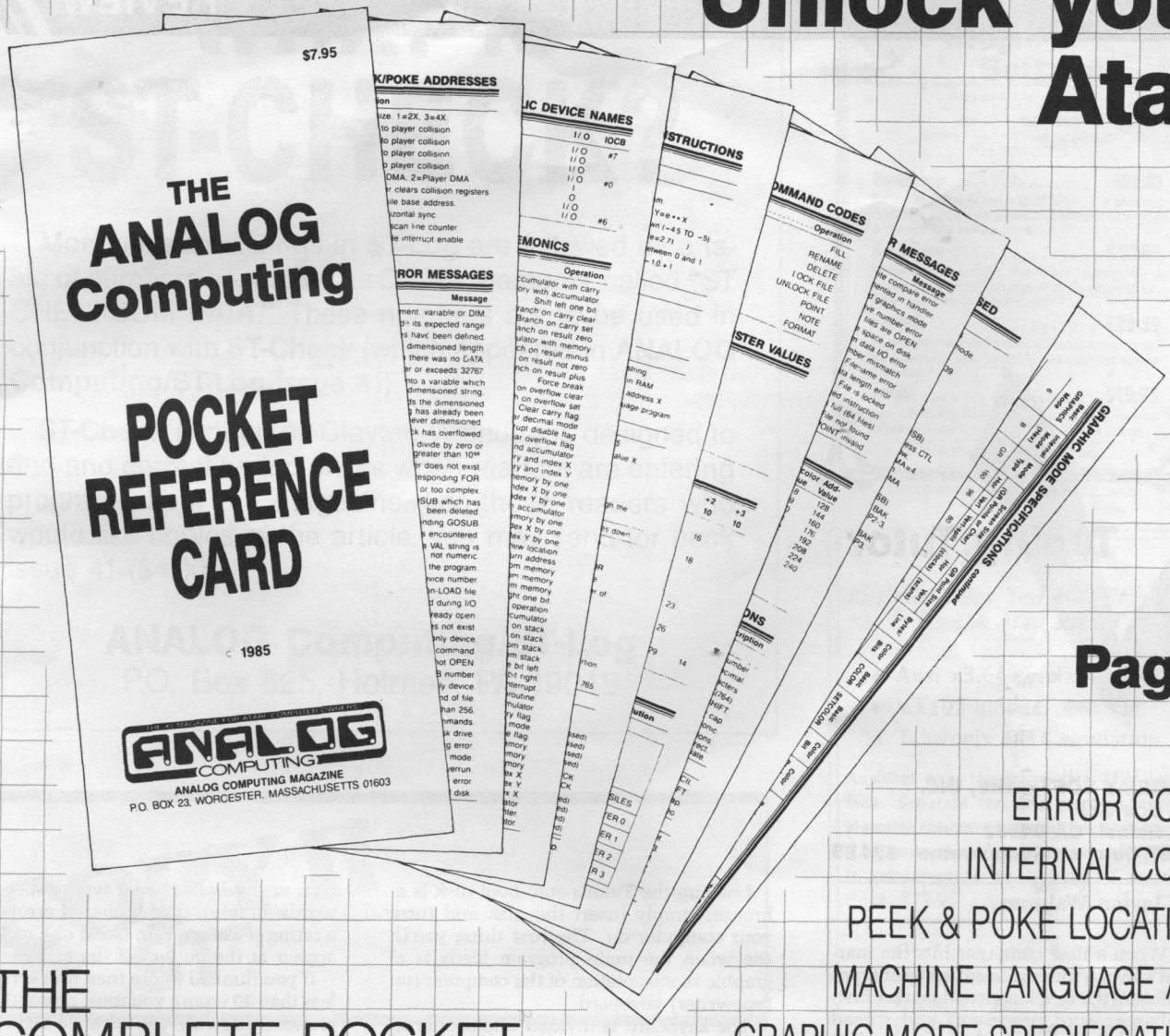

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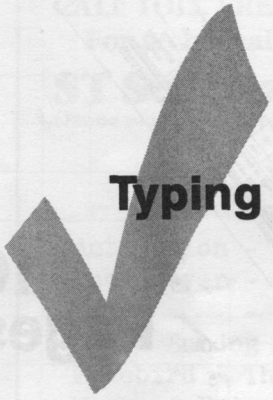

Typing Tutor

ACADEMY SOFTWARE, INC.
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by Clayton Walnum

When a new computer hits the market, it's always interesting to see what types of software the developers will market first. Databases, word processors and spread sheets inevitably leap to the top of the list, followed closely—especially in the ST's case—by adventure games. Once the public's desire for these classic offerings has been satisfied, many suppliers turn their efforts toward educational software.

Repeat after me: rationalization is a wonderful thing.

What's my point? Well, remember when you purchased your first computer, how you kept telling yourself what a great *educational* tool the machine would be—even while your trembling fingers stretched toward **Star Raiders** and **Pac-Man**? And in that first stack of software, buried somewhere under **Zork** and **Asteroids**, wasn't there a copy of Atari's **Touch Typing**? Rationalization at its classic best.

With the ST, all this has come full circle. There's a brand new market, and never has the user had such a cornucopia of delights to pick from. There are dozens of great excuses to buy an ST. If you find yourself having to balance the purchase of **Sundog** with something to assuage your throbbing conscience, you could do a lot worse than pick Academy Software's **Typing Tutor**.

Loading the **Tutor**'s auto-boot disk is a breeze; simply insert the disk and turn your computer on. The first thing you'll see when the main program loads is a graphic representation of the computer (or typewriter) keyboard.

The keyboard is divided into sections, each a different color, indicating the correct finger usage for each key. Throughout your lessons, hitting the ESCape key will bring you back to this screen, allowing you to check finger positions or change program options.

Typing Tutor leads the beginning typist through a series of eight lessons, starting with learning the "home row" keys, right through the typing of full sentences—including upper and lower case letters, punctuation and the dreaded top row (numbers and all those other nasties lurking up there).

Each of the eight levels is divided into nine "pages," the ninth being an exam for that level. The screen displays the current level and page on either side of a small typing window containing three lines of text.

As you type, your input appears beneath the exercise text. If you make an error, the letter you typed will turn red. You'll also hear a short beep. You aren't allowed to correct your errors, but there's nothing in the manual forbidding cursing or the childish (but highly satisfying) striking of innocent, inanimate objects.

When you've finished typing, your efforts are evaluated. Your typing speed (in words/minute), the number of errors and a rating (Passing, Fair, Good or Excellent) appear at the bottom of the screen.

If you flunked (more than four errors or less than 10 wpm), you must repeat the exercise. Otherwise, you advance to the next page. The ninth page is an exam to test your abilities within that level. If you pass it, you go on to bigger and better things. If not, you must review the current level.

Once you've gotten past the second level, you've attained the skills necessary to begin battle against **Word Invaders**. In this bonus game, an alien ship empties its cargo of dictionary dropouts into the sky, perhaps in an attempt to conquer our planet, perhaps just to create litter and be a general nuisance.

In either case, each line of text moves inexorably downward, while you type with a vengeance, deploying your best key-tapping skills to rid the world of this Webster-style threat. You must clear the words from the screen before they reach the bottom (of course, one has to wonder how much damage the word *fork* can do, should it find its way past your barrage and into our cities).

The game has four levels of play (level one covers **Typing Tutor**'s lessons 1 and 2, level two covers lessons 3 and 4, etc.) and includes four speed settings. It's a simple, enjoyable test of your abilities.

Typing Tutor comes with a brief (12

WHAT IS ST-CHECK?

Most program listings in **ST-Log** are followed by a table of numbers appearing as DATA statements, called "ST CHECKSUM DATA." These numbers are to be used in conjunction with **ST-Check** (which appeared in **ANALOG Computing/ST-Log** issue 41).

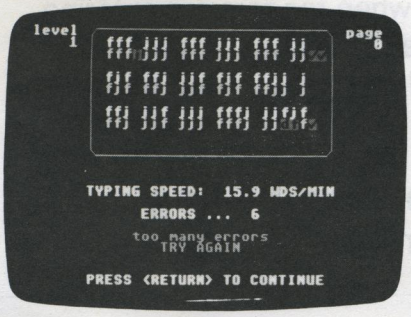
ST-Check (written by Clayton Walnum) is designed to find and correct typing errors when readers are entering programs from the magazine. For those readers who would like copies of the article, you may send for back issue 41 ($4.00).

ANALOG Computing/ST-Log
P.O. Box 625, Holmes, PA 19045

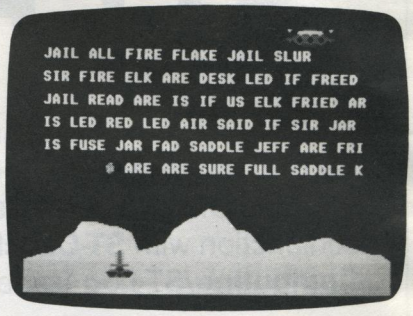
Review *continued*

pages, half of which are loading instructions and such) but complete manual. Each level is explained, including the keys covered and the proper finger techniques.

The only real complaint I have with **Typing Tutor** (other than a typo that got past the programmers—a bit ironic considering the subject matter) is that it doesn't allow the user to construct his own lessons. Because of this, the advanced typist will find little here for a challenge, though **Word Invaders** (which can handle up to 80 wpm) offers an addictive method for increasing speed.



Typing Tutor.



Word Invaders.

Many times, reviewing software can be a tedious and frustrating experience. One may find oneself with a notebook full of quirks and complaints that must be passed on to the potential buyer. In the case of **Typing Tutor**, I find my notepaper virtually bare. This is a fine—though not terrifically original—program, and I can recommend it without reservation.

And how effective is it? Let's see. Eyes forward. Fingers in place. *The quick brown fox on the meadow jumped over the lazy old dogs.* I did it!

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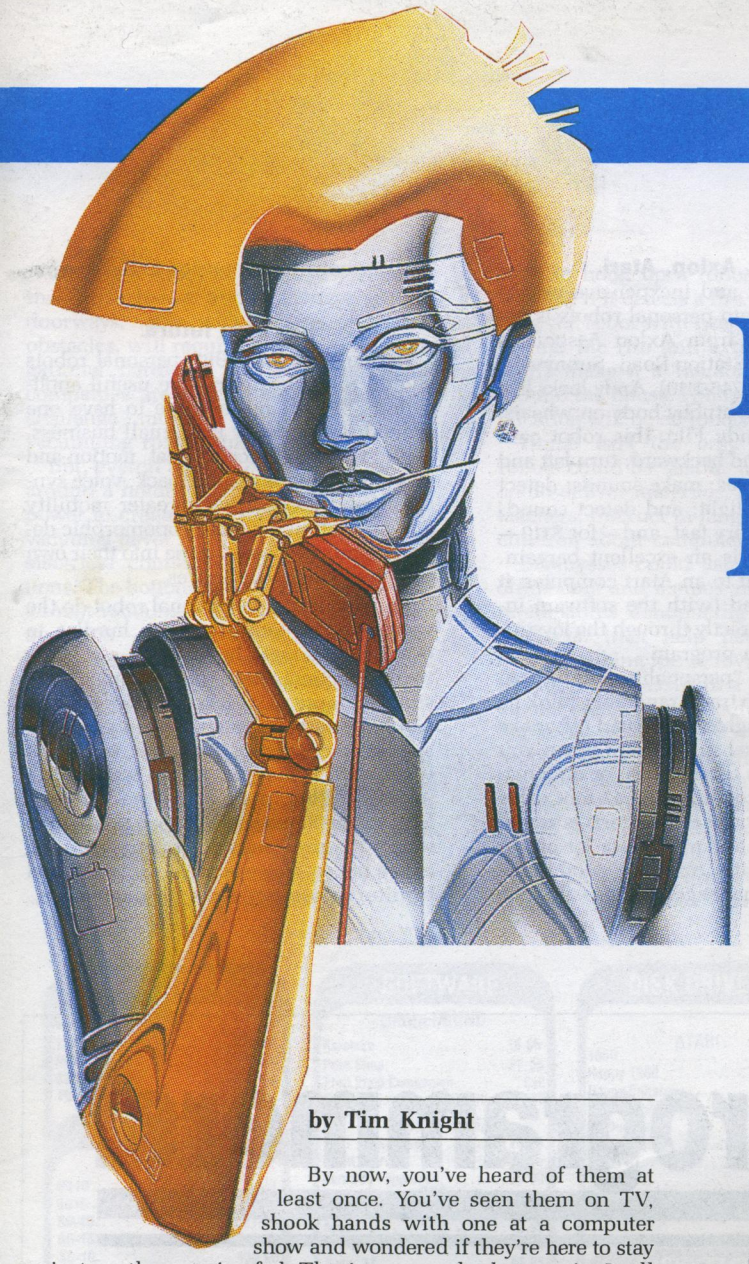

Personal Robots and the Atari

by Tim Knight

By now, you've heard of them at least once. You've seen them on TV, shook hands with one at a computer show and wondered if they're here to stay or just another passing fad. They're personal robots, or (as I call them) *probots*. They appeared on the market a few years ago, but have only now started to receive some serious attention.

A personal robot is, in short, a computer on wheels with features that allow it to function in the "real world." You could build a personal robot by putting your computer on a motorized platform that travels around with some accuracy, then adding sensors to measure distance and detect motion.

Of course, personal robots today have those features and many more. There are robots that can talk, sing, flash their eyes, make sounds, detect light, detect sound, pour and deliver drinks, entertain guests, and guard the house.

However, as a member of the personal robot industry, I'm sorry to say—for all of the press releases and fancy marketing claims—the personal robots of today can't do anything truly useful. Practical personal robots won't start appearing until late this year.

The real tragedy facing us now is that the makers and sellers of personal robots claimed that their robots could do a lot more than they were really capable of. Now that the damage is done, it appears many personal robot manufacturers have burned their bridges, and their future credibility, refusing to be realistic about their products.

Atari and robots.

There's a very close relationship between personal computers and personal robots: the latter are essentially computers with add-on features. Robots can be designed two different ways: they can have a computer on-board (and, therefore, be completely independent), or they can be hooked up in some way (infrared link, cable, or radio control) to a separate computer. The second method makes for a less expensive robot, but it's somewhat restrictive.

You're aware of what your Atari can do—receive and process information at a relatively high speed. There are quite a few accessories which can interface directly with an Atari computer and transform it into a robot of sorts. Check out the following:

A "rangefinder" sensor.

This device measures distance. Polaroid makes the most popular one, but you can build your own for a fraction of the cost. A rangefinder can help a robot determine if he's going toward or away from something, if he's going to run into an object, and so on. With each of these sensors and accessories, the uses are completely up to your imagination.

For example, RB Corporation developed a software program that would let children guess the distance from their hands to the RB robot. The robot would then tell them the exact distance. This doesn't exactly make for hours of fun, but ideas like this show you how flexible one add-on device can be.

A motorized platform.

This one causes a lot of problems for robot engineers, since they have to deal with navigation, varying surfaces, speed, powering the motors, and so forth. However, it's important that a robot be able to move around, and there are different ways to make it mobile. It may have two wheels, each with an independent motor to steer and power the robot, or it may "walk" on two or four legs—more difficult for the engineer, but a lot more fun to watch.

Motion detector.

This is a useful device if you want the robot to guard the home, or to say "hello" when someone walks in the room. It's up to you to design the software so the robot doesn't warmly greet a burglar and later welcome his master with "Freeze! I'm calling the police."

An arm.

A robot must be able to operate in its environment and should also be able to manipulate that environment. An arm gives your robot the capability to pick things up, deliver objects, pour drinks and perform other useful functions. Moreover, when you equip a robot with an arm (or arms), assisting the elderly and disabled becomes possible.

Light, sound, heat and smoke detectors.

Extras like these expand the robot's use. The more features it has, the more flexible the robot becomes.

"Gee Whiz" add-ons.

If you want the robot to look flashy, you can add a head that turns left and right, a humanoid body, flashing eyes, a simple sound synthesizer, or any other features which make it look like most people's vision of a robot. Serious personal robot fans seem to shun gimmicky add-ons, but when you realize that Tomy has probably sold *twenty* times as many cute-looking **Omnibots** as Heath has boxy-looking **Hero Jr**'s., you begin to see that looks mean a lot to the buying public.

Andy, Axlon, Atari.

One excellent and inexpensive way to get your Atari into personal robots is via the **Andy** robot from Axlon Associates (1287 Lawrence Station Road, Sunnyvale, CA 94089, (408) 745-1110). **Andy** looks like a robot head and stubby body on wheels. Designed by Andy Filo, this robot can: travel forward and backward; turn left and right; flash its eyes; make sounds; detect the presence of light; and detect sound.

Andy moves very fast, and—for $119—this little robot is an excellent bargain. When connected to an Atari computer, it can be controlled (with the software included) either directly through the joystick or via your own program.

Using Andy's "personality editor," you can program it to travel randomly, blink its eyes when the lights are turned off, make sounds and travel in a square when you clap your hands three times, or do whatever else you program. The 12-foot cable (connected to port 2 of an Atari) is somewhat confining to Andy, but a lot of fun to experiment with. And it's a good introduction to the challenges and possibilities of the robot as an extension to the computer.

The near future.

In late 1986 and 1987, personal robots should really begin to have useful applications. It will make sense to have one around the home or in a small business. With more sophisticated heat, motion and sound sensors, tactile feedback, voice synthesis and recognition, greater mobility and navigation, and anthropomorphic design, "probots" should come into their own as useful home appliances.

Imagine having a personal robot do the vacuuming. There are some hurdles to overcome, though, before such a robot is really practical. First, if our homes were simply empty boxes, a robotic vacuum would be easy to design. The robot would start at one corner of the house, travel forward until it bumped into a wall, rotate 90 degrees left, proceed forward about a foot, rotate 90 degrees left once again, then repeat the process until it completed the entire house. However, real walls and real furniture pose problems for engineers.

Getting a robot to thoroughly vacuum the entire house, and maneuver around doorways, sofas, tables, chairs and other obstacles, will require sophisticated navigational hardware and software. Some companies are already facing up to this challenge and are going to introduce vacuuming robots this year.

But, even if a robot *could* make its way around a home, how will it have enough power to create the kind of suction most vacuums have? A large battery or a wired electrical connection are possible solutions. The bottom line is: when people buy a robot vacuum, they want it to do a thorough job—without leaving any dirt behind. We can hope that by 1987, a truly useful and inexpensive robot vacuum will be introduced to the mass market.

It looks like RB Robot Corporation used an idea from the movie *Star Wars* when it planned to install a fire detector/extinguisher on the RB5X. (To my knowledge, this add-on, like most of the others, was never made available to consumers.)

We certainly have the technology needed to sense if a fire is present, and it's not hard to hook up a robot to emit a loud warning if it detects a fire. However, equipping the robot with heat and light sensors to *find* the fire and *extinguish* it would really make it a valuable friend to have around the house. I believe this sort of application will be on robots by late this year.

Home isn't the only place personal robots could be useful. In school, robots could deliver materials, tell stories, assist teachers, instruct in languages, and teach children about computers and robots.

Businesses could use robots to deliver office mail and memos and travel around retail stores announcing sales and new products, then help people find what they're looking for. A roving robot with a tall flag could assist in a large store; customers could press a button corresponding to the product they want to find. The robot could then lead them to the area, perhaps describing some of the new products in that department along the way.

The late 1980s will see exciting advances in the world of personal robots. Prices should drop dramatically, and more features and more powerful software should become available. It's a lot of fun to see what's happening with robots now and imagine what they'll be like in the future. Your Atari can be your key into this new field. A

Tim Knight publishes Personal Robotics Magazine *and is the President of Robot Center, the first personal robot store in Silicon Valley. He also wrote* Probots and People: The Age of the Personal Robot, *from McGraw-Hill. You can write him at P. O. Box 61046, Palo Alto, CA 94306-1046.*

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PANAK STRIKES!

by Steve Panak

I'm often accused of disliking *all* the games that come my way. This is true, and it's quite calculated, for two reasons.

> **Critic:** *n.*, from the Greek *kritikos*, from *krites*, a judge, discerner; from *krinein*, to judge, separate, distinguish **1:** a person who forms and expresses judgements of the qualities and comparative worth of books, movies, etc. **2:** one who censors or finds fault.

Unless I make some sort of incorrect, immoral attempt to misclassify myself, I'm branded and governed by *Webster's*. Still, I don't create the faults; I only express my perceptions of them. When a faultless game comes around, I'll be the first to tell you about it.

Reason two is entertainment, my own and that of my readers. It's much easier to write these reviews with a grain of salt—preferably ground firmly into a deep flesh wound. I read a lot of technical stuff, and I'll take it seasoned any day. A simple recitation of the facts is fine for a textbook—something you *have* to read. I'd much rather have people *want* to read **Panak Strikes** than *have* to.

SPY VS SPY, VOLUME II
THE ISLAND CAPER
by Mike Riedel
FIRST STAR SOFTWARE
18 East 41st Street
New York, New York 10017
48K Disk $29.95

It's really hard to convey the fun I (or, rather, *we*) had playing this game. *We* is the operative word. When two play, the fun never stops. Played alone, the game isn't as enjoyable—unless you're practicing, gaining an edge while your nemesis sleeps.

Spy vs Spy II is nearly identical to the original **Spy vs Spy**, which I reviewed about a year ago (see issue 30). I voiced the same opinion of the original as I do about its sequel; if you have **Spy I**, expect nothing new here.

Again, there's a futile attempt to sap some of *MAD* magazine's glory to hype an otherwise slightly above average video game. However, for some reason, I'm not angry at **Spy II** because of it. Perhaps it's because I've mellowed. More likely it's because **The Goonies**, reviewed in issue 41, incurred the bulk of my wrath.

This time out, the spies have parachuted onto an island. They must find and assemble a three-part missing missile. On completing this task, the victorious spy wades into the water, boards a sub (piloted by a buxom babe) and sails from the arena. If neither should finish, the unstable volcano erupts, frying both spies in the ensuing lava flow.

As in the first version, each spy sets traps—a difficult task to master. Once you're proficient (which takes between 45 minutes and 2 hours), the sequences of joystick manipulation and button activation will become second nature.

Your biggest mistake will be stepping in your own traps. The traps are, in order of increasing lethality: snares, pits, pits with pointed (punji) sticks at the bottom, gasoline-filled coconut bombs and napalm. You're limited as to your use of each. For example: to set coconut bombs, you need gasoline, which is in short supply. Ropes, punji sticks, shovels and coconuts must be gathered on the island before use.

Other options allow you to view a map of the island, showing your location and those of the missile parts. There are seven skill levels, varying the size and complexity of the island(s), as well as the time you have to complete your mission.

With each new game, a randomly generated set-up is created—you never know where various items will be. Rounding out the features is a variable IQ for the computer-controlled spy, should you choose the one-player option.

The trapulator again controls the action, displaying options with icons, plus your gas reserve (for filling coconut bombs) and strength. When the latter reaches 0, a gravestone rises to mark your final resting place. Any such misfortune is immediate-

CIRCLE #147 ON READER SERVICE CARD

CIRCLE #131 ON READER SERVICE CARD

CIRCLE #148 ON READER SERVICE CARD

ly reflected in your opponent's spy, who will pause his espionage long enough to have a hearty laugh over your mishap.

Thanks to Simulvision, both spies work simultaneously on a split screen, until they occupy the same area of the island. Then it's hand-to-hand combat, unless one spy has been lucky enough to locate the pistol hidden on every island.

If you play the game correctly (as you really must, to win), no one will waste time watching the other spy's screen, trying to see where he plants the traps. Although each of the deadlier traps is marked by a mound in the soil, there's nothing to prevent your opponent from leaving one right at the entrance to or from a screen. So, if you don't exit correctly, it's BLAM! —and you're temporarily reduced to ashes.

Spy vs Spy II.

The graphics, while small in size, are discernible, and the new design of the trapulator is an improvement over the original. A common complaint of new players was the difficulty in learning the game, and the difficulty in differentiating between various on-screen objects. Both of these vanish with practice. Most amusing are the animated sequences depicting the various fates of unsuccessful spies who are shot, blown up, or otherwise trapped.

The manual, while not as humorous as one might hope, was well organized. We tended to look up the information as we needed it, while learning to play the game. Usually the person looking it up could find the answer before the other spy did too much damage.

Add to all this the usual dangers of a desert island, such as quicksand and shark-infested waters, and you've got an action-packed game. **Spy vs Spy II** is a fantasy adventure recommended for all who enjoy a little harmless espionage.

THE MASK OF THE SUN
by Ultrasoft
BRODERBUND
17 Paul Drive
San Rafael, CA 94903
48K Disk $39.95

Mask of the Sun is dependent on graphics to get its point across. Since the novelty of static-image adventures disappeared for me long ago, this game didn't engage me.

After booting up the first disk of this four-disk odyssey, you enter the disease-ridden body of Mac Steele/Archaeologist, Seeker of Lost Treasures. It seems a not-so-friendly colleague gave you an amulet —and forgot to tell you about the curse. Or maybe you just laughingly dismissed it.

Well, you're not laughing now, as a hacking cough racks your broken body. The doctor's pills are a temporary remedy, at best. Your only hope is to try to find the **Mask**, which—rumor has it—will break the deadly curse. Unfortunately, this **Mask** is hidden somewhere in the ruins of an unexplored Aztec city, nestled in vicious Mexico.

So, in the company of your supposedly loyal (to whom?) servant Raoul, you set out from the hidden airfield in search of the treasure. . . and to save your life.

In **Mask**, we again inhabit the body of Mac Steele, who you'll remember from **Serpent's Star**, a game reviewed in issue 30. This game gives you basically more of the same, with a couple of improvements.

First, the bugs I complained about in **Star** didn't seem to exist here. Second, for some reason, I liked it more—a purely subjective call. However, the game suffers from the affliction which dooms all graphic adventure games: subordination of plot and characterization to images.

The program has a rather large vocabulary and understands complete sentences, as well as the simple subject-verb combinations in games of this type. Further, it will accept multiple and complex commands, such as "drop all but rifle." This flexibility was a plus.

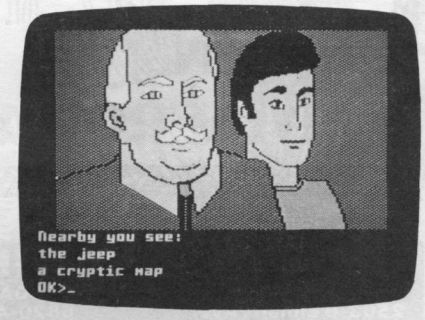
The minus is that most of the puzzles are relatively easy. We moved through the majority of the program without effort. However, even after a month of testing, we have yet to complete the game, get into the temple and use the fourth disk. I don't think this is due to difficulty, so much as to missing one detail somewhere. Of course, that might be what's so difficult about **Mask**.

The pictures are entertaining to look at, impossible to escape. The rapid sequences of flashing images give an illusion of movement and transformation. However, there is no on-off switch. The pictures, each of which requires a lengthy disk load, slow the game down and lessen its appeal through familiar territory.

Often illogical and arbitrary programming has decreased the realism of the game. For example, in some rooms you aren't allowed to take inventory. Since the taking of inventory would consume time, there are, admittedly, occasions when it would be inappropriate to delay more important action—say, when spear-toting skeletons are lunging toward you. But you're not allowed to take inventory even *before* they come to life, as one choice in an otherwise normal situation. Similarly, your pills act randomly, often killing you without warning— or as soon as you set them down.

There is a save game feature, although only one game can be saved per disk. **Mask** allows you to save the game before a particularly hazardous act, then restore your predisaster position.

The program duplicates the copy protection scheme used in many of the better



Mask of the Sun.

business programs. A key disk is copy protected, but the data disks (which, I assume, contain the graphics) may be backed up for archival purposes.

The manual was complete in describing the program, but nearly antiseptic. Little background was laid to support an otherwise acceptable graphics adventure. Play time is unknown, since we have yet to finish it. The first two disks lasted through only about a week of sporadic play, and I'm still certain it's just a silly little thing we're missing.

The addition of pictures no doubt decreases the complexity and realism possible in a text-only adventure. Such games evidently have a market, though, and if you enjoy the images you see on your adventure, you'll enjoy the latest voyage of Mac Steel in **The Mask of the Sun**. However, if you'd rather have strong plot and characterization, you're better off staying home.

ANKH
by David Van Brink
DATAMOST
20660 Nordhoff Street
Chatsworth, CA 91311-6152
48K Disk $19.95

In the machine language **Ankh**, you

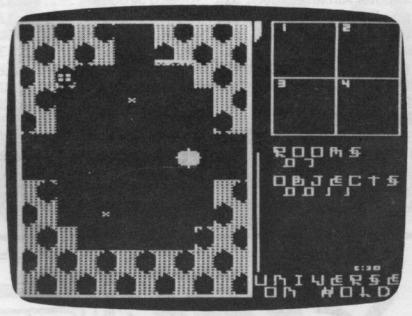
move your "Other" through the sixty-four rooms which comprise its Metareal world. That's right, "Meta-real." Literal translation would seem to be "changed genuine." I really have no idea what this new word's supposed to mean, and I'm similarly at a loss to explain this game.

If you're not familiar with it, the *Ankh* is the Egyptian symbol of life—a cross with a loop at the top. I have absolutely no explanation of why the game is called **Ankh**, except that the word sounds "cool." The game itself is a little like **Berserk**, but with a square representing you, rather than a figure. **Berserk** was years ago, though, and I can barely remember it. Hopefully, **Ankh**, too, will soon be forgotten.

The first reason **Ankh** didn't fare well was because of the graphics. They were a little like the vector graphics of **Tempest**, but nowhere near as detailed and fast. Although it scrolled smoothly, the screen still was not satisfying, or engaging to the eye. Subtract from that an unoriginal and predictable game and, well, there's little left.

The view is from above as you move through the maze, touching and shooting anything and everything. The instructions say puzzles may be solved through a combination of logic, destruction and the scientific method. What this means is that, if you destroy something and nothing happens, you go ahead and destroy until something does.

You also have to pick up objects and carry them about, but there's little rhyme or reason to your actions—at least, not enough to make me care. So uninterested was I that I rarely bothered picking up objects, preferring to just move and shoot, commando-style. The challenge of completing the game was a nebulous and immaterial concept.



Ankh.

The manual is adequate at explaining how to play, but advanced no substantial explanation for the game's existence. The warranty card was a nice shade of blue, but a replacement copy will be the last thing on your mind after a couple of days with **Ankh**.

After I finished testing this game, I heard that the company was in trouble. By the time this gets out, it could be dead. Well, if that's the case, **Ankh** is one corpse that is better left buried.

Well, that's about it for this month. If you're thinking of getting a game, **Spy vs Spy II** provides two players with an excellent time. On the downside, avoid **Ankh**, unless you have money to burn.

Wrapping up a few loose ends, I'm not sure what's on the menu for next time. I know I want to get started on the new Infocom games, and I'm hoping to do some baseball games in time for the all-star break. So, till next month, keep an eye out for power spikes and static discharge, and reserve a joystick for me. A

The author wishes to express his appreciation to The Magic One Computer Shop of Barberton, Ohio for their constant support.

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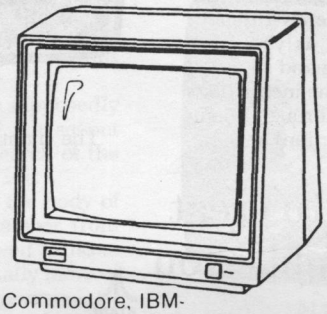

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THE END USER

THIS MONTH:

What's cooking, real-time help, hard ware and a CHAT update

by Arthur Leyenberger

Hi there. I just got my Atari 800 back from the shop, after running the **Paperweight** program from issue 41 (April 1986) of **ANALOG Computing**. The nice fellow at Atari's service center said he couldn't find anything wrong with the machine. He also said the SDV (Self-Destruct Vector) checked out okay.

Anyway, welcome to this month's edition of **The End User**, the magazine column that asks the computer question: "If a shave and a haircut costs 2 bits, and I have an 8-bit computer, can I get four style-and-blow-drys, or can three friends and I get our hair done all at once?" While some of you are figuring out the answer to that one, I'll go ahead and start the column.

New, improved.

For several years, Electronic Arts has produced a stable of fine software for the 8-bit Ataris. In fact, they were one of the first to produce high-quality software for *any computer*. Their notable titles easily slip off the tongue—**M.U.L.E.**, **Pinball Construction Set**, **Archon** and, yes, **Financial Cookbook**.

"Financial Cookbook?" you ask incredulously. Yup, this program is useful, works as advertised (which is more than I can say for a lot of programs) and is inexpensive. When I reviewed **Financial Cookbook** in issue 37 of **ANALOG Computing**, I said it was useful for anyone who makes decisions about money matters—all of us. I still say so.

Fast forward to the present. Electronic Arts has neglected the ST software market since the computer first appeared. Trip Hawkins has gone so far as to engage in running debates (tirades?) on CompuServe about the merits of the ST versus the Commodore Amiga. I'm happy to report that EA has finally produced their first software title for the ST. It is—you guessed it—**Financial Cookbook**.

Financial Cookbook contains thirty-two "recipes" (*cookbook*, get it?) that produce answers about taxes, investments, savings, mortgages and other personal financial questions. To get the answer to a specific money question, the user simply chooses a recipe from the menu (*cookbook*, get it?) and enters certain variables needed for the calculation. All the calculations are done without any complicated models, as required when using a spreadsheet.

The ability to instantly recalculate problems involving a mortgage or interest—with the results appearing in separate windows—is one of the program's advantages.

Some entries (such as interest rate on savings, marginal tax rate and inflation rate) appear in nearly every recipe. To save you the effort of retyping this information every time, a "Profile" command allows you to enter the data once and store it on the disk for future use. A "Print" command is also provided for hardcopy output.

Using the various recipes, any user—regardless of financial sophistication—can quickly and easily figure out such things as: returns on investments, effective tax rates, lease-versus-buy decisions, effects of inflation, mortgage calculations, IRA savings and future value, and much, much more.

Financial Cookbook for the Atari ST pro-

Arthur Leyenberger is a human factors psychologist and free-lance writer living in New Jersey. He has been an Atari enthusiast for four years. When not computing, he enjoys playing with robotic toys.

CompuServe — 71266,46
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vides a lot of financial power that's easily accessible. . . All for $50. Electronic Arts, 1820 Gateway Drive, San Mateo, CA 94404 — (415) 571-7171.

It's about time.

One of the minor annoyances of the STs is their lack of a real-time clock with battery backup. Sure, the STs have all kinds of internal clock registers and whatnot, but if you want to get correct date- and time-stamping of your files, you have to enter the date and time each time you boot up, via the control panel.

At least with TOS in ROM, Atari has corrected the bug that caused the ST to crash its time and date when you changed screen resolution modes. Still, sometimes I forget to enter date and time, and don't realize it. In that case, you might as well not even *have* date/time-stamping.

Fortunately, I need whine no longer. Soft Logik Corporation, the folks who make the ST solitaire and blackjack games mentioned in issue 40's **End User**, have come out with a real-time clock cartridge for the ST.

You insert the **LogiKhron Clock Card** into the ST's cartridge port and leave it there. There's a desktop accessory program that forces the computer to read time and date from the card, and lets you change the information whenever you want (usually only when you first install it).

Through the use of an internal battery, **LogiKhron** maintains the correct time and date, even when the computer is off. Installation is easy and, once done, you can forget it. I've had the **LogiKhron** in my ST for about three weeks now. So far, I haven't had to change the time or the date. The cartridge sells for $50 and is worth the price, simply because it works as advertised.

There have been a couple of changes made for the better since the card came out. First, the original model was completely sealed. Although the battery was said to last 3 to 5 years, there was no way to replace it without destroying the cartridge. There's now a little door through which the battery can be accessed.

Another change involves the desktop accessory used to modify the time. Currently, the accessory program and its resource file must be on the disk when the computer is booted up. The accessory loads and uses a valuable accessory slot (only six accessory names are allowed on the ST).

Soft Logik has decided to free up that slot, by providing a runnable program with all clock cards they're currently selling. You no longer have to set or change time by means of an accessory. Good move.

There isn't much else to say about the **Logikhron Clock Card**, other than to reiterate what I said above—it works and is a useful addition to your Atari ST. Soft Logik Corp. can be reached at: 429 Old Baumgartner, St. Louis, MO 63129 — (314) 894-8608.

Supra hard disk.

Atari has been promising a 10-, 15-, 20-megabyte hard disk for the ST since. . . well, since time immemorial. As of April 1986, they had not yet delivered. Of course, most astute readers of **ANALOG Computing** and **End User** realize that what Atari *says* and what Atari *does* are sometimes two entirely different things.

Anyway, while Atari was promising, other companies were delivering. So far, two have produced a hard disk for the ST: Haba and Supra.

Haba had some problems with their model at first, and, although these have since been corrected, I've had no first-hand experience with their product. On the other hand, Supra allowed software companies at the Winter Consumer Electronics Show to borrow working units of their 10-megabyte ST hard disk and began shipping the product shortly afterwards.

For over a month, I've had a Supra 10-meg hard disk on loan in my basement computer lab. It's fast, undemanding and works as advertised. Several software developers frequenting CompuServe also have the drive and speak highly of it.

I did have one small problem when I first got the drive, the fix for which was found by trial and error. In case you experience a similar glitch, let me share the problem and its fix.

Using the Supra hard disk for about a week, everything was fine. I was experiencing its speed, quietness and, most of all, its convenience. Then, suddenly, I couldn't boot the hard disk. Every time I tried, it kept returning to the desktop.

As it turned out, I had somehow mashed the DESKTOP.INF file on the hard disk and thus made it go crazy when it tried to boot up. I couldn't delete that file on the hard disk because, obviously, I couldn't get the hard disk to boot up in the first place. . .the old "catch-22" problem.

Anyway, I figured out what to do by trial and error (my usual approach). Here it is: I turned the hard disk off and used the Supra hard disk boot program. GEM told me I had an invalid drive identifier. However, I did get a drive C icon on the screen. So I clicked on the drive C icon and did a "show info" (from the drop-down menu). I got nothing. I did it again; this time it displayed information about the drive, which meant it had responded.

I then double-clicked on the drive C icon, deleted the DESKTOP.INF file, and rebooted the hard disk and the ST. That fixed the problem, and it's worked fine ever since.

In discussing this problem I'd experienced with the folks at Supra, they couldn't tell me why the DESKTOP.INF file got garbled in the first place. They did agree that, for most users, the process I went through is too much to ask of them. Consequently, Supra is working on some utility programs to come with the hard disk, which will allow the user to recover from a problem such as I had. The programs should be finished by the time you read this, and they'll be made available to existing Supra hard disk owners.

The **10-megabyte Supra Drive: Atari ST Hard Disk** sells for $ 799. A 20-megabyte version is available for $1095, and they're working on even larger capacity drives. Supra can be reached at: 1133 Commercial Way, Albany, OR 97321—(503) 967-9075. I'm very happy with the Supra drive I have on loan and highly recommend it. The only problem: I have just a few thousand bytes left on the drive. I need a bigger one!

Speaking of bigger drives, Supra was recently showing the actual production version of their 20-megabyte drive for the Atari ST at the West Coast Computer Faire. This $1095 hard disk could be the answer for all of us byte hogs. They were also showing a streaming tape backup unit. Unlike the 20-meg drive, it can't be purchased yet, but you'll be able to get one by the time you read this.

Supra earns their money the old fashioned way—they work for it. They provide good support and a good product for the money. They had hard disks before Atari, provided the software disk drivers before Atari, and promise to continue to offer high-performance hard disks for the ST. If you need or are considering a hard disk for your ST, be sure to check out what Supra has to offer.

Getting on line.

When I review software, I call 'em as I see 'em. That you can count on. My perspective is from the user's point of view, not that of the software and hardware companies, for sure. Occasionally, a company will be offended, because I've been honest in a review.

If there's a serious problem with a product, I always call the company and discuss it with them, before putting my opinion into print. I try to determine if they're aware of the problems I've uncovered, what their attitude is, and what plans they have (if any) to correct the problems. **CHAT**, a telecommunications program for the Atari ST, is a good case in point.

When SST first made the product available, I was eager to get my hands on it and put a review in print as soon as possible. It was an inexpensive product that looked useful. I soon discovered **CHAT** could not up- and download from CompuServe. It worked fine on most BBSs, but I thought the CompuServe connection was important— and mentioned the problem in my review.

The company took exception to my review, saying I was biased. As I told Wynn Rostek in my reply to him, I'm only biased to the extent that I want good software for

the ST. . .and I want it to work as advertised.

This story has a happy ending, because SST has recently come out with **CHAT 2.0**. The new version is a good program and does, in fact, work as advertised. **CHAT 2.0** lists for $20 and is available from: SST System of 3456 Willis Drive, Titusville, FL 32796 — (305) 269-0063.

If you have the older version of the program, you can upgrade to **2.0** for $3 (the program and documentation on the disk) or $4 (the program and a printed manual).

I've told many companies that, if their product isn't up to snuff when I review it, I have to give honest criticism. If later it's improved, fixed, or otherwise made better than the original, I'm quite willing to give it a second look, as I did **CHAT 2.0**.

MichTron's DOS Shell.

MichTron, Inc., the ST's most prolific software publisher, has a new program you may find very useful. Called **DOS Shell**, it provides an MS-DOS (the operating system used on IBM computers and clones) environment for the Atari ST.

Now, you can issue DEL, DIR and COPY commands just like the boys in those corporate offices downtown. Seriously, **DOS Shell** commands can list files on a disk, copy files and check the free space—much faster than GEM's commands.

Instead of using the mouse to point at and drag files around the screen, **DOS Shell** uses short, English-like commands to control the disk drives and the files contained on the disks.

Written by Timothy Purves, **DOS Shell** can do just about everything that GEM does, and a lot more. All the file commands are there: copying, deleting, renaming, typing (showing), etc.

There are a bunch of directory (folder) commands, too. Directories can be created, removed and copied. There's a "path" command that lets you tell the **Shell** where to look (in which directories) for various commands. This lets you put commands, programs and utilities in any directory you want, to best organize and structure your file system. Once the path command is issued, DOS knows where to look.

One of the best features of MS-DOS (on a PC) and of **DOS Shell** (on an ST) is the ability to use batch files.

A batch file lets you automatically run a group of programs (or DOS commands) simply by including their names in a file and typing the file's name. This is extremely useful for common or repetitive operations, like setting up your computer at the beginning of a session.

You can also create one special batch file, called AUTOEXEC.BAT, which, if present when your computer's turned on, will run automatically.

You may create as many other batch files as you'd like. The only restriction is that any batch file you create must have a name extension of *.BAT*. A batch file can even call another batch file, nested up to five levels deep.

The debate concerning which is best—GEM or MS-DOS—is far from over. If you're already familiar with MS-DOS, or are tired of the cutesie nature of GEM, you may want to switch to **DOS Shell**.

It sells for $39.95 and is available from MichTron, 576 S. Telegraph Road, Pontiac, MI 48053 — (313) 334-5700.

A final note.

It appears that Atari 1040STs are starting to become available around the country. However, several owners have told me the 1040s do *not* have an RF output for a TV. I recently saw a 1040 at a local dealer and—sure enough—no TV video output.

On the other hand, I'm happy to report 520STs are now coming through with TOS on ROM, already installed, *and* an RF video output. I have yet to observe the quality of the TV picture, but I'll do so by next issue.

Until we meet here again next time, keep on computing.

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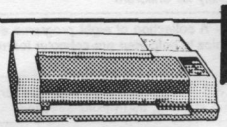

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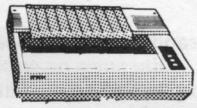

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CIRCLE #155 ON READER SERVICE CARD

Critical Connection

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by Curtis W. Crowe

How often have you spent time on your Atari and wished you had the printers, ports, disk drives, etc. that are on your CP/M-based machine? If you're like me, you bought the Atari for the kids—and ended up liking it yourself. However, no matter how much you enjoy working with the Atari, it's difficult to get used to a machine that lacks the peripherals to make your larger machine such a joy.

Buying the needed devices is the obvious answer, but it isn't always possible or desirable. I wasn't going to buy another serial port and disk drive for the Atari, when I had already purchased these items for my CP/M system. A California company called USS Enterprises has come to the rescue. Now I can use a plug-in "black box" that will allow my CP/M machine to be used in conjunction with my Atari 400.

The secret to this magic is that Atari has interfaced its disk drives and other devices to the computer in an unusual way. Most companies employ a form of parallel data transfer to communicate with their disk drives. Atari uses a 19200-baud serial port for all its peripherals. This is the port all your Atari-manufactured devices plug into.

From a marketing standpoint this was a smart move, because it allowed Atari to keep the disk controller, modem ports and other add-ons outside the computer—keeping down the cost of the basic unit. The downside of this scheme is that most industry standard peripherals will not directly plug into Atari computers, unless you buy the interface box.

Plain disk drives can't be added, because Atari mounted the controller board inside the disk system. But shouldn't my CP/M computer then be able to communicate with the Atari, since it has a serial port that can be run at 19200 baud? The answer is yes, but two things are needed to make that happen.

First, you need some hardware to change your CP/M system's RS-232 level signals to the TTL level signals that the Atari uses. Second, and most important, you need a piece of software on the CP/M system that makes the Atari think it's talking to one of its own devices. That is, when the Atari wants to talk to the disk drive, it will send a command down the line. The CP/M system must receive this command and respond just as a real 810 or 1050 disk drive would. This is quite a trick. It puts the project out of the reach of most hackers.

Critical Connection is the hardware and software system that can do this job—and do it very well. When you open the box, you'll find a 30-foot cable with a male DB-25 connector on one end (to go to your CP/M system). On the other end is a connector that plugs into the peripheral port on the Atari. In the middle is a small, square box that apparently contains the electronics to perform the voltage level conversions.

I say "apparently," because inside this box you'll find only a big glob of epoxy. This is a sort of "copy protection" scheme for hardware. Also included is a CP/M disk in a format to match your machine, and a 12-page instruction manual.

I really can't figure out why the folks at USS Enterprises supply such a long cable. While I appreciate their thoughtfulness, you'll want your CP/M machine and your Atari to be where you can reach both keyboards, and the extra cable will be mostly unused.

To use **Critical Connection**, plug in the cable between the CP/M machine and the Atari, then copy all the software from the **Connection** disk onto a bootable CP/M disk.

Since the **Connection** works with several different CP/M systems, you must first go through a procedure called "install," to customize the software for your particular hardware environment. The install program first presents a list of computers supported, then asks if yours is on the list. If you're lucky enough to have one of these systems, you need only choose yours from a menu—and you're ready to start using the **Connection**. Here's a list of computer systems directly supported by the software: Morrow Disk Jockey, Port A of CCS 4 Port Serial Card Model 2710, Kaypro II, Serial Port of CCS CPU Card, Superbrain, Heath/Zenith H/Z-89 with HA-88-3, Z80 SIO with Data A4 and Status A5, Xerox 820, Sanyo MBC-1000, LOBO, and Heath/Ze-

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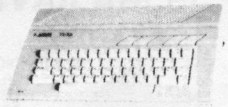

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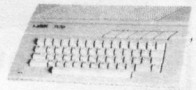

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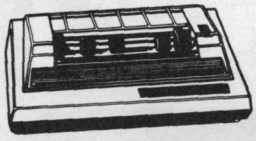

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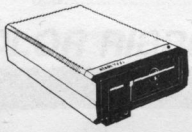

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nith H/Z-100 (now supported for auto install).

If your system isn't listed here, you must go through a nonautomatic install procedure. This requires that you know how to initialize your port for 19200 baud, and that you know the address of your data and status port.

It may sound difficult, but with this option and the appendix in my Heathkit manual, I was able to get my Heathkit H-100 running in only five minutes. If you have any doubts, call USS Enterprises; they should be able to help you.

Now you're ready for the moment of truth. Install the BASIC cartridge in the Atari, run the program called *ATARI* on the CP/M system, then turn the Atari off and back on. You'll see a message on the CP/M screen indicating Atari DOS boot sectors are being sent. You'll then see the familiar Atari BASIC prompt on the TV screen.

To load a sample BASIC program included with the **Connection**, just type *ENTER "D:CHICKEN.ATR"*. Your CP/M disk drive should come alive, and you'll hear the sound of the Atari loading software from your CP/M drive! When you get the *READY* prompt, type *RUN*. You'll see that the Atari now treats your CP/M system as a disk drive, and loads and saves BASIC programs.

While this alone would make the **Connection** a desirable product, that's not all it can do. If you have a printer on your CP/M system, you can also use it as the Atari printer, and the **Connection** software will even use some of the CP/M system's memory as a print spooler.

To see it work, you need only type *LIST "P*. In addition, by issuing the *K* command, you can use your CP/M system's keyboard in place of the Atari keyboard when typing in or editing BASIC programs. This is a real advantage if you have a 48K Atari 400, as I do.

The above commands all deal with Atari BASIC, but the people at USS haven't left out support for Atari DOS. The problem is that, since DOS is a copyrighted product, it can't be included with the **Connection**. But if you already own a copy and can borrow an 810 or 1050 disk drive, you can create disks that contain the entire Atari DOS with the same directories, file structures, etc.

To do this, you go into the **Connection**'s "virtual disk" mode and assign CP/M disks as Atari *D0:* through *D4:*. You can have up to four drives on your Atari system—any combination of real or virtual drives. You only need a real drive on your system long enough to copy software you have purchased to your CP/M disks, then the real 810 or 1050 can be disconnected.

Here's an example that may make this clear: On my Heathkit H-100, I have a 27-megabyte hard disk. I have put on it twenty "Atari" disks. I just tell the **Connection** that I want *D0:* to be my CP/M file called GAMES, and then I can boot the Atari, do directories, run programs, delete and rename files—just as if I had a real Atari drive in front of me.

The only difference you'll notice is that your **Critical Connection** might be significantly faster than an 810 or 1050. To change to another disk, I simply change the assignment of *D0:*. This allows tremendous flexibility in the use of the CP/M system as a server for the Atari.

As you can tell, I'm very happy with my **Critical Connection** and can recommend it wholeheartedly. However, any product has something that could have been done better. With the **Connection**, the weakest point is its documentation.

The manual is adequate—but just barely so. The second annoying thing is the problem of copy-protected software. Remember, if you buy a commercial software product and want to put it on your CP/M system for use on the Atari, you must first have a real 810 or 1050 drive, in order to copy it to the CP/M disk. Copy-protected software makes this very difficult. The **Connection** comes with an Atari utility called "copydisk" that's supposed to copy any disk, but some protection schemes beat it.

One final point: I was apprehensive about buying this product through the mail, because you never know what kind of support you might need. I can tell you that the people at USS Enterprises have been helpful with all my questions—and have even incorporated some of their users' suggestions, in the form of an update, to the software portion of the package.

This update was offered at a reasonable $15 and includes an experimental command that could make the product even better. The command allows users of some CP/M systems to actually read disks made for the Atari. This would make it unnecessary to even have a Atari drive. The capability is still experimental, so if it's important to you, call the folks at USS Enterprises and ask if your CP/M system can be made to read Atari disks directly.

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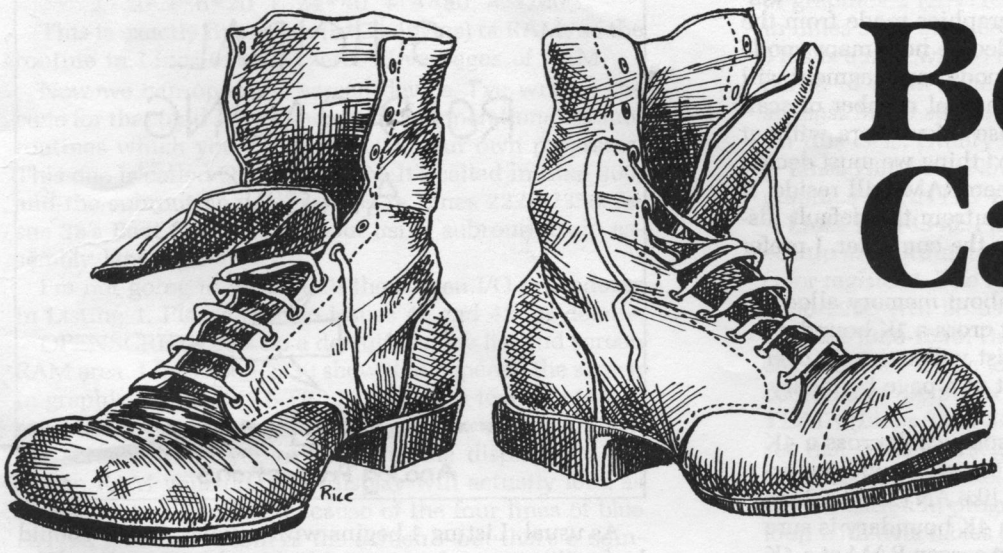
CIRCLE #159 ON READER SERVICE CARD



Boot Camp

by Karl E. Wiegers

I must be out of my mind. I spent all of last month's column talking about number crunching, when we all know home computers are really bought for their graphics (good thing, in the case of the Atari). Let's get back to graphics programming in assembly lanuage.

The **Boot Camp** columns in issues 41 and 42 laid a foundation for us, explaining how to place text and graphics displays on-screen. In the next few months, I'll open the doors to more sophisticated graphics techniques. We'll do this in the context of a game-type project.

This time, we'll build the title screen for "Attack of the Suicidal Road-Racing Aliens." Next month, we'll spice up that title screen with some display list interrupts.

Mixed-mode displays.

In issue 41's **Boot Camp**, you learned how to open the graphics screen (device S:) to get a particular graphics mode. You can make much more interesting screens by combining several different modes, to form a "mixed-mode display."

To refresh your memory, Table 1 summarizes the available graphics modes. Note that each has both a BASIC mode number and an ANTIC mode number (except ANTIC mode 3). The table shows the number of horizontal TV "scan lines" that make up a single "mode line" in each mode. There are 192 scan lines in a standard Atari display.

You probably know ANTIC is a chip in the Atari that controls the screen display. ANTIC has its own tiny programming language, and a program for ANTIC is called a "display list." The display list tells ANTIC which graphics mode each on-screen line uses and where to find the section(s) of RAM allocated to the screen display.

Table 1.

ATARI GRAPHICS MODES

ANTIC Mode	BASIC Mode	Scan Lines/ Mode Line	Mode Lines/ Screen	Bytes/ Mode Line
2	0	8	24	40
3	NONE	10	about 19	40
4	12 (XL)	8	24	40
5	13 (XL)	16	12	40
6	1	8	24	20
7	2	16	12	20
8	3	8	24	10
9	4	4	48	10
10	5	4	48	20
11	6	2	96	20
12	14 (XL)	1	192	20
13	7	2	96	40
14	15 (XL)	1	192	40
15*	8	1	192	40

*GTIA modes also use ANTIC mode 15.

When you open the screen device *S:* using CIO, the operating system sets aside a block of RAM for the screen display and creates an appropriate display list, based on the graphics mode requested. By default, the screen RAM is located at the very top of available memory, and the display list is stored immediately beneath screen RAM.

To use mixed-mode displays, we need to create our own customized display list, decide where we want screen RAM to be located, then set some pointers to tell ANTIC

what we're up to. Other display list modifications are needed to use display list interrupts and fine scrolling—topics for upcoming columns.

To create a mixed-mode display, first sketch out your screen. It will contain several horizontal bands or "segments," each having a different graphics mode from the ones above and below it. Next, decide how many mode lines of the appropriate graphics mode each segment will contain. Remember, you want the total number of scan lines to be about 192 (you can use a few more without causing major problems). The next thing we must decide is where the display list and screen RAM will reside. If you aren't making drastic changes from the default display list, you can leave this up to the computer. I prefer to control the situation myself.

There are a couple of rules about memory allocation. First, the display list can't cross a 1K boundary (multiple of $400). Since the list will never be over 256 bytes long, I always start it at a page boundary, like $3F00.

Second, the screen RAM display can't cross a 4K boundary (multiple of $1000), at least not without using a trick. Of course, in modes like ANTIC 15, where 8K of screen RAM is needed, a 4K boundary is sure to be encountered. I always start screen RAM at a 4K boundary (like $4000), to minimize these problems.

There are four sections to the display list:

(1) Decimal 112 (hex $70) is stored in 3 consecutive bytes. This tells ANTIC to skip twenty-four scan lines, to make sure the display is positioned properly on the monitor screen.

(2) There's a byte equal to the ANTIC mode number of your first segment plus decimal 64 (hex $40), followed by the beginning address of screen RAM in low-byte, high-byte format. The addition of 64 to the ANTIC mode number identifies this byte as a "load memory scan" (or LMS) instruction. ANTIC looks at the next 2 bytes to find the screen RAM area.

Okay, I'll tell you the trick I postponed earlier. If your screen RAM region crosses a 4K boundary, you'll need to put an extra LMS instruction in your display list, right where the 4K boundary occurs. Let's not worry about LMS instructions for now, though.

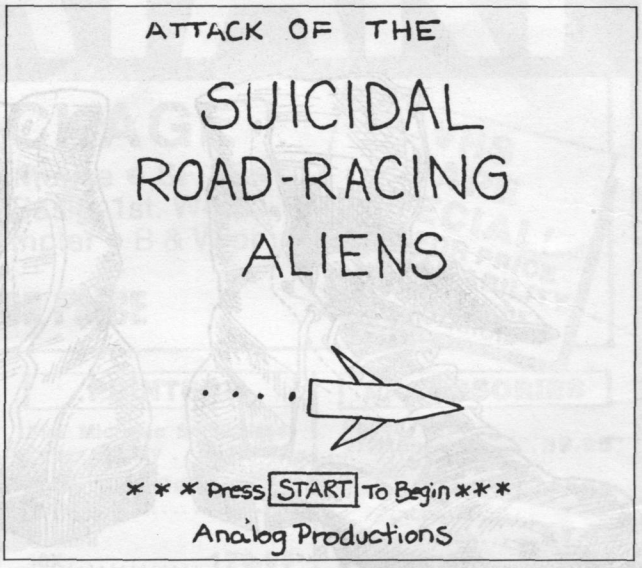
(3) Next is a list of the ANTIC mode numbers for all the other mode lines in your screen display, in sequence, from the top of the screen to the bottom.

(4) Finally, we have a byte set to decimal 65 ($41), followed by the address of the beginning of your display list. The 65 is a jump instruction, and tells ANTIC where to go for the next display list instruction. In our case, it will always point to the first byte of the display list.

Our title screen.

Enough preliminaries. Figure 1 is a sketch of the title screen for our alien game. There are four segments: two lines of ANTIC 6; six lines of ANTIC 7; twenty-four lines of ANTIC 13; and four lines of ANTIC 2. (Keep Table 1 handy, since we need both the ANTIC and the BASIC graphics mode numbers at various times). The program to create this enticing display is found in Listing 1.

Figure 1.



As usual, Listing 1 begins with equates. These should be familiar to you from our earlier graphic excursions. The new locations of interest are in Lines 240-270.

DINDEX contains the BASIC mode number of the segment in which we're currently printing or plotting. SAVMSC is the 2-byte address for the beginning of screen RAM. SDMCTL is a byte that lets you turn the screen off (store 0) or on (store decimal 34). It's also used in controlling player-missile graphics (another future topic). SDLSTL is the 2-byte address for the display list itself.

A few other locations we need appear in Lines 420-440. CONSOL tells us which of the console buttons (START, OPTION, SELECT) are being pressed. STRGNO is my own variable, for storing the number of the text string we printed most recently. And SCRRAM is the beginning of screen RAM, which I've set at $4000.

Our display list is described in Lines 490-560. Can you find the four sections of the display list mentioned above? The long list of 13s is for the 24 lines in segment 3. The display list for a graphics 8 screen has 191 15s in a row (plus the LMS instruction I promised not to mention)!

The program itself begins at address $5000 in Line 600. I want to digress here and describe how I lay out my assembly programs.

First, of course, come the equates. After that, I put things appearing in memory below the main program—in this case, the display list. The third section is the program code itself, followed by all the subroutines called.

I might place small, separate routines (like display list interrupts and vertical blank interrupts) after the subroutines. Finally, text strings to be printed and data tables appear at the very end of the program. This may not be the best way to organize things, but it works for me.

One problem with choosing your own screen RAM region is that you don't know what's initially stored there. So let's begin by zeroing the screen RAM area. But wait! We know where it starts, but where does it stop? Multiply

the number of mode lines (of each kind) times the bytes needed for each such line, and add them up to find out how much memory our custom display consumes:

```
2*20 + 6*20 + 24*40 + 4*40 = 1280
```

This is exactly five pages (5*256 bytes) of RAM, so the routine in Lines 690-760 zeroes five pages of RAM.

Now we can open the screen device. I've written the code for that (and some other common operations) as subroutines which you can include in your own programs. This one is called OPENSCREEN. It's called in Line 800, and the subroutine itself resides in Lines 2220-2350. Issue 38's **Boot Camp** talks about using subroutines in assembly language.

I'm not going to explain all the screen I/O procedures in Listing 1. Please refer to issues 41 and 42 for details.

OPENSCREEN sets up a default display list and screen RAM area. Lines 2300-2330 show that I opened the screen in graphics mode 0 (ANTIC 2) without a text window. It really doesn't matter much which mode you use to open the screen, when you're handling the display list and screen RAM yourself. This display will actually look as if it has a text window, because of the four lines of blue ANTIC 2 at the bottom of the screen—but that's a coincidence.

Our first task is to override the default display list with our own. Lines 830-860 tell ANTIC to use our own screen RAM area, not the one it just selected. I like to turn the screen off momentarily when switching display lists, just to avoid unsightly flashes (Lines 870-880).

Lines 890-920 store the address of our display list in SDLSTL, so ANTIC forgets all about the one it just created. Now we can turn the screen back on (Lines 930-940).

Now, to write on the screen. The idea is to think of each segment as a separate little screen. We need to tell ANTIC the graphics mode of the current segment and where it begins in memory. Then we can print and plot in it as usual.

To move on to the next segment, add the number of bytes occupied by the current segment to the value stored in SAVMSC. This makes ANTIC think the screen RAM starts at the first byte of the next segment.

This trick is required because mode lines in different graphics modes demand different amounts of memory. It does make it awkward to write into previous segments, since you must first subtract the right number of bytes from SAVMSC to back up in memory.

Here's how it works, line by line:

Lines 980-990: The first segment is in graphics 1 (ANTIC 6).

Line 1000: Calls the subroutine to position the cursor for the first text string. This is where the STRGNO equate is used. The data tables in Lines 3150-3160 contain the coordinates for all text strings to be printed. Notice that these coordinates are all relative to the upper left corner of the *segment*, not of the entire screen.

Lines 1010-1060: Print the text string, using the subroutine PRINTLINE at Lines 2600-2680.

Lines 1070-1080: Add *40* (two mode lines of graphics 1 at 20 bytes per line) to the value in SAVMSC, using another subroutine (ADDMEM, Lines 2740-2800).

Lines 1090-1170: Now we're in segment 2, six lines of graphics 2 (ANTIC 7). Notice that the text string in Lines 3220-3280 covers several lines on the screen. This is a nice way to reduce program code, at the expense of a few bytes of memory in the blank text strings. Make sure each text line is the right length (in this case, twenty characters).

Lines 1180-1210: Now, in the third segment, we have graphics 7 (ANTIC 13).

Lines 1250-1340: Plot one point in the stylized rocket ship at coordinates *60,8* within the segment, using color register 1. The PLOTPOINT subroutine at Lines 2850-2930 will be used again later.

Lines 1380-1530: Draw the rest of the rocket, using color register 1. The loop plots thirteen points, whose coordinates are pulled from tables called XDATA and YDATA (Lines 3390-3440). If you trace this out, you'll see that some line segments are drawn twice. This is a tiny sacrifice in execution time, to gain the valuable simplification in program code afforded by using this loop with data tables and the DRAWLINE subroutine (Lines 2980-3030).

Lines 1570-1750: Use a similar loop and data tables to plot four points for the rocket exhaust, selecting color register 0.

Lines 1800-1850: Segment 3 requires 960 bytes. I couldn't add this to SAVMSC in one step, so I built a little loop to do it.

Lines 1890-2040: Complete the display by printing two lines in the fourth segment, a graphics 0 (ANTIC 2) block. It looks like a text window, but really isn't. (Incidentally, by using a custom display list you can put a text window anywhere you want on the screen.)

Okay, if you assemble this beast and run it at address $5000, you should see our title screen. This screen prompts you to press START, to begin the (nonexistent) game. This is where CONSOL comes in.

CONSOL will contain values from *0* to *7*, depending on which combination of the START, SELECT and OPTION keys have been pressed. Table 2 gives the lowdown. It's a good practice to clear this register by loading an *8* into it before checking for a button press, as we do in Lines 2090-2100.

Table 2 reveals that pressing the START button alone sets CONSOL to a value of *6*. The loop in Lines 2110-2140 just checks endlessly for this situation. If it happens, the graphics screen is closed, then re-opened under default conditions, just to clear it. In real life, you'd probably have another custom display list set up to use for the next screen of the game. Press RESET when you're tired of looking at the blue screen.

Table 2.

CONSOL VALUES

Value	Buttons Pressed
0	OPTION, SELECT, START
1	OPTION, SELECT
2	OPTION, START
3	OPTION
4	SELECT, START
5	SELECT
6	START
7	none

Notice the subroutine called CLOSEANY (Lines 2390-2430). If you load the right multiple of hex $10 into the X-register before calling this subroutine, it will close the corresponding IOCB. See Lines 2150-2160 for an example using IOCB #6.

Epilogue.

This wraps up our session. You can apply these ideas to create mixed-mode displays of limitless complexity, just by building the right display list and setting aside enough memory for the screen requirements.

Next month, we'll see how to spice up this screen, with lots of colors and perhaps some character set changes, using the powerful and simple display list interrupts.

Listing 1.
Assembly listing.

```
0100 ;Mixed-Mode graphics displays
0110 ;in Atari assembly language
0120 ;
0130 ;by Karl E. Wiegers
0140 ;
0150  .OPT NOLIST
0160 ;
0170 OPEN   = $03     ;equates for CIO
0180 PUTREC = $09     ;operations
0190 CLOSE  = $0C
0200 DRAW   = $11
0210 EOL    = $9B     ;carriage return
0220 ROWCRS = $54     ;cursor row
0230 COLCRS = $55     ;cursor column
0240 DINDEX = $57     ;graphics mode
0250 SAVMSC = $58     ;screen RAM area
0260 SDMCTL = $022F   ;screen on/off
0270 SDLSTL = $0230   ;starting address
0280 ;                 of display list
0290 CRSINH = $02F0   ;disable cursor
0300 ATACHR = $02FB   ;select color reg
0310 ;
0320 ;equates for IOCB #0
0330 ;
0340 ICCOM = $0342    ;command byte
0350 ICBAL = $0344    ;buffer address,
0360 ICBAH = $0345    ;low and high
0370 ICBLL = $0348    ;buffer length,
0380 ICBLH = $0349    ;low and high
0390 ICAX1 = $034A    ;auxiliary byte 1
0400 ICAX2 = $034B    ;auxiliary byte 2
0410 CIOV  =  $E456   ;CIO entry point
0420 CONSOL = $D01F   ;console buttons
0430 STRGNO = $CB     ;work byte I need
0440 SCRRAM = $4000   ;screen RAM start
0450 ;
0460 ;Display list starts at address
0470 ;$3F00, screen RAM at $4000
0480 ;
0490  *=  $3F00
0500 DLIST
0510  .BYTE 112,112,112,70,0,$40
0520  .BYTE 6,7,7,7,7,7,7,13,13
0530  .BYTE 13,13,13,13,13,13,13
0540  .BYTE 13,13,13,13,13,13,13
0550  .BYTE 13,13,13,13,13,13,13
0560  .BYTE 13,2,2,2,2,65,0,$3F
0570 ;
0580 ;program begins here
0590 ;
0600  *=  $5000
0610 ;
0620  CLD           ;binary mode!
0630  LDA #0        ;zero current
0640  STA STRGNO    ;text line counter
0650  TAX
0660 ;
0670 ;zero out screen RAM area
0680 ;
0690 ZERO
0700  STA SCRRAM,X          ;loop goes
0710  STA SCRRAM+$0100,X    ;256 times
0720  STA SCRRAM+$0200,X    ;each line
0730  STA SCRRAM+$0300,X    ;does one
0740  STA SCRRAM+$0400,X    ;page of RAM
0750  INX
0760  BNE ZERO
0770 ;
0780 ;open screen device, "S:"
0790 ;
0800  JSR OPENSCREEN
0810  LDA #1          ;turn off cursor
0820  STA CRSINH
0830  LDA DLIST+4     ;tell ANTIC
0840  STA SAVMSC      ;where to find
0850  LDA DLIST+5     ;display memory
0860  STA SAVMSC+1
0870  LDA #0          ;turn off the
0880  STA SDMCTL      ;screen briefly,
```

```
0890  LDA #DLIST&255 ;tell ANTIC
0900  STA SDLSTL     ;where to
0910  LDA #DLIST/256 ;find the
0920  STA SDLSTL+1   ;display list,
0930  LDA #34        ;turn screen
0940  STA SDMCTL     ;back on
0950  ;
0960  ;start printing text lines
0970  ;
0980  LDA #1         ;graphics mode 1
0990  STA DINDEX
1000  JSR POSITION   ;position cursor
1010  LDX #$60       ;use IOCB #6
1020  LDA #LINE1&255 ;print first
1030  STA ICBAL,X    ;line of text,
1040  LDA #LINE1/256 ;in Graphics 1
1050  STA ICBAH,X    ;segment
1060  JSR PRINTLINE
1070  LDA #40        ;skip ahead 40
1080  JSR ADDMEM     ;bytes in RAM
1090  LDA #2         ;Graphics mode 2
1100  STA DINDEX
1110  JSR POSITION   ;position cursor
1120  LDX #$60       ;use IOCB #6
1130  LDA #LINE2&255 ;print all
1140  STA ICBAL,X    ;text lines
1150  LDA #LINE2/256 ;in Graphics 2
1160  STA ICBAH,X    ;segment
1170  JSR PRINTLINE
1180  LDA #120       ;go up 120 bytes
1190  JSR ADDMEM     ;in screen RAM to
1200  LDA #7         ;Graphics 7
1210  STA DINDEX     ;segment
1220  ;
1230  ;plot 1st point of rocket ship
1240  ;
1250  LDA #60        ;set coordinates
1260  STA COLCRS     ;of first point
1270  LDA #8         ;to plot for
1280  STA ROWCRS     ;rocket
1290  LDX #$60       ;use IOCB #6
1300  LDA #REG1&255  ;color register 1
1310  STA ICBAL,X
1320  LDA #REG1/256
1330  STA ICBAH,X
1340  JSR PLOTPOINT
1350  ;
1360  ;routine to draw the rocket
1370  ;
1380  LDA #2         ;color register 1
1390  STA ATACHR
1400  LDY #0
1410 POINT           ;loop to plot
1420  LDA XDATA,Y    ;points and
1430  STA COLCRS     ;connect them
1440  LDA YDATA,Y    ;with lines
1450  STA ROWCRS
1460  TYA
1470  PHA
1480  JSR DRAWLINE   ;drawing sub.
1490  PLA
1500  TAY
1510  INY
1520  CPY #13        ;done all 13 pts?
```

Some program listings reproduced in **ANALOG Computing** may contain "strange" characters not shown on the keyboards of earlier Atari models. These are special characters which use the CTRL, ESC and "ATARI LOGO" (inverse) keys. Shown below is a list of these characters and the keystrokes used to get them.

--- CTRL ,
--- CTRL A
--- CTRL B
--- CTRL C
--- CTRL D
--- CTRL E
--- CTRL F
--- CTRL G
--- CTRL H
--- CTRL I
--- CTRL J
--- CTRL K
--- CTRL L
--- CTRL M
--- CTRL N
--- CTRL O
--- CTRL P
--- CTRL Q
--- CTRL R
--- CTRL S
--- CTRL T
--- CTRL U
--- CTRL V
--- CTRL W
--- CTRL X
--- CTRL Y
--- CTRL Z
--- ESC ESC
--- ESC CTRL UP-ARROW
--- ESC CTRL DOWN-ARROW
--- ESC CTRL LEFT-ARROW
--- ESC CTRL RIGHT-ARROW
--- CTRL .
--- CTRL ;
--- ESC SHIFT CLEAR
--- ESC BACK S
--- ESC TAB
--- INVERSE CTRL ,
--- INVERSE CTRL A
--- INVERSE CTRL B
--- INVERSE CTRL C
--- INVERSE CTRL D
--- INVERSE CTRL E
--- INVERSE CTRL F
--- INVERSE CTRL G
--- INVERSE CTRL H
--- INVERSE CTRL I
--- INVERSE CTRL J
--- INVERSE CTRL K
--- INVERSE CTRL L
--- INVERSE CTRL M
--- INVERSE CTRL N
--- INVERSE CTRL O
--- INVERSE CTRL P
--- INVERSE CTRL Q
--- INVERSE CTRL R
--- INVERSE CTRL S
--- INVERSE CTRL T
--- INVERSE CTRL U
--- INVERSE CTRL V
--- INVERSE CTRL W
--- INVERSE CTRL X
--- INVERSE CTRL Y
--- INVERSE CTRL Z
--- ESC DELETE
--- ESC INSERT
--- ESC CTRL TAB (CLR)
--- ESC SHIFT TAB (SET)
--- INVERSE SPACE
--- INVERSE _
--- INVERSE CTRL .
--- INVERSE CTRL ;
--- INVERSE |
--- ESC CTRL 2
--- ESC CTRL BACK S
--- ESC CTRL INSERT

```
1530  BNE POINT       ;no, loop
1540 ;
1550 ;plot points for rocket exhaust
1560 ;
1570  LDX #$60
1580  LDA #REG0&255   ;color reg. 0
1590  STA ICBAL,X
1600  LDA #REG0/256
1610  STA ICBAH,X
1620  LDY #0
1630 POINT2           ;loop to get
1640  LDA EXHAUSTX,Y  ;coordinates
1650  STA COLCRS      ;for points
1660  LDA EXHAUSTY,Y  ;from table,
1670  STA ROWCRS
1680  TYA
1690  PHA
1700  JSR PLOTPOINT   ;plotting sub.
1710  PLA
1720  TAY
1730  INY
1740  CPY #4          ;done 4 pts?
1750  BNE POINT2      ;no, loop
1760 ;
1770 ;add 960 bytes to current screen
1780 ;RAM starting point, 10*96
1790 ;
1800  LDX #10
1810 ADDEMUP
1820  LDA #96
1830  JSR ADDMEM
1840  DEX
1850  BNE ADDEMUP
1860 ;
1870 ;now in bottom segment, Gr. 0
1880 ;
1890  LDA #0          ;Graphics 0
1900  STA DINDEX
1910  JSR POSITION    ;set cursor
1920  LDX #$60        ;use IOCB #6
1930  LDA #LINE3&255  ;print first
1940  STA ICBAL,X     ;text line
1950  LDA #LINE3/256  ;in Graphics 0
1960  STA ICBAH,X     ;segment
1970  JSR PRINTLINE
1980  JSR POSITION    ;print last
1990  LDX #$60        ;text line
2000  LDA #LINE4&255
2010  STA ICBAL,X
2020  LDA #LINE4/256
2030  STA ICBAH,X
2040  JSR PRINTLINE
2050 ;
2060 ;loop until START pressed, then
2070 ;close screen & reopen so blank
2080 ;
2090  LDA #8          ;initialize
2100  STA CONSOL      ;buttons
2110 EXIT
2120  LDA CONSOL      ;value of 6 here
2130  CMP #6          ;means START
2140  BNE EXIT        ;no? try again
2150  LDX #$60        ;close screen
2160  JSR CLOSEANY
2170  JSR OPENSCREEN  ;and reopen
2180 END JMP END      ;wait for reset
2190 ;
2200 ;subroutine to open the screen
2210 ;
2220 OPENSCREEN
2230  LDX #$60        ;use IOCB #6
2240  LDA #OPEN       ;command is OPEN
2250  STA ICCOM,X
2260  LDA #SCREEN&255 ;device to open
2270  STA ICBAL,X
2280  LDA #SCREEN/256
2290  STA ICBAH,X
2300  LDA #12         ;no text window
2310  STA ICAX1,X
2320  LDA #0          ;graphics mode 0
2330  STA ICAX2,X
2340  JSR CIOV        ;go do it
2350  RTS
2360 ;
2370 ;subroutine to close any IOCB
2380 ;
2390 CLOSEANY
2400  LDA #CLOSE      ;close screen
2410  STA ICCOM,X
2420  JSR CIOV
2430  RTS
2440 ;
2450 ;subroutine to position cursor
2460 ;for next text string to write
2470 ;
2480 POSITION
2490  LDX STRGNO      ;get point number
2500  LDA XPOS,X      ;get x-coordinate
2510  STA COLCRS      ;and store
2520  LDA YPOS,X      ;get y-coordinate
2530  STA ROWCRS      ;and store
2540  INC STRGNO      ;ready for next
2550  RTS             ;point, and exit
2560 ;
2570 ;subroutine to print line up to
2580 ;120 chars long at cursor
2590 ;
2600 PRINTLINE
2610  LDA #120        ;maximum length
2620  STA ICBLL,X     ;of text string
2630  LDA #0          ;is 120 chars.
2640  STA ICBLH,X
2650  LDA #PUTREC     ;operation is to
2660  STA ICCOM,X     ;PUT a RECord
2670  JSR CIOV        ;go do it
2680  RTS
2690 ;
2700 ;subroutine to add a constant
2710 ;(in accumulator) to current
2720 ;address for start of screen RAM
2730 ;
2740 ADDMEM
2750  CLC
2760  ADC SAVMSC      ;add constant to
2770  STA SAVMSC      ;low byte & save
2780  BCC NOINC       ;if carry set,
2790  INC SAVMSC+1    ;increment high
2800 NOINC RTS        ;byte,then exit
2810 ;
2820 ;subroutine to plot a point
2830 ;using current color register
2840 ;
2850 PLOTPOINT
2860  LDA #PUTREC
2870  STA ICCOM,X
2880  LDA #1
2890  STA ICBLL,X
2900  LDA #0
2910  STA ICBLH,X
2920  JSR CIOV
2930  RTS
2940 ;
2950 ;subroutine to draw from last
2960 ;plotted point to current one
2970 ;
2980 DRAWLINE
2990  LDX #$60
3000  LDA #DRAW
3010  STA ICCOM,X
3020  JSR CIOV
3030  RTS
3040 ;
3050 ;data values needed for opening
3060 ;screen and picking color regs.
```

```
3070 ;
3080 SCREEN .BYTE "S"
3090 REG0   .BYTE "A"
3100 REG1   .BYTE "B"
3110 ;
3120 ;tables of X- and Y-positions
3130 ;for lines to be printed
3140 ;
3150 XPOS .BYTE 3,0,5,11
3160 YPOS .BYTE 0,0,1,3
3170 ;
3180 ;text strings to print
3190 ;
3200 LINE1
3210  .BYTE "attack of the",EOL
3220 LINE2
3230  .BYTE "       SUICIDAL       "
3240  .BYTE "                      "
3250  .BYTE "    ROAD-RACING       "
3260  .BYTE "                      "
3270  .BYTE "        ALIENS        "
3280  .BYTE EOL
3290 LINE3
3300  .BYTE "*** Press START to"
3310  .BYTE " begin ***",EOL
3320 LINE4
3330  .BYTE "Analog"
3340  .BYTE " Productions",EOL
3350 ;
3360 ;tables of coordinates for
3370 ;drawing silly-looking rocket
3380 ;
3390 XDATA
3400  .BYTE 100,130,100,60,60,95
3410  .BYTE 68,81,60,60,95,68,81
3420 YDATA
3430  .BYTE 8,11,14,14,8,8,0,8
3440  .BYTE 8,14,14,22,14
3450 EXHAUSTX .BYTE 40,46,52,58
3460 EXHAUSTY .BYTE 11,11,11,11
```

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OmniWriter 80 by C. David Young OMNIVIEW CDY Consulting (214)235-2146 03/16/86

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```
PC NV-BDIZC AC X  Y  SP
EAF3  FE    01 FE 31 1F3
```

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CIRCLE #101 ON READER SERVICE CARD

Arm your Atari

by Ted Wilmot

Robotics is an exciting new field. Along with Artificial Intelligence, it's bound to create a new Industrial Revolution. Unfortunately, most people are fascinated by robots, but few get hands-on experience, due to the high cost and industrial nature of the mechanisms.

Unless you're rich or are a mechanical wizard, the robotics scene has probably drifted from your thoughts. But take heed, Atari fans, there's a new kid in town. His name is Armatron, and he wants to meet your computer.

Who is this Armatron, anyway? I first learned of him some time ago, browsing through a Radio Shack catalog. Off the page jumped the ad for their Armatron robot arm. Intrigued, I read the blurb. Before I could finish, the little kid inside me was shouting, "Get it!"

Soon I was on my way to check one out. My initial impression was so positive that, even before I'd purchased one, visions of interfacing it to my computer were percolating through my mind.

For about $30, you can be the proud owner of an Armatron. For an additional $30 and three evenings' work, you can convert the "toy" into a precision computer-controlled servo-system. The process requires a basic knowledge of electronics and simple hand tools. Here's the procedure.

The mechanics.

First, remove the arm's plastic housing. Take out the seven Phillips head screws on the bottom of the housing. Be sure to remove the housing with the arm in normal operating position (i.e., the arm on top). Remove the joysticks, along with the top of the housing, and set those parts aside.

You'll now notice the complex mechanical transmission to distribute power from the single permanent magnet motor to the rest of the arm. Figure 1 shows the internal arrangement of the various assemblies within the transmission.

Now, remove the three largest ring gears on top of the gear housing (see Figure 1). With the gears in a safe place, take out the eight Phillips head screws holding down the gear and joystick housings. *Note: one screw is somewhat hidden inside the ring gear pit.*

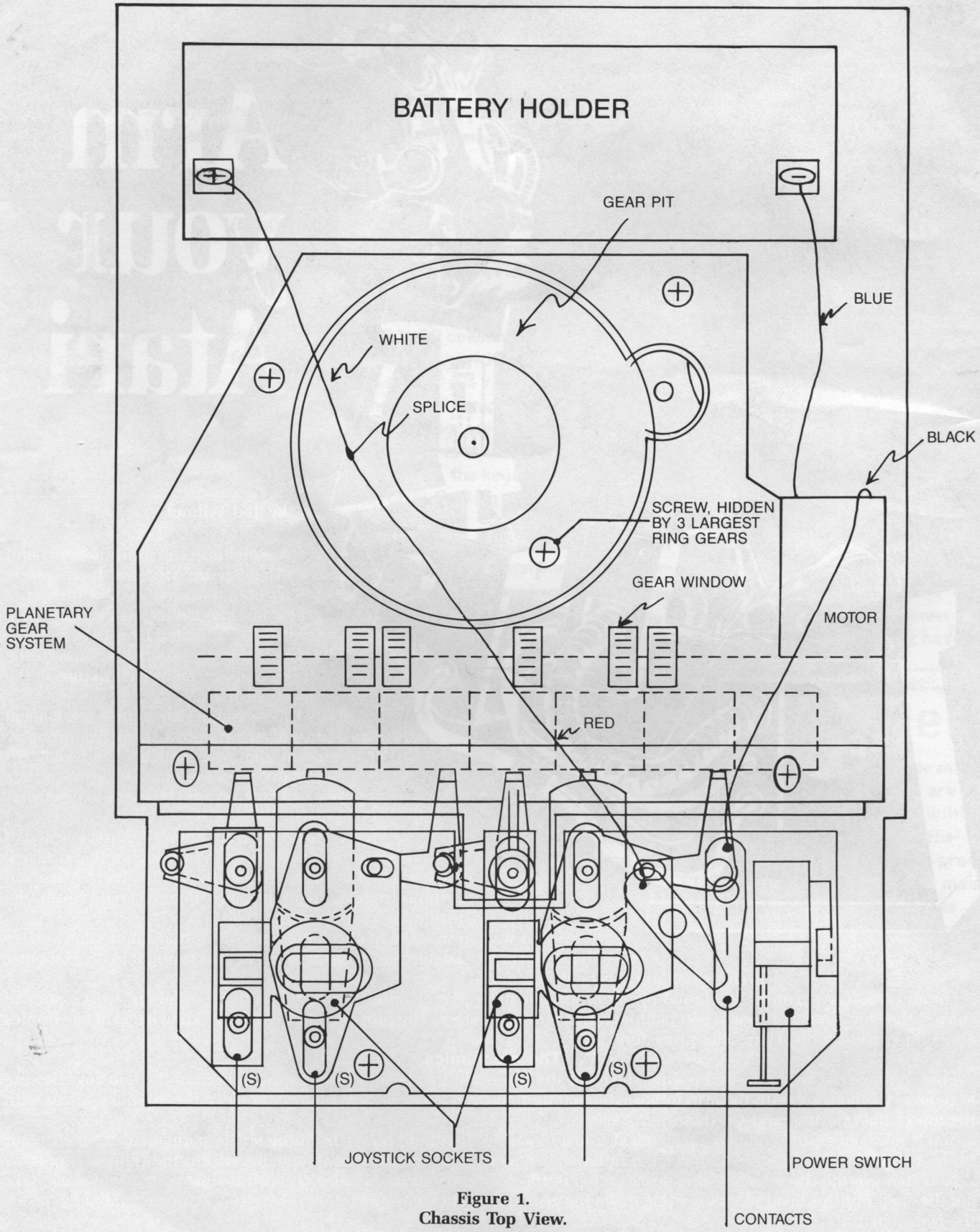


Figure 1.
Chassis Top View.

At this point, the "energy level" mechanism should be removed. Disconnect both wires at the energy level switch (two pieces of copper over the energy level indicator) and splice them together, eliminating the switch. Now, remove the energy level switch and the energy level indicator (the orange tube with some gears at one end).

With the energy level switch bypassed, remove the gear housing, then the joystick housing. Now, remove the two remaining gears, those that powered the energy level indicator (both are worm gears with regular gear ends just above the motor shaft).

Now that all the preliminary work is done, we'll begin interfacing the arm's transmission to the computer.

The arm's joysticks control a series of six plates, which connect with cams on a rotating series of planetary gears. The motor continuously rotates the planetary gear system, and when a joystick is moved, one of three plates connects with a corresponding cam on the gear system to transmit power from the motor to the arm.

To interface our electrical computer to the arm's mechanical transmission requires some sort of electrical to mechanical converter. Of course, a motor comes to mind, but it would be very tricky to install a separate motor to run each of the arm's joints. Therefore, I chose to use solenoids to simulate the action of the joysticks, instead.

This way, solenoids can be mounted outside the arm's housing and connected mechanically to the joystick plates via nylon fishing line.

A total of twenty holes must be drilled in the bottom portion of the arm's housing. Twelve holes give the fishing line a direct route from the solenoids to their corresponding plates. The remainder are to fasten the solenoids' Plexiglas supports and legs.

Figure 2 shows the location of holes to be drilled to accommodate the fishing line. The holes have numbers next to them, indicating the distance from the bottom of the chassis at which they should be drilled. For best results, use a #60 printed circuit board drill to make the holes.

NOTE

Part 1 of this article will work with any 8-bit Atari. However, Part 2 requires three joystick ports, so it's not compatible with the XL and XE series computers.

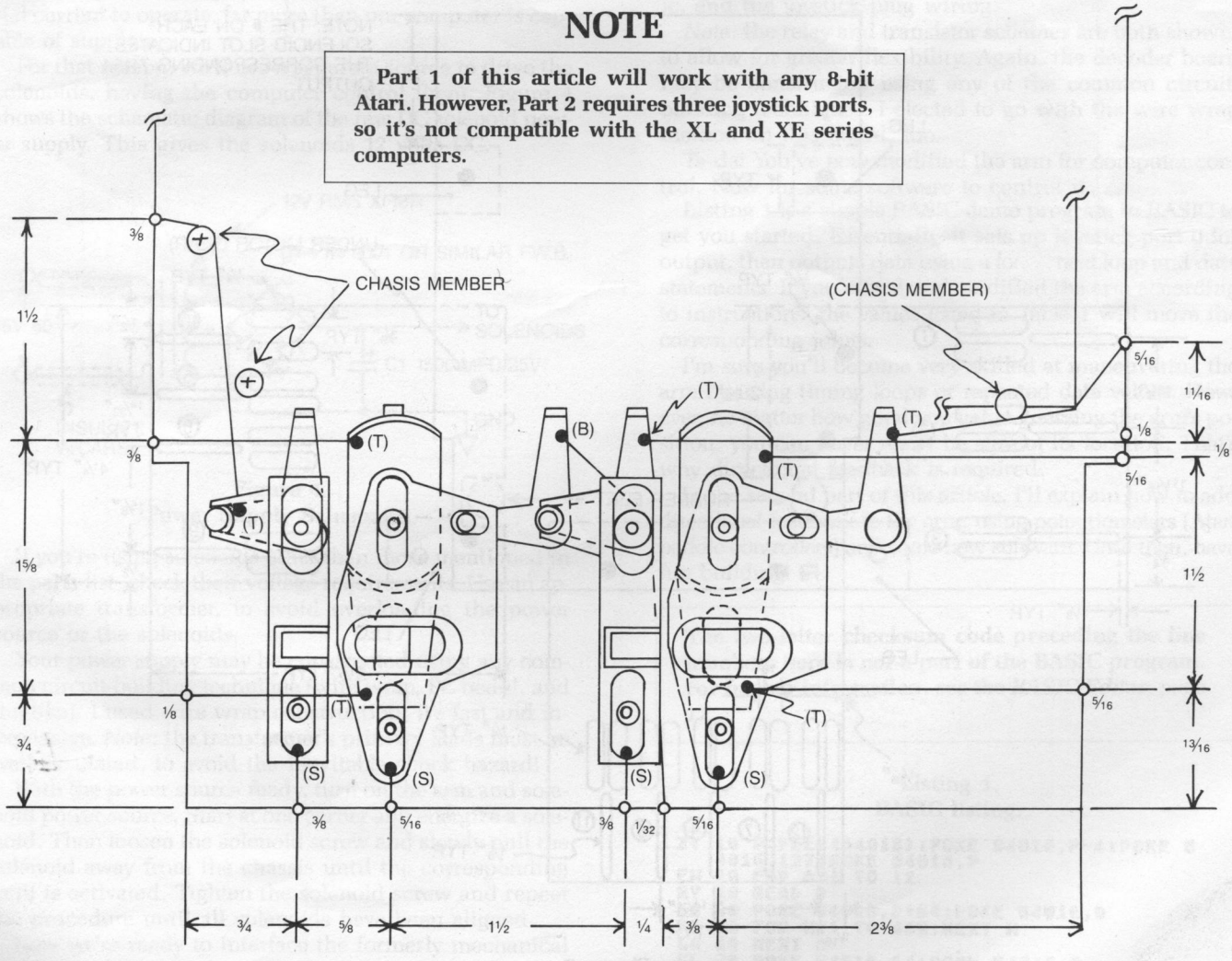


Figure 2.
Plate Assembly View/Drill Guide.

Figure 3 shows the location of the remaining eight holes. With all the chassis holes completed, the plates are now ready to be drilled. For best results, use a 1/8" drill.

Each joystick has its own plate assembly, composed of five parts: three plates and two levers. Also, each plate assembly is a mirror image of the other. Figure 2 shows a view of the plate assembly and where the holes should be drilled in the various parts. The letters *B*, *T* and *S* indicate where the nylon fishing line should exit the part.

For example, the rightmost lever in the plate assembly has a *T*, indicating that the line should exit through the top of the hole. The second to the right plate has an *S*, indicating that the line should exit from the side.

Again, a #60 PCB drill should be used to make all holes. Once all the plate holes are completely cut (twelve 20-inch pieces of 12-pound test nylon fishing line), the line should be tied in a knot about four times, before being drawn through the part (a good-sized knot, so the line won't slip through the hole). Refer to Figure 2 to see which hole each line passes through.

Now, let's make the legs and solenoid supports. There's a lot of flexibility in the leg design. The only real requirement is that they raise the arm at least 1 inch. Why? Well, later on, we'll be mounting a potentiometer under the arm's chassis for directional feedback.

I found scrap 2x4s cut into 1-inch square blocks worked well, but anything will do—as long as it raises the arm 1 inch. Oh, by the way, you'll need four legs for this critter.

The solenoid supports will be a bit more complicated. You'll need three pieces of 4 1/2 x 5 1/2 x 1/8-inch Plexiglas (or similar material).

Figure 3 shows the shapes necessary and their location on the chassis. Now, mount the legs and solenoid supports as per Figure 3.

Check the fishing lines to be sure they won't catch on anything (like the planetary gears or plates) during normal operation, then reinstall the gear and joystick housings.

Next, install the solenoids in their mounting holes (slots), as close to the arm as possible. Hand tighten them.

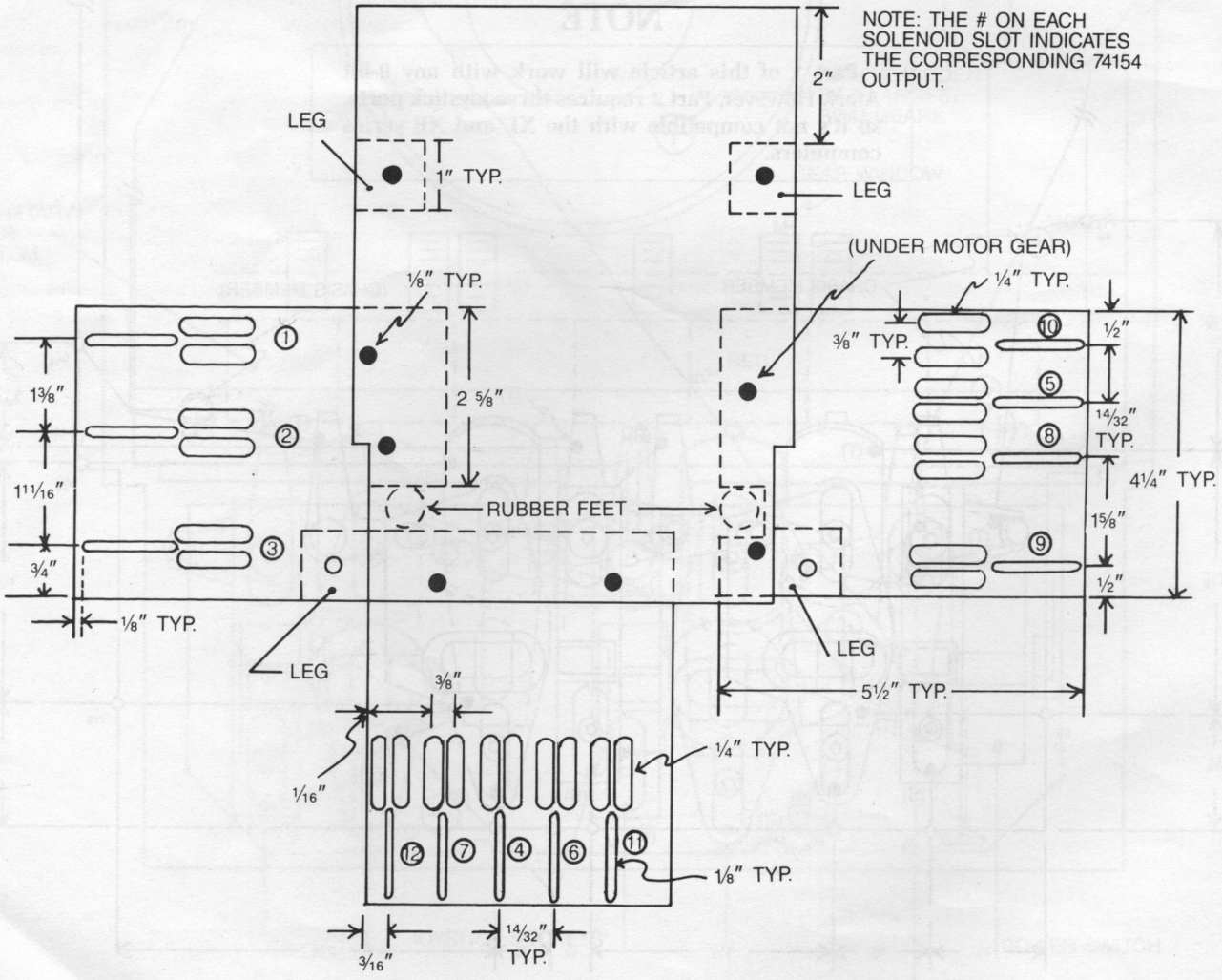


Figure 3.
Leg/Solenoid Mount View.

Note: the solenoids I used (listed in the parts list) had their ends bent perpendicular to the plunger axis. If you use these too, bend them so each end is parallel with the plunger axis.

Now, install the joysticks in their sockets (on top of the joystick housing). Starting at one corner, pull a piece of fishing line snug, until it just starts to move the joystick. With the solenoid plunger fully retracted, tie the line firmly to the solenoid in three to four knots. Repeat this procedure until all solenoids have been connected to their corresponding lines.

At this point, the three ring gears should be replaced in the top of the gear housing and the top or chassis of the arm reassembled.

Making it work.

Congratulations! Most of the mechanical work is finished. Now for some electronics.

Our first task will be to construct a power supply for the solenoids. Why a separate power supply? Well, solenoids are generally high power devices requiring substantial current to operate, far more than our computer is capable of supplying.

For that reason, we'll use a separate source to drive the solenoids, having the computer control them. Figure 4 shows the schematic diagram of the raw DC solenoid power supply. This gives the solenoids 12 volts DC.

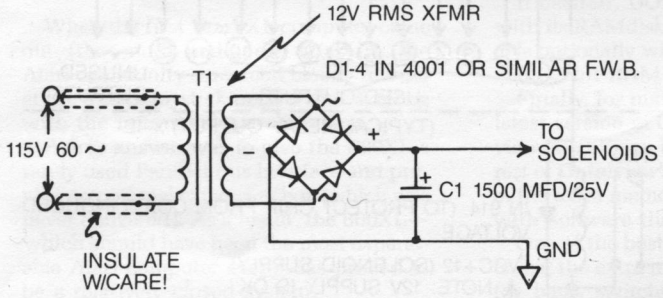


Figure 4.
Power Supply Schematic.

If you're using solenoids other than those mentioned in the parts list, check their voltage requirements. Use an appropriate transformer, to avoid overloading the power source or the solenoids.

Your power supply may be constructed using any common circuit-building technique (wire wrap, PC board, and the like). I used wire wrap construction; it's fast and inexpensive. *Note:* the transformer's primary leads must be well insulated, to avoid the inevitable shock hazard!

With the power source ready, turn on the arm and solenoid power source. Start at one corner and energize a solenoid. Then loosen the solenoid screw and slowly pull the solenoid away from the chassis until the corresponding joint is activated. Tighten the solenoid screw and repeat the procedure until all solenoids have been aligned.

Now we're ready to interface the formerly mechanical arm to our electronic computer. Joystick port 0 will be used to output data to the arm.

The port has a 4-bit output, capable of sixteen unique data patterns. To make life easy, we'll use a 74154 four- to sixteen-line decoder to change the computer's binary output into a form usable by the arm.

Basically, the decoder has four input and sixteen output lines. The output lines are normally at logic 1 (5 volts). When binary data is sent to the input lines, the corresponding output will go to a logic 0, or ground.

For example, suppose we sent a 5 (or *0101*) to the decoder. Output line 5 would go low, while all the others remained high.

At this point, we've only decoded the computer's binary output. We still have to drive the solenoids. Like the computer, the 74154 has a limited current carrying capability. Therefore, we must buffer the decoder's output, so it can supply enough current to drive the solenoids.

I used reed relays to accomplish the buffering, simply because there were quite a few in my "junk box." However, if you have an affinity for transistors, they may also be used. Figure 5 shows the decoder/buffer board schematic, and the joystick plug wiring.

Note: the relay and transistor schemes are both shown, to allow for greater flexibility. Again, the decoder board may be constructed using any of the common circuit-building techniques. I elected to go with the wire wrap method on this board, too.

Ta-da! You've now modified the arm for computer control. Now for some software to control it. . .

Listing 1 is a simple BASIC demo program in BASIC to get you started. Essentially, it sets up joystick port 0 for output, then outputs data using a for. . . next loop and data statements. If you wired and modified the arm according to instructions, the values listed in Table 1 will move the corresponding joints.

I'm sure you'll become very skilled at maneuvering the arm by using timing loops or repeated data values. However, no matter how good you get at guessing the arm's position, you can never really be sure of its location. That's why directional feedback is required.

In the second part of this article, I'll explain how to add directional feedback to the arm, using potentiometers (Atari paddle controllers) and some new software. Until then, have fun building!

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor*, page 17.

Listing 1.
BASIC listing.

```
ZT 10 P=PEEK(54018):POKE 54018,P-4:POKE 5
   4016,127:POKE 54018,P
EW 20 FOR A=1 TO 12
XY 30 READ D
FA 40 POKE 54016,D+64:POKE 54016,D
FS 50 FOR W=1 TO 450:NEXT W
GA 60 NEXT A
GL 70 POKE 54016,64:POKE 54016,0
AG 80 DATA 1,2,3,4,5,6,7,8,9,10,11,12
YX 90 END
```

Table 1.

OUTPUT DATA	RESPONSE
1	Close Jaw
2	Elbow Left
3	Elbow Right
4	Wrist CCW Rotation
5	Wrist CW Rotation
6	Wrist Up
7	Wrist Down
8	Shoulder CW Rotation
9	Shoulder CCW Rotation
10	Shoulder Up Rotation
11	Shoulder Down Rotation
12	Open Jaw

Parts List.

QTY.	DESCRIPTION	Vendor/Part #
(12)	12V Solenoids	All electronics SOL-12D, $1.50 ea.
(1)	74 LS 154 4- to 16-bit decoder	R/S, Jameco, etc.
(12)	Transistors/buffers	ECG 159
or		
(12)	Reed Relays, any type with ½-amp contacts	
(1)	12V Transformer, ½-amp and line cord	
(1)	Bridge rectifier or 4-inch 4001 diodes	
(1)	2500 MFD filter capacitor	
(3)	9-pin female connectors	
(4)	1 MΩ linear potentiometers	
(2)	Micro switches	

Miscellaneous wire, metal for mounting brackets, fishing line, etc.

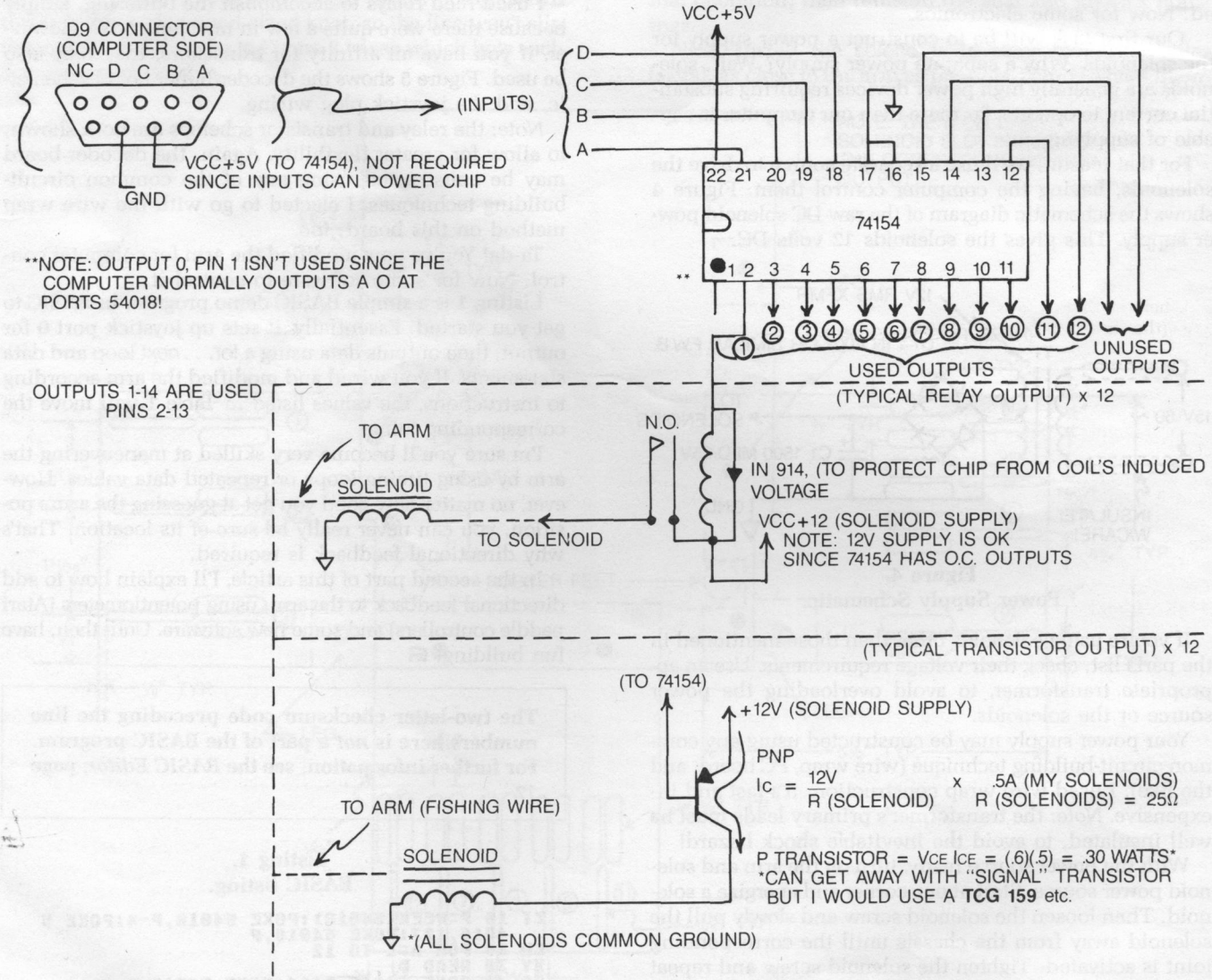
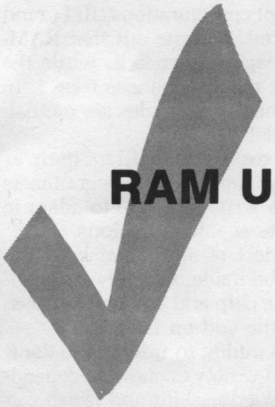


Figure 5.
Decoder Schematic/Joystick Wiring Diagram.



RAM Upgrade Kits

256K XL RAM UPGRADE KIT
NEWELL INDUSTRIES
602 E. Highway 78
Wylie, TX 75098
(214) 442-6612
800XL $28.00

ICD RAMBO XL UPGRADE KIT
ICD, INC.
1220 Rock Street, Suite 310
Rockford, IL 61101-1437
(815) 229-2999
800XL $49.95

by Felix J. Torres

When the first Atari XL computer came out (the much-maligned 1200XL), the Atari community screamed bloody murder at the loss of joystick ports 3 and 4, along with the internal slot architecture.

Atari's answer was to give the 800XL a rarely used Parallel Bus Interface and provide an optional expansion box (which was never delivered). As a result, the 800XL—which should have been the most expandable Atari computer ever—has proved to be a relatively closed system.

The loss of the two joystick ports, however, made possible the 130XE, with its 128K of bank-switchable RAM. This, in turn, has made possible what may prove to be the most significant third-party product for the 8-bit Atari computers since the first parallel printer interface for the serial bus. The products in question are, of course, memory expansion kits.

Let's look first at Newell Industries' **256K XL RAM Upgrade Kit** (for brevity, the **256K XL**).

Newell's kit provides the 800XL with 256K of bank-switchable RAM in a manner that usually (but not always) emulates the 130XE. This memory is available for use by programs looking for it as a RAMdisk.

The **256K XL** consists of a circuit board with a ribbon cable jumper, a socket for the jumper (in case it's needed) and a 5-page document describing how the upgrade is installed. Also included is a disk with a copy of MYDOS 4.0, which allows use of the extra memory as a RAMdisk of varying size.

If desired, DOS 2.5 can be used along with its RAMdisk handler. The kit is available optionally with eight 150-nanosecond 256Kx1-bit RAM chips.

Finally, for maximum convenience, the latest version of CDY Consulting's **Omniview XL/XE** can be used. Along with the rest of **Omniview**'s features, this allows use of the extra memory as a RAMdisk—even with software that doesn't use DOS.

One of the best features of the **256K XL** is that the extra memory can be used both for bank switching software and for a RAMdisk, simultaneously. Thus, a program like OSS's BASIC XE, which takes 128K of RAM, can have a 128K RAMdisk on the side. This happens to be the capacity of an enhanced-density disk. Nice balance.

Installing the **256K XL** in an 800XL is by no means a trivial exercise. Just how hard it is depends not only on the installer's soldering skills, but also on the age of the computer itself.

The earliest 800XLs were assembled with sockets for all the chips on the circuitboard. Installing the kit on these is simply a matter of replacing the computer's 64K RAM chips with 256K chips, replacing a logic chip nearby with the jumper for the kit's circuit board, removing a resistor and soldering eight or nine wires (depending on whether an extra switch is installed to allow the ANTIC chip to bank switch, too).

Owners of later models, depending on the configuration of their circuit boards, will have to de-solder the logic chip and maybe even the memory chips, to install sockets in their stead. I suspect most owners will also need to change the ANTIC chip (a $10 to $15 expense), since computer operation may be erratic in older models when DMA is turned off.

There's little to be said about the absolute performance of the **256K XL**, other than that it performs pretty much as advertised. Software expecting extra memory will; it'll think it's running on a 130XE, but, unless it's prepared to deal with more than 128K (or you have an **Omniview 256**), the rest will remain untouched.

On price/performance, there's more to consider. First, there are various added expenses. There's the labor required to install it, then the price of the kit itself. It isn't overpriced, but when one adds in labor costs and other "optional" components, the total cost approaches $150.

Even if you get the kit without RAM for $50 and find the RAM elsewhere at December 1985 prices (around $2.50 per chip), the total cost still comes out at $130. That happens to be the current discount price (by mail order) for the 130XE.

The **256K XL**'s documentation is quite complete, as far as installation goes, but offers very little help for using the RAMdisk software.

The saving grace here is MYDOS itself, very user friendly and well thought out. The only thing it lacks is a warning: the RAMdisk can't be used in double-density mode, as physical drives can.

In itself, the Newell **256K XL** is a long overdue, well-conceived product, whose

limitations aren't really Newell's fault. Since the Parallel Bus Interface lacks the lines required for bank switching, any memory upgrade expected to be even *partly* XE compatible will require work inside the 800XL. And it'll run into the same problems with the ANTIC chip.

I have no regrets about upgrading my trusty XL; I expect to get plenty of use out of both the RAMdisk and extended memory software I'm getting to run on it.

Again, if you can install it—and have a use for all the memory—the **256K XL** will do the job for you. But try to get it *without* the RAM chips; it'll save enough to pay for the installation.

The **RAMBO XL** (cute name, huh?) provides 256K of bank-switchable RAM to any 800XL or 1200XL, regardless of which ANTIC chip it may use. This RAM can be used to run the same software as the 130XE does, as long as ANTIC isn't expected to use a different bank of memory than the 6502 (or as long as it's not special software that expects to find 256K of total RAM).

The **RAMBO XL** kit consists of a circuit board with a five-wire ribbon cable, three jumper plugs, a piece of hook-up wire, a piece of heat-shrink tubing, and a 13-page installation manual.

The kit includes neither RAM chips (it recommends you buy them separately, listing a pair of mail-order dealers), nor software for testing or using the RAM, once installed.

Installation is relatively simple, if you've enough soldering skill to attach seven to nine wires to the XL circuit board, mostly at various ANTIC and PIA pins. Owners of late-model 800XLs would also have to de-solder a logic chip (and maybe even the eight existing RAM chips), replacing them with sockets for the new hardware.

The installation manual is very detailed and includes three diagrams to help find various attachment points on the circuit boards. The same plug-in board is used in all three possible scenarios, but the jumpers to be connected to it head for different locations, depending on the ANTIC chip's serial number, and whether or not the computer's a 1200XL.

The **RAMBO XL** does indeed perform as specified; it will load and run bank-switching software and the 130XE, as long as the ANTIC and 6502 are expected to look at the same RAM whenever the display address falls into the switching window.

By itself, the **RAMBO XL** looks fairly good, but since the Newell **256K XL** kit also provides an upgrade path for 800XL owners, comparisons between the two are inevitable.

In some areas, the **RAMBO XL** comes out ahead; in others it doesn't fare nearly as well.

The **RAMBO XL**, is designed for all 800XL and 1200XL computers, while the **256K XL** only works with 800XLs—and recommends that the ANTIC be the latest version, with a 9-bit refresh line.

The **256K XL**, however, keeps the ANTIC firmly locked in the main bank of memory, unless the optional installation procedure (which allows use of an external switch to decide whether or not ANTIC sees the extra RAM) was used. The **256K XL** also offers complete separation between main RAM and extra RAM, like the 130XE. The **RAMBO XL** doesn't distinguish between any RAM at the hardware level, which allows one to bank switch all 256K of RAM into the window. Needless to say, it can get very messy.

Finally, the **256K XL** kit includes a copy of MYDOS 4.0, to let you use the extra RAM as a RAMdisk of up to 192K. The **RAMBO XL** merely explains the virtues of two utilities available to owners of the **SpartaDOS Construction Set**. They even provide a phone number for you to order it (at the full list price of $40). Of course, there's always DOS 2.5 and its 64K RAMdisk handler. . .

Me? I simply dug out my copy of MYDOS 4.0, booted up and configured the RAMdisk as suggested for the **256K XL**.

Then I tried writing to the "RAMBOed" XL. It locked up. Every single time. Since MYDOS lets you name the individual banks you want the RAMdisk to use, I tried several different configurations till I found one that worked. It turns out that **RAMBO XL** uses page sequence 2, while the **256K XL** uses page sequences 0 or 1. In other words, the two upgrades are mutually *incompatible*!

This would seem to bode ill for both, as far as software support goes. Programmers would have to write software to adapt to both—or write separate versions.

What's saddest of all is that both upgrades could be made mutually compatible with a logic chip and a switch between the PIA and the add-on boards.

A person planning to upgrade to 256K of RAM faces a variety of choices, depending on their soldering skills and which machine they own. For 1200XL owners, the choice is relatively simple: the **RAMBO XL** is pretty much the only game in town.

For 800XL owners, the choice isn't quite so easy; first, because there's a *third* alternative for them. Claus Buchholz, the gentleman who developed the 256K RAM upgrade described in the September 1985 issue of *Byte*, has recently modified his upgrade to make it 130XE compatible. This one's also **RAMBO XL** compatible.

The March 1986 issue of *Computer Shopper* carries the new schematic and explains how to get public domain software needed to use the RAM to its fullest potential. Both schematic and software should be available from local user groups and bulletin boards, since Mr. Buchholz has placed them in the public domain, to encourage development of 256K RAM applications. Maybe there's still hope for a uniform standard.

As a result, any 800XL owner with the skill to install either commercial upgrade will most likely opt to assemble the Buchholz version for well under $50. The rest of us, however, still have to choose between the **RAMBO XL** and the **256K XL** (unless we want to pay to have an upgrade installed).

The **RAMBO XL** has the advantage of working with all ANTIC chips, saving some $15 and being compatible with the public domain upgrade. Total cost would be between $100 and $140.

The Newell **256K XL** has better error protection, includes the software needed to install a RAMdisk and is better with the 130XE if the optional installation procedure is followed. Moreover, it works with **Omniview**. Total cost would be between $100 and $115, excluding **Omniview**.

For 800 or 130XE owners, there are public domain upgrades to bring their total RAM to 288K and 320K, respectively. It seems that, in the world of Atari computing, there are goodies for everybody. . .

Blast!

by S. Grimm

The control room of the Space Defense Center was chaotic. Technicians milled about, carrying their reams of printouts; white-haired scientists debated the reliability of the McPherison fusion shield in outer space, and military officials barked orders to nobody in particular.

The date was September 23; the year was 2140. Titan 16, a research probe orbiting the planet Pluto, had picked up evidence of an object traveling at near light speed. This in itself wasn't particularly remarkable. Several natural phenomena were known to attain speeds of that magnitude. What was making the scientists and the military so nervous was that the object was headed directly toward Earth. Even more ominous: it had changed course to avoid a comet in its path.

If the thing continued on its present course, it would reach Earth in less than ten days. The world trembled with anticipation. Almost everyone agreed that it was an alien artifact of some sort.

That was about the *only* thing everyone could agree on. One person's answer to the important questions was as good as any other's. . .What was it? Were there aliens on board? Would they be friendly? Most important, why was the object coming?

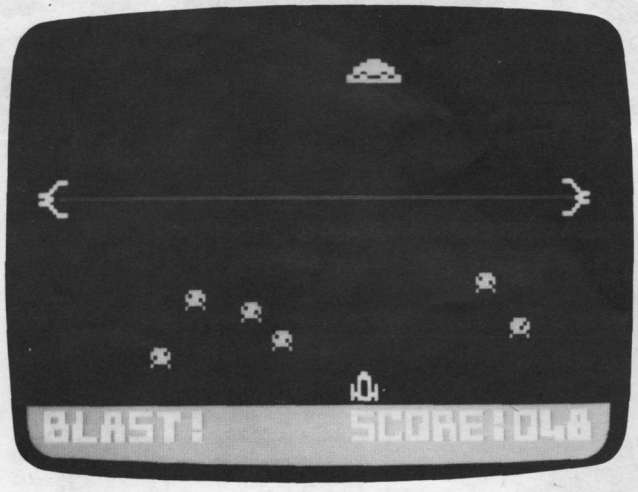
Five days later, the first photographs of the object were transmitted to Earth by Titan 8, orbiting Saturn. The subject was a blue dome of about 50 meters in diameter. It was covered with black and green markings, presumably writing of some sort. On the dome's base, two dish-shaped devices like radio telescopes were attached. There was a large hole in the center of the base of the dome.

Still the artifact hurtled toward the Earth. Finally, as predicted by the scientists, it reached its "target." Unfortunately, it seemed to know more about Earth than the Earth's creatures knew about it. It was in geosynchronous orbit directly above the Space Defense Center.

The planet waited. For two days, the object hovered over the Space Defense Center. It was decided to send fifteen of Earth's newest ships to meet the object and attempt to make contact.

The messenger ships were 6 kilometers from the artifact when seven creatures emerged from its large hole. They sped toward the greeting party, seized the ships and dragged them into the craft. The ships were never heard from again.

Nobody was quite sure what to make of this hostility from the alien ship. The World Congress debated for 48 hours before deciding to send three more ships to meet it. This set of ships would be armed, however. If the creatures wanted to come out and steal more of Earth's fleet, they'd have a fight on their hands.



Blast!

You are the pilot of the three ships. As you approach the alien craft, the two dishes detach from the dome and separate. There's a brief flash of light, then a gray force field springs into being between your command ship and the alien vessel.

The creatures emerge from the artifact. They penetrate the field easily. If your ship is destroyed you'll be teleported to one of the remaining ones, so you aren't that concerned with your safety. You doubt that they can stand up to the high-energy particle beam generator mounted on the front of your ship, anyway.

Indeed, you clear away the first twelve creatures with ease. But what's this? The field is coming closer! It will be harder to dodge the creatures now. . .

Typing it in.

Listing 1 is the BASIC data used to create both disk and cassette versions of **Blast!** Those readers who are interested in how the game works may obtain the assembly listing on either the magazine disk version or the **ANALOG Computing** TCS.

Disk users should refer to the **M/L Editor** article on page 38 for typing instructions.

If you have a cassette system, type in Listing 1, then add the lines shown in Listing 2. Type RUN and press RETURN. The program will begin checking the data statements, printing the line numbers as it goes. It will alert you to any problems. Fix any incorrect lines and rerun the program until all errors are eliminated.

When all your data lines are correct, the computer will beep twice and prompt you to *READY CASSETTE AND PRESS RETURN*. Now, insert a blank cassette in your recorder, press the RECORD and PLAY buttons simultaneously, and hit RETURN. The message *WRITING FILE* will appear, and the program will create a machine language boot tape version of **Blast!**, printing each data line number as it goes. When the *READY* prompt appears, the game is recorded and ready to play. CSAVE the BASIC program on a separate tape before continuing.

To play the game, rewind the tape created with the BASIC program to the beginning. Turn the computer off and remove all cartridges. Press the PLAY button on your recorder and turn on your computer, while holding down the START key. If you have an XL or XE series computer, you must hold the START and OPTION keys when you turn on the power. The computer will beep once. Hit RETURN, and **Blast!** will load and run automatically.

Blast!ing away.

Using a joystick in port 0, you control the movement of the current command ship. Pressing the fire button activates the particle beam generator, firing one burst forward.

Your ship is destroyed when a creature touches it. You're then transported to the next ship in your fleet, to continue the battle. If you have no ships remaining (surprise!), the game ends.

Occasionally, the alien craft will release one of the captured Earth ships. Shooting the captured ship will transport it to Earth, where it will be refitted with weaponry and launched to join your fleet.

There are two modes of difficulty in **Blast!**—each of which can be set in one of two ways. The first variable is speed, which can be *fast* or *slow*. Here, "speed" refers to how frequently the alien ship releases creatures. The beings themselves always move at the same rate.

The second mode is the skill level—*easy* or *hard*. When set on *easy*, the creatures will move in the same direction as the alien ship does. Choosing *hard* causes them to move in a random direction, once they're released. This setting mainly affects the later levels of **Blast!**, when anticipating where the creatures will be is a large part of the strategy.

From the title page, press the OPTION button to switch between *fast* and *slow*. Press SELECT for *hard* and *easy*. Hitting START or the joystick button will begin the game.

Take a hint.

Might as well get a few tips to improve your scoring.

(1) Always stay as far away as possible from the right and left edges of the screen. It's very easy to be trapped in a corner, with no route of escape.

(2) Aim before firing. Your game won't last too long if you hold down the fire button without looking at what you're doing.

(3) During the later levels, it's helpful to shoot the creatures before they penetrate the force field and start bouncing around. Try to anticipate where they'll be, so that you can time your shots properly. (This is what makes *hard* so tricky.)

(4) Play *slow* and *easy* until you can complete the game every time. The later levels are next to impossible if you aren't an ace at the game.

I've won three times with **Blast!** set to *fast* and *hard*, so it *is* possible. Good luck!

Steven Grimm is a senior in high school. He plans to attend the University of California at Santa Cruz, where he'll major in computer science.

The two-letter checksum code preceding the line numbers here is *not* a part of the BASIC program. For further information, see the *BASIC Editor*, page 17.

The code is simply a double check for Listing 1; it's of more use with Listing 2.

Listing 1.
BASIC listing.

```
UC 1000 DATA 255,255,0,32,239,47,0,0,0,0,
   0,0,0,0,0,28,3818
ZQ 1010 DATA 28,28,28,0,28,28,0,0,63,63,6
   3,63,63,63,0,0,5833
KW 1020 DATA 248,252,62,63,63,62,63,63,63
   ,63,63,63,63,63,252,252,6001
IH 1030 DATA 62,63,63,62,252,248,0,0,255,
   255,255,255,255,255,0,0,1998
XA 1040 DATA 3,7,15,31,63,63,0,0,240,248,
   252,254,63,63,255,255,1985
NW 1050 DATA 63,63,63,63,63,63,0,0,15,31,
   60,60,31,15,0,0,4811
VR 1060 DATA 255,255,0,0,192,240,0,0,15,1
   5,15,15,15,15,0,0,5260
MS 1070 DATA 63,63,15,15,15,15,0,0,252,25
   2,240,240,240,240,0,0,8317
AQ 1080 DATA 240,240,240,240,240,240,0,12
   7,99,99,99,103,103,127,0,28,4907
KB 1090 DATA 12,12,12,30,30,30,0,127,3,3,
   127,96,96,127,0,126,276
JR 1100 DATA 6,6,127,7,7,127,0,112,112,11
   2,112,119,127,7,0,127,1789
UJ 1110 DATA 96,96,127,7,7,127,0,126,102,
   96,127,99,99,127,0,127,3172
XN 1120 DATA 103,7,14,28,28,28,0,62,54,54
   ,127,119,119,127,0,127,1403
DI 1130 DATA 99,99,127,7,7,7,0,28,28,28,0
   ,28,28,28,252,254,1605
KH 1140 DATA 255,255,255,255,254,252,15,1
   5,0,0,15,15,15,15,15,15,7912
YJ 1150 DATA 15,15,15,15,15,15,240,240,24
   0,240,240,240,240,240,240,240,9065
LM 1160 DATA 0,0,240,240,240,240,0,0,8,28
   ,20,85,119,93,0,62,913
TI 1170 DATA 54,54,127,119,119,119,0,126,
   102,102,127,115,115,127,0,127,4526
LK 1180 DATA 103,96,96,96,99,127,0,126,99
   ,99,115,115,115,126,0,127,4229
UF 1190 DATA 96,96,127,112,112,127,0,127,
   96,96,127,112,112,112,0,127,4266
OH 1200 DATA 99,96,112,119,115,127,0,54,5
   4,54,127,119,119,119,0,24,1520
GH 1210 DATA 24,24,28,28,28,28,0,3,3,3,7,
   103,103,127,0,51,7113
AP 1220 DATA 51,51,124,115,115,115,0,48,4
   8,48,112,112,112,127,0,127,2608
MG 1230 DATA 75,75,107,107,107,107,0,115,
   123,111,119,119,119,119,0,127,4500
ZQ 1240 DATA 99,99,103,103,103,127,0,127,
   99,99,127,112,112,112,0,127,4229
GV 1250 DATA 99,99,99,99,111,124,0,126,10
   2,102,127,115,115,115,0,127,4399
OP 1260 DATA 96,96,127,3,3,127,0,127,31,2
   8,28,28,28,28,0,99,7277
VH 1270 DATA 99,99,115,115,115,127,0,99,9
   9,99,119,118,118,126,0,67,3477
AK 1280 DATA 67,67,107,107,107,127,0,103,
   103,103,60,115,115,115,0,99,3037
VX 1290 DATA 99,99,127,28,28,28,0,127,115
   ,3,127,112,115,127,0,30,963
KI 1300 DATA 24,24,24,24,30,0,0,64,96,48,
   24,12,6,0,0,120,5952
JN 1310 DATA 24,24,24,24,120,0,0,8,28,54,
   99,0,0,0,0,0,0,4095
WI 1320 DATA 0,0,0,0,255,0,112,80,77,0,16
   ,13,13,13,13,13,5798
BA 1330 DATA 13,13,13,13,13,13,13,13,13,1
   3,13,13,13,13,13,13,3098
II 1340 DATA 13,13,13,13,13,13,13,13,13,1
   3,13,13,13,13,13,13,3108
KU 1350 DATA 13,13,13,13,13,13,13,13,13,1
   3,13,13,13,13,13,13,3118
NG 1360 DATA 13,13,13,13,13,13,13,13,13,1
   3,13,13,13,13,13,13,3128
PS 1370 DATA 13,13,13,13,13,13,13,13,13,1
   3,13,13,13,13,13,13,3138
QR 1380 DATA 13,13,13,13,141,0,71,146,34,
   65,0,34,112,112,112,112,1740
JT 1390 DATA 112,112,112,112,112,112,112,
   112,71,166,34,65,102,34,112,112,4149
EP 1400 DATA 240,71,186,34,7,112,6,112,6,
   112,112,112,112,112,7,112,2792
BP 1410 DATA 112,7,112,112,7,65,120,34,34
   ,44,33,51,52,1,0,32,6780
YN 1420 DATA 32,0,0,51,35,47,50,37,26,16,
   16,16,0,0,0,0,0,3521
MF 1430 DATA 0,0,39,33,45,37,0,47,54,37,5
   0,0,0,0,0,0,3908
CJ 1440 DATA 0,0,0,0,2,3,2,0,7,8,10,11,13
   ,14,12,15,2652
LW 1450 DATA 0,0,0,0,0,0,0,0,4,5,4,6,4,9,
   2,27,2292
UM 1460 DATA 29,30,28,31,0,0,0,0,0,0,162,
   185,128,179,180,165,5269
WA 1470 DATA 182,165,174,128,167,178,169,
   173,173,0,0,0,0,172,161,179,6730
NP 1480 DATA 180,154,144,144,144,0,168,16
   9,167,168,154,144,144,144,0,0,6717
ML 1490 DATA 0,0,0,0,0,239,240,244,233,23
   9,238,0,115,108,111,119,237
HR 1500 DATA 0,0,0,0,0,0,0,0,0,243,229,23
   6,229,227,244,0,9096
QU 1510 DATA 101,97,115,121,0,0,0,0,112,1
   14,101,115,115,0,243,244,6317
GK 1520 DATA 225,242,244,0,116,111,0,98,1
   01,103,105,110,0,40,80,120,3085
BY 1530 DATA 160,200,240,24,64,104,144,18
   4,224,8,48,88,128,168,208,248,1114
GY 1540 DATA 32,72,112,152,192,232,16,56,
   96,136,176,216,0,40,80,120,6004
HQ 1550 DATA 160,200,240,24,64,104,144,18
   4,224,8,48,88,128,168,208,248,1134
MK 1560 DATA 32,72,112,152,192,232,16,56,
   96,136,176,216,0,40,80,120,6024
NI 1570 DATA 160,200,240,24,64,104,144,18
   4,224,8,48,88,128,168,208,248,1154
GZ 1580 DATA 32,72,112,152,192,232,16,56,
   96,136,176,216,0,0,0,0,2364
OG 1590 DATA 0,0,0,1,1,1,1,1,1,2,2,2,2,2,
   2,2,1811
FL 1600 DATA 3,3,3,3,3,3,4,4,4,4,4,4,5,5,
   5,5,2181
LZ 1610 DATA 5,5,5,6,6,6,6,6,6,7,7,7,7,7,
   7,7,2511
OR 1620 DATA 8,8,8,8,8,8,9,9,9,9,9,9,10,1
   0,10,10,2881
RD 1630 DATA 10,10,10,11,11,11,11,11,11,1
```

```
   2,12,12,12,12,12,12,3211
GL 1640 DATA 13,13,13,13,13,13,14,14,14,1
   4,14,14,138,74,74,24,7035
YU 1650 DATA 121,70,35,133,128,185,166,35
   ,105,16,133,129,138,41,3,10,2429
WB 1660 DATA 105,2,72,160,0,177,130,170,2
   00,177,130,133,132,104,168,177,1077
UN 1670 DATA 130,72,200,177,130,133,131,1
   04,133,130,184,80,11,165,128,24,6687
ZH 1680 DATA 105,40,133,128,144,2,230,129
   ,160,0,177,130,145,128,200,196,910
WS 1690 DATA 132,144,247,152,24,101,130,1
   33,130,144,2,230,131,202,208,221,2738
RX 1700 DATA 96,173,68,36,72,173,69,36,72
   ,169,169,141,68,36,169,0,4471
PY 1710 DATA 141,69,36,32,6,36,104,141,69
   ,36,104,141,68,36,96,169,3676
SW 1720 DATA 48,141,7,212,162,0,138,157,0
   ,50,157,0,51,157,128,49,3743
HJ 1730 DATA 232,208,244,169,0,141,8,208,
   141,10,208,141,11,208,169,192,363
QJ 1740 DATA 141,12,208,169,1,141,9,208,1
   69,48,141,2,208,169,200,141,9685
IC 1750 DATA 3,208,169,120,141,1,208,169,
   124,141,7,208,169,8,141,192,9270
TP 1760 DATA 2,169,136,141,193,2,169,204,
   141,194,2,141,195,2,96,160,8350
ZZ 1770 DATA 0,185,47,44,157,0,50,232,200
   ,192,8,144,244,96,165,140,215
WV 1780 DATA 24,101,141,133,140,201,10,17
   6,4,169,1,133,141,201,144,144,8789
FJ 1790 DATA 4,169,255,133,141,165,140,24
   ,105,44,141,7,208,56,233,4,6363
DM 1800 DATA 141,1,208,76,152,38,152,72,1
   62,0,189,55,44,153,128,50,5130
DR 1810 DATA 232,200,224,7,144,244,104,24
   ,105,2,168,169,0,153,128,49,5933
AM 1820 DATA 169,192,153,129,49,96,162,0,
   189,62,44,153,0,51,189,72,4645
NZ 1830 DATA 44,153,128,51,232,200,224,10
   ,144,238,96,72,164,142,185,70,387
RB 1840 DATA 35,133,128,185,166,35,24,105
   ,16,133,129,160,38,104,145,128,6299
UZ 1850 DATA 136,208,251,96,189,97,37,170
   ,160,94,189,82,44,153,0,50,5642
KN 1860 DATA 232,200,192,101,144,244,96,0
   ,7,14,21,28,35,42,49,56,9772
JS 1870 DATA 63,0,0,0,0,181,144,133,133,1
   81,156,133,132,181,180,48,9128
NT 1880 DATA 14,230,132,165,132,201,83,20
   8,18,169,255,149,180,208,12,198,2566
WJ 1890 DATA 132,165,132,197,142,208,4,16
   9,1,149,180,165,133,24,117,168,8841
OW 1900 DATA 133,133,201,8,208,4,169,1,14
   9,168,201,142,144,4,169,255,668
WY 1910 DATA 149,168,165,132,149,156,165,
   133,149,144,96,181,156,168,142,107,154
   9
WB 1920 DATA 37,181,144,56,233,4,170,96,1
   33,130,132,131,32,181,37,32,5660
AV 1930 DATA 6,36,174,107,37,96,162,11,18
   1,192,240,53,48,41,41,254,7643
OE 1940 DATA 168,10,141,4,210,185,6,47,72
   ,185,7,47,168,104,32,194,5508
GQ 1950 DATA 37,246,192,181,192,201,16,14
   4,24,32,100,38,206,126,38,169,7017
CH 1960 DATA 0,141,5,210,76,11,38,32,111,
   37,169,152,160,44,32,194,5397
WQ 1970 DATA 37,202,16,196,173,109,37,240
   ,41,41,7,170,189,232,38,141,8368
QI 1980 DATA 6,210,162,22,160,47,134,130,
   132,131,174,108,37,238,109,37,7788
HB 1990 DATA 172,109,37,192,89,144,12,32,
   91,36,169,0,141,109,37,141,4116
IB 2000 DATA 7,210,96,76,6,36,149,144,169
   ,10,149,156,165,141,172,132,9403
EN 2010 DATA 39,240,9,173,10,210,41,1,208
   ,2,169,255,149,168,169,1,8504
QZ 2020 DATA 149,180,169,128,149,192,238,
   127,38,96,169,152,133,130,169,44,9900
BY 2030 DATA 133,131,32,181,37,32,91,36,1
   74,107,37,169,0,149,192,206,7880
TB 2040 DATA 127,38,96,0,0,0,169,12,141,1
   26,38,169,0,141,110,37,3001
KI 2050 DATA 141,125,38,141,127,38,162,79
   ,149,144,202,16,251,96,198,138,728
RP 2060 DATA 208,75,173,110,37,208,37,173
   ,125,38,201,12,240,30,173,10,6608
CG 2070 DATA 210,41,7,208,23,165,140,24,1
   05,3,141,108,37,169,5,141,4492
RY 2080 DATA 109,37,141,110,37,169,166,14
   1,7,210,208,22,173,127,38,201,9143
TM 2090 DATA 6,176,26,174,125,38,224,12,1
   76,19,165,140,32,64,38,238,6698
JU 2100 DATA 125,38,169,165,174,131,39,24
   0,2,169,101,133,138,96,20,40,5810
WK 2110 DATA 80,120,200,120,80,40,173,124
   ,2,208,8,165,139,201,8,240,9100
GM 2120 DATA 2,198,139,173,125,2,208,8,16
   5,139,201,144,240,2,230,139,1420
KP 2130 DATA 165,139,24,105,48,141,0,208,
   96,173,129,39,240,44,206,129,9186
DB 2140 DATA 39,206,129,39,206,129,39,174
   ,129,39,142,2,210,169,3,157,7393
BT 2150 DATA 128,49,157,129,49,157,130,49
   ,169,0,157,134,49,157,135,49,6352
UV 2160 DATA 157,136,49,224,26,176,31,32,
   97,39,173,132,2,208,23,165,5964
PX 2170 DATA 139,24,105,3,141,130,39,105,
   48,141,4,208,169,94,141,129,7356
OJ 2180 DATA 39,169,196,141,3,210,96,174,
   129,39,169,0,157,128,49,157,7538
QX 2190 DATA 129,49,157,130,49,157,131,49
   ,157,132,49,157,133,49,141,129,7654
CF 2200 DATA 39,169,0,141,3,210,96,0,0,0,
   0,169,16,133,129,169,3825
ZI 2210 DATA 0,133,128,168,162,15,145,128
   ,200,208,251,230,129,202,208,246,7433
VQ 2220 DATA 32,121,36,169,0,141,47,2,32,
   230,39,169,250,141,197,2,7725
OT 2230 DATA 169,166,141,198,2,169,60,141
   ,196,2,169,0,141,48,2,169,5400
VQ 2240 DATA 34,141,49,2,169,3,141,29,208
   ,169,214,141,0,2,169,39,5588
UX 2250 DATA 141,1,2,32,101,228,169,46,14
   1,47,2,96,72,169,134,141,6432
ES 2260 DATA 10,212,141,26,208,169,10,141
   ,22,208,104,64,165,20,197,20,6363
VI 2270 DATA 240,252,96,169,0,133,141,169
   ,80,141,0,210,169,72,141,1,7101
KG 2280 DATA 210,164,141,32,0,37,32,230,3
   9,32,230,39,32,230,39,32,4057
SH 2290 DATA 230,39,32,230,39,230,141,165
   ,141,201,17,144,228,169,1,133,163
XX 2300 DATA 141,169,80,133,140,169,0,141
   ,1,210,96,0,32,97,39,166,4573
EN 2310 DATA 143,189,149,40,133,142,169,1
   68,141,1,210,173,37,40,141,0,6303
QQ 2320 DATA 210,56,233,5,168,32,32,37,32
   ,230,39,32,230,39,32,230,6010
FK 2330 DATA 39,238,37,40,173,37,40,56,23
   3,11,48,223,197,142,144,219,555
MB 2340 DATA 240,217,169,170,32,53,37,169
   ,80,141,0,210,162,0,189,140,8121
IU 2350 DATA 40,141,197,2,9,96,141,1,210,
   32,230,39,32,230,39,32,4828
KN 2360 DATA 230,39,232,224,9,144,231,169
   ,100,141,1,210,169,240,141,0,651
ZF 2370 DATA 210,96,2,8,14,14,12,10,8,6,4
   ,15,30.40,45.50.5909
NG 2380 DATA 55,60,65,70,72,162,94,32,201
   ,36,169,76,133,139,169,124,8410
HJ 2390 DATA 141,0,208,76,97,39,162,127,1
   69,0,149,128,202,16,251,141,9895
RQ 2400 DATA 26,44,32,27,44,32,133,39,32,
   32,43,32,237,39,169,0,2000
JV 2410 DATA 141,37,40,133,143,32,38,40,1
   69,2,141,26,44,32,27,44,303
VV 2420 DATA 32,159,40,32,128,38,141,30,2
   08,76,130,42,72,138,72,152,6059
CC 2430 DATA 72,206,0,1,160,32,174,0,1,14
   2,10,212,142,22,208,232,8197
XD 2440 DATA 136,16,246,104,168,104,170,1
   04,64,169,32,141,244,2,169,0,7293
KV 2450 DATA 141,47,2,141,8,210,141,29,20
```

```
   8,32,230,39,169,250,141,197,1928
DP 2460 DATA 2,169,168,141,198,2,169,200,
   141,199,2,169,120,141,48,2,7248
RF 2470 DATA 169,34,141,49,2,169,230,141,
   0,2,169,40,141,1,2,169,4028
KX 2480 DATA 192,141,14,212,32,127,41,169
   ,42,141,47,2,173,132,2,208,6189
DM 2490 DATA 3,76,176,40,173,31,208,201,6
   ,208,3,76,176,40,201,5,6470
TJ 2500 DATA 208,21,173,132,39,73,1,141,1
   32,39,32,127,41,173,31,208,5767
YB 2510 DATA 201,7,208,249,76,70,41,201,3
   ,208,209,173,131,39,73,1,6882
QV 2520 DATA 141,131,39,16,229,173,131,39
   ,10,10,105,3,170,160,3,189,5416
RK 2530 DATA 168,41,153,22,35,202,136,16,
   246,173,132,39,10,10,105,3,3551
TW 2540 DATA 170,160,3,189,176,41,153,42,
   35,202,136,16,246,96,115,108,8346
BK 2550 DATA 111,119,102,97,115,116,101,9
   7,115,121,104,97,114,100,32,97,5814
MR 2560 DATA 39,169,60,141,129,39,32,230,
   39,32,216,36,32,216,36,206,7379
RT 2570 DATA 129,39,16,242,169,0,162,255,
   157,0,51,202,208,250,169,8,1077
ZZ 2580 DATA 141,1,210,169,24,141,0,210,1
   69,97,141,129,39,174,129,39,7767
IV 2590 DATA 32,201,36,32,216,36,32,216,3
   6,32,230,39,206,129,39,173,7987
TL 2600 DATA 129,39,201,22,208,231,169,0,
   141,1,210,165,139,56,233,3,8810
DQ 2610 DATA 41,254,141,129,39,32,216,36,
   32,216,36,32,230,39,165,140,7764
FV 2620 DATA 205,129,39,208,240,162,128,3
   2,230,39,202,16,250,154,76,220,2296
EX 2630 DATA 43,169,0,133,77,173,11,212,2
   01,30,208,249,32,216,36,32,8616
XG 2640 DATA 216,36,173,11,212,201,105,14
   4,249,32,208,37,32,145,42,169,8717
WD 2650 DATA 170,32,53,37,173,126,38,208,
   3,32,10,43,173,252,2,201,6738
VE 2660 DATA 33,208,36,169,255,141,252,2,
   169,0,141,1,210,141,3,210,8987
LP 2670 DATA 141,5,210,141,7,210,173,252,
   2,201,33,208,249,169,255,141,5108
ZT 2680 DATA 252,2,169,100,141,1,210,96,3
   2,43,42,32,240,38,32,19,2792
QY 2690 DATA 39,32,91,43,76,130,42,173,0,
   208,41,4,240,103,141,30,5812
IP 2700 DATA 208,162,11,173,130,39,56,245
   ,144,201,11,144,44,202,16,243,9876
RB 2710 DATA 173,109,37,240,80,162,22,160
   ,47,134,130,132,131,174,108,37,8106
OV 2720 DATA 172,109,37,32,91,36,169,0,14
   1,109,37,141,7,210,32,97,4724
QG 2730 DATA 39,238,26,44,32,27,44,208,44
   ,173,129,39,56,233,16,245,7956
TZ 2740 DATA 156,32,0,43,201,10,176,197,1
   81,192,16,193,169,1,149,192,564
LF 2750 DATA 181,144,24,105,4,149,144,32,
   73,43,32,97,39,169,8,141,3741
KM 2760 DATA 5,210,141,4,210,96,201,0,16,
   5,73,255,24,105,1,96,4047
JU 2770 DATA 169,0,32,53,37,230,143,165,1
   43,201,10,208,3,76,184,41,7555
VE 2780 DATA 32,38,40,76,128,38,169,16,14
   1,163,34,141,164,34,141,165,7819
ZI 2790 DATA 34,96,162,2,56,189,163,34,10
   5,0,201,26,144,2,169,16,4496
PZ 2800 DATA 157,163,34,202,16,239,96,168
   ,32,44,43,136,208,250,96,166,856
GR 2810 DATA 143,189,81,43,76,65,43,1,2,3
   ,4,5,6,8,10,15,5557
YX 2820 DATA 20,173,4,208,41,4,240,89,141
   ,30,208,32,97,39,169,0,5234
QX 2830 DATA 133,137,32,43,42,32,43,42,32
   ,43,42,32,43,42,32,43,8423
OJ 2840 DATA 42,166,137,32,78,37,230,137,
   165,137,201,10,144,228,230,137,2963
QZ 2850 DATA 166,137,32,100,38,198,137,16
   ,247,169,0,141,127,38,169,12,6766
YQ 2860 DATA 56,237,126,38,141,125,38,206
   ,26,44,173,26,44,48,19,32,2219
AI 2870 DATA 27,44,169,76,133,139,169,124
   ,141,0,208,141,30,208,76,159,9705
SK 2880 DATA 40,96,104,104,169,0,141,47,2
   ,141,1,210,141,3,210,141,7288
SU 2890 DATA 5,210,141,7,210,32,230,39,16
   9,102,141,48,2,169,34,141,6756
WM 2900 DATA 49,2,162,2,189,163,34,9,128,
   157,252,34,202,16,245,232,1819
HX 2910 DATA 224,3,240,23,189,5,35,221,25
   2,34,144,4,240,241,208,11,970
AL 2920 DATA 162,2,189,252,34,157,5,35,20
   2,16,247,169,42,141,47,2,6068
SA 2930 DATA 169,0,141,29,208,162,64,32,2
   30,39,202,208,250,76,3,41,8547
MM 2940 DATA 0,169,32,162,0,236,26,44,144
   ,2,169,0,157,153,34,232,7552
HA 2950 DATA 224,3,208,241,96,24,60,36,16
   5,165,231,189,0,0,24,60,5364
YP 2960 DATA 66,90,165,255,0,7,8,16,224,6
   0,224,16,8,7,0,224,4005
SH 2970 DATA 16,8,7,60,7,8,16,224,0,90,60
   ,165,165,231,189,0,7004
GB 2980 DATA 66,60,60,165,231,189,0,0,60,
   36,189,231,126,0,0,0,3684
HN 2990 DATA 60,36,255,255,0,0,0,0,60,255
   ,255,0,0,0,0,0,802
IU 3000 DATA 126,255,0,0,0,0,0,60,126,0,0
   ,0,0,24,60,6570
EI 3010 DATA 0,0,0,0,0,0,24,0,0,0,0,0,0,0
   ,7,4,3347
SL 3020 DATA 162,44,186,44,210,44,234,44,
   0,0,0,0,0,15,240,0,1118
GO 3030 DATA 0,51,252,0,0,63,204,0,0,15,2
   40,0,0,48,12,0,9336
ED 3040 DATA 0,0,0,0,0,3,252,0,0,12,255,0
   ,0,15,243,0,1602
NE 3050 DATA 0,3,252,0,0,12,3,0,0,0,0,0,0
   ,0,255,0,7730
HS 3060 DATA 0,3,252,192,0,3,63,192,0,0,2
   55,0,0,3,0,192,2504
UA 3070 DATA 0,0,0,0,0,0,63,192,0,0,255,4
   8,0,0,252,240,6048
EQ 3080 DATA 0,0,63,192,0,0,192,48,0,0,0,
   0,6,3,16,45,6845
CM 3090 DATA 34,45,52,45,70,45,0,0,0,5,80
   ,0,17,84,0,21,6833
TY 3100 DATA 68,0,5,80,0,16,4,0,0,0,0,1,8
   4,0,4,85,6151
FL 3110 DATA 0,5,81,0,1,84,0,4,1,0,0,0,0,
   0,85,0,5188
WQ 3120 DATA 1,21,64,1,84,64,0,85,0,1,0,6
   4,0,0,0,0,5621
JT 3130 DATA 21,64,0,69,80,0,85,16,0,21,6
   4,0,64,16,6,3,6786
XS 3140 DATA 98,45,116,45,134,45,152,45,0
   ,0,0,5,80,0,16,84,8904
ZL 3150 DATA 0,21,4,0,5,80,0,0,0,0,0,0,0,
   1,84,0,4983
QN 3160 DATA 4,21,0,5,65,0,1,84,0,0,0,0,0
   ,0,0,0,4230
JG 3170 DATA 85,0,1,5,64,1,80,64,0,85,0,0
   ,0,0,0,5526
SD 3180 DATA 0,0,21,64,0,65,80,0,84,16,0,
   21,64,0,0,0,6449
YD 3190 DATA 5,3,180,45,195,45,210,45,225
   ,45,0,0,0,5,80,0,741
GT 3200 DATA 16,20,0,20,4,0,5,80,0,0,0,0,
   1,84,0,4,5284
PN 3210 DATA 5,0,5,1,0,1,84,0,0,0,0,0,85,
   0,1,1,4964
JX 3220 DATA 64,1,64,64,0,85,0,0,0,0,0,21
   ,64,0,64,80,7568
MV 3230 DATA 0,80,16,0,21,64,5,3,250,45,9
   ,46,24,46,39,46,9614
SL 3240 DATA 0,0,0,5,80,0,16,4,0,16,4,0,4
   ,16,0,0,4284
ZM 3250 DATA 0,0,1,84,0,4,1,0,4,1,0,1,4,0
   ,0,0,3730
XF 3260 DATA 0,0,85,0,1,0,64,1,0,64,0,65,
   0,0,0,0,5396
UG 3270 DATA 0,21,64,0,64,16,0,64,16,0,16
   ,64,5,3,64,46,7323
PG 3280 DATA 79,46,94,46,109,46,0,0,0,5,8
   0,0,16,4,0,16,6188
IF 3290 DATA 4,0,0,0,0,0,0,0,0,1,84,0,4,1,0
```

```
   ,4,1,4280
NH 3300 DATA 0,0,0,0,0,0,0,0,85,0,1,0,64,
   1,0,64,5946
TM 3310 DATA 0,0,0,0,0,0,0,0,21,64,0,64,16,
   0,64,16,0,6086
CU 3320 DATA 0,0,4,3,134,46,146,46,158,46
   ,170,46,0,0,0,5,64
RT 3330 DATA 80,0,16,4,0,0,0,0,0,0,0,0,1,84
   ,0,4,1,4654
KH 3340 DATA 0,0,0,0,0,0,0,0,0,85,0,1,0,64,
   0,0,0,4948
ZI 3350 DATA 0,0,0,0,0,21,64,0,64,16,0,0,0,
   3,3,192,46,8192
GG 3360 DATA 201,46,210,46,219,46,0,0,0,5
   ,80,0,0,0,0,0,0,6768
TD 3370 DATA 0,0,1,84,0,0,0,0,0,0,0,0,0,85,
   0,0,0,4814
VW 3380 DATA 0,0,0,0,0,0,0,21,64,0,0,0,2,3,23
   8,46,244,46,2146
MP 3390 DATA 250,46,0,47,0,0,0,1,64,0,0,0
   ,0,0,80,0,5704
CJ 3400 DATA 0,0,0,0,0,20,0,0,0,0,0,0,5,0,6,4
   5,88,45,6303
PZ 3410 DATA 170,45,240,45,54,46,124,46,1
   82,46,228,46,13,4,32,47,2967
DI 3420 DATA 84,47,136,47,188,47,0,0,0,0,
   0,252,0,0,12,48,9388
HD 3430 DATA 192,0,3,51,0,0,60,252,240,0,
   3,155,0,0,3,155,2849
RW 3440 DATA 0,0,3,155,0,0,0,236,0,0,0,23
   6,0,0,0,48,9557
EW 3450 DATA 0,0,0,48,0,0,0,48,0,0,0,0,0,
   0,0,63,5034
YD 3460 DATA 0,0,3,12,48,0,0,204,192,0,15
   ,63,60,0,0,230,2498
RU 3470 DATA 192,0,0,230,192,0,0,230,192,
   0,0,59,0,0,0,59,762
AO 3480 DATA 0,0,0,12,0,0,0,12,0,0,0,12,0
   ,0,0,0,3768
OS 3490 DATA 0,0,0,15,192,0,0,195,12,0,0,
   51,48,0,3,207,771
PX 3500 DATA 207,0,0,57,176,0,0,57,176,0,
   0,57,176,0,0,14,51
PT 3510 DATA 192,0,0,14,192,0,0,3,0,0,0,3
   ,0,0,0,3,4826
BI 3520 DATA 0,0,0,0,0,0,0,0,3,240,0,0,48,1
   95,0,0,12,9007
EK 3530 DATA 204,0,0,243,243,192,0,14,108
   ,0,0,14,108,0,0,14,9953
BR 3540 DATA 108,0,0,3,176,0,0,3,176,0,0,
   0,192,0,0,0,8644
DC 3550 DATA 192,0,0,0,192,0,224,2,225,2,
   3,41,0,0,0,0,8856
```

Listing 2.
BASIC listing.

```
UK 10 REM *** BLAST! ***
LI 20 REM CASSETTE MAKER PROGRAM
EI 40 DIM DAT(16):LINE=990:RESTORE 1000:T
   RAP 120:? "CHECKING DATA"
DO 50 LINE=LINE+10:? "LINE:";LINE:FOR X=1
    TO 16:READ DAT:IF DAT<0 OR DAT>255 TH
   EN 220
YY 60 DAT(X)=DAT:NEXT X:DATLIN=PEEK(183)+
   PEEK(184)*256:IF DATLIN<>LINE THEN ? "
   LINE ";LINE;" MISSING!":END
WP 70 TOTAL=LINE:FOR X=1 TO 16
HM 80 IF PASS=2 THEN PUT #1,DAT(X):NEXT X
   :READ CHKSUM:GOTO 50
AJ 90 TOTAL=TOTAL+DAT(X)*X:IF TOTAL>9999
   THEN TOTAL=TOTAL-10000
LR 100 NEXT X:READ CHKSUM:IF TOTAL=CHKSUM
    THEN 50
MO 110 GOTO 220
ZR 120 IF PEEK(195)<>6 THEN 220
ZT 130 IF PASS=0 THEN 200
AD 160 FOR X=1 TO 128:PUT #1,0:NEXT X:CLO
   SE #1:END
SD 200 ? "READY CASSETTE AND PRESS RETURN
   ";:OPEN #1,8,128,"C:":RESTORE 230:FOR
   X=1 TO 40:READ N:PUT #1,N:NEXT X
QS 210 ? :? "WRITING FILE":PASS=2:LINE=99
   0:RESTORE 1000:TRAP 120:GOTO 50
MI 220 ? "BAD DATA: LINE ";LINE:END
WH 230 DATA 0,32,210,31,249,31,169,0,234,
   234,234,169,60,141,2,211,169,0,141,231
   ,2,133,14,169,56,141,232,2
FH 240 DATA 133,15,169,3,133,10,169,41,13
   3,11,24,96
```

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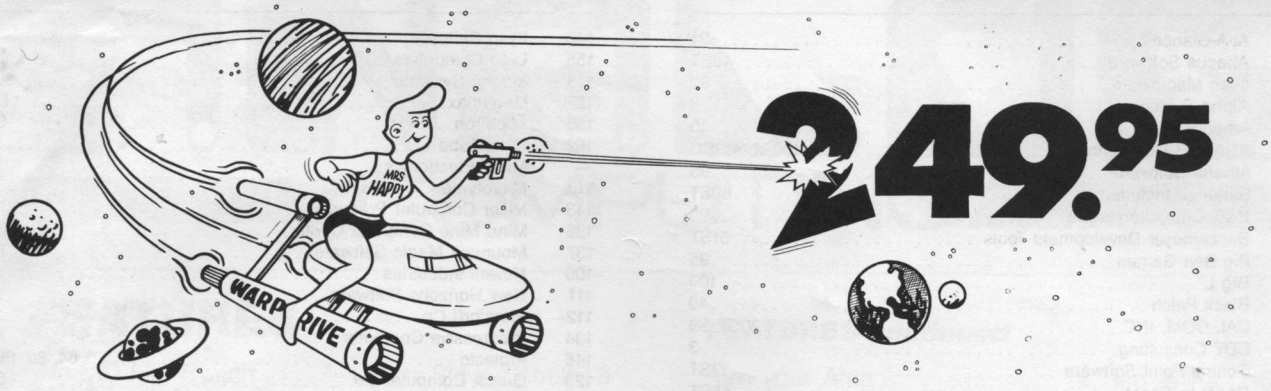

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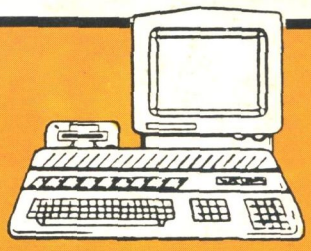

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