



THE BIG PUSH

I believe good things are going to happen to and for our computer. There has been an absolute ground-swell of programs becoming available to those with 'expanded systems' and the newest products to hook up to our computer are realities instead of wishes. We [those who have hung in there] are having our faith in this powerful computer justified. More is still on the horizon. The best proof we have of that is to point at what has already recently been made. BUT.... and it is a big BUT. As a Users' Group we are missing something very big. We are missing that influx of new people that is vital to our survival. Sure new members are appearing; but what is so galling is how they learn about us. Of the last dozen new members that have joined our group over half learned about us from other than local sources. People who live around Atlanta have written to us because they have learned of our address from Computer Shopper which is published nationally and contains addresses of users groups (TI and others) around the country, and they even have our ZIP CODE WRONG! Another national publication is the paperback entitled FREE SOFTWARE FOR THE 99/4A. That book is in its second edition. While it is heartening that people are learning about us at all; it is maddening that there is so little LOCAL advertisement of our existence. Bill Kleinsorge has been sending 'announcements' of our meetings to local papers and radio stations for over 6 months now. That helps but is not enough. The BIG PUSH, remember the title? Jim Hubbard has printed up good looking ANNOUNCEMENT on card stock that can be placed in book stores, department stores, grocery stores, churches, computer stores and supply houses, and anywhere else that you can think of. This notice is slightly smaller than half a sheet of standard paper and since it is card stock will look more professional and last longer when it is posted. The notice briefly announces our existence and lists several phone numbers in different parts of the city to encourage people to call as well as listing the Club's address. These notices are NOT month specific and should last for several months once posted. Several people took packets of the notices which included some club business cards as well. If you took some, I hope you have put them up by now. The BIG PUSH is for September. Contact Jim Hubbard or myself and we will get you some of these cards to post. There IS time to do this and get some to put up before the meeting September 15th! but don't quit there. Put them up afterwards as well. There are thousands of people in this city who would love to know that we exist. They really would! We need to show them that just the basic machine can do a lot. If you already are in the club then don't let it be your fault by not helping if the club does not meet your needs.

Gary Matthews

MEETINGS

The date and time for the meetings of the Atlanta 99/4a Computer User's Group is the third Sunday of the month at the downtown Atlanta Public Library (off Margaret Mitchell Square) at 3 p.m. For more information call a club officer or 231-0992.

SOUTHSIDE chapter meetings are held the first Sunday of the month at the Clayton County Recreation Center in Jonesboro, 101 Lake Jodeco Rd., meetings begin at 3 p.m. For more information call Francis Hauke at 461-7193.

EASTSIDE chapter holds regular meetings on the first Monday of every other month. For more information call Ralph Danson at 292-3427.

FACTS and FICTION

It seems every time I turn around I hear of someone else getting rid of their system, or hungering over the "NEW" 99/8 or what ever it may turn out to be. Everyone of these souls is saying that the 99/4A is not doing the job, is not big enough, is not fast enough, doesn't have enough programs. **HUMBUG!!!** If you're not getting Home Computer Mag take another look, the last several issues have had very impressive programs for the 99/4A. Take a look at the list of Freeware displayed in this newsletter, these programs are inexpensive and do the job that they say they'll do.

If you purchased the same type of program doing the same thing for an MS-DOS machine expect to pay 100-500 dollars, their programs are not any better, they are just more expensive.

As to hardware the list is becoming so large its hard to list all of it. The latest is the announcement by Morning Star Software of CP/M fame that it is releasing a 128K card, that makes three cards so far. The novelty of the Morning Star Card is that it is designed to work with TI's 32K Expansion Card not replace it, giving you 160 total K, and 40 or 48K of true RAM expansion, for a total of 64K total in the machine. Now if they only will provide a Printer Buffer with the card.

For more information (and because so little is known about this card, I strongly suggest you get more info before you rush out to spend your hard earned dollars,) or to order the card price \$199.00 plus shipping, contact:

Morning Star Software
4325 S.W. 109th Ave.
Beaverton, Or 97005
(503) 646-4695

CALL NEWSLETTER

CALL NEWSLETTER is the voice of the Atlanta 99/4A Computer Users Group. P.O.Box 19841, Atlanta, GA 30325.

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CALL NEWSLETTER is published by and for the members of the A9CUG to enhance their knowledge of home computers. CALL NEWSLETTER is composed of articles written and/or donated by members of our group and from articles appearing in other Home Computer Users Groups around the world.

Opinions expressed by the authors do not necessarily represent those of the Officers or members of the A9CUG. Permission is hereby granted to any users group receiving our newsletter to reproduce any article in this newsletter, unless the article is otherwise noted, provided credit is given to the author and to CALL NEWSLETTER. The A9CUG freely exchanges Newsletters with other Users Groups around the country. If another club would like to receive our Newsletter but does not have one of their own to exchange, we will gladly send it to them. We do ask that they send \$5 a year or 50 cents a Newsletter to help cover costs.

Membership is open to families and individuals who own or are interested in using and programming home computers. Membership includes copies of this newsletter as they are published, access to meetings of the main group and sub-groups, subject to the rules of the sub-group, and the groups Public Domain Library. Annual dues are \$15.00.

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(1)345-5905
George Sears Vice President
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***** trading post *****

For Sale: Percom Data Disk Drive, with the TI Disk Manager 2; \$200.00. Stand alone RS232 (TI PHP 1700) Interface, with TE II; \$75.00. Tom Francis, 140 Woodland Trails Drive, Belton, Tx 76513; (817)780-2341

For Sale: TI 99/4A system: Console with Cartridge Expander and Speech Synthesizer; P-Box with Disk Controller, RS232 Card, 32K Memory Card, TI Disk Drive, Tandem External Drive, with power supply and box. Cassette Player, Sketch-Mate, TI-Writer, Disk Man 2, TE II, Pirate Adven, Touch typing, Ms. Pac-Man, and nine other modules. Misc other disks of games and programs, magazines and manuals. Asking \$650.00 Victor Brady (404)-971-8789. 20 Rhodes Dr. SE Marietta, Ga 30067

For Sale: P-Box with 32K Memory Expansion; \$200.00. Logo 1; \$10.00. Jackie Griffith (404)491-7654 (Tucker)

Wanted: TI Disk Drive and Disk Controller Call Stan Mislou: Days 636-3096 Nights 633-9581

For Sale: Complete Texas Instruments TI-99/4A Home Computer System. Two 99/4A's; P-Box, RS232 Card, Disk Drive, Disk Controller Card, 32K Mem Expansion, 5 Speech Synthesizers, 2 Remote Controllers, cassette cable, Composite Color Monitor Cable, Serial Printer Cable, 44 Command Modules, books, manuals, 99'er mag and much more. PRICE \$1200.00 FIRM. If you are interested contact: GEORGE GLENN SHAFFER; 5753-G Santa Ana Canyon Road; Anaheim Hills, California 92807, (818)282-4440.

For Sale: Complete system; Console, PEBox, RS232 card, 32k Mem Expan, Disk Controller, Three disk drives. Foundation 280 card, Foundation 80 column card, Morning Star CP/M Card, Widget, E-A Cart, TI-Writer, TE II, EX Basic, Multiplan, much more, games, programs, books, magazines.

(I'll have this 3 page letter at the next meeting if you'r interested). Asking \$1326.00 or best offer. Might sell some pieces separately. For more information call, write or Easyplex me at the following: Peter B. Morgan 33 S. Oakridge Ct. New Orleans, La. 70128 Ph. (504)242-2066 Compuserve easyplex at 70337,3521

***** CLUB SALES ***** Available at the Meetings

TI FORTH Members \$20 Non-members \$30 --- thru mail Members \$25 Non-members \$30 Diskettes \$1.50-\$2.00 Depending on brand Cassettes Tapes C-10, C-20, C-30 \$.90-\$1.10 Best of 99ex Magazines as well as selected issues of Home Computer Magazine. The prepared diskettes are: \$3 Mm. \$4 Non-mem.

DISK MANAGER 1000

by Bruce Caron
The Ottawa TI-99/4A Users' Group

Our library has a new program, and what a program it is!!! We did not get any documentation with it so this is my attempt to cover the performance of the program and explain it. The programs first screen states that it is Freeware, but we do not have any address or price on it yet, as soon as we do we will let you know where and how much to send.

This program is as much of an improvement over Disk Manager 2, as DM 2 was over DM 1. Maybe more, for its at least twice as fast as DM 2. While Cataloging, the screen stops when full and allows you to toggle back and forth between screens. The only DM 2 feature missing is Disk Testing.

When the main menu appears, it has three choices:

- 1-File Utilities
- 2-Disk Utilities
- 3-Misc Utilities

However before we get to these choices press FCTN 3, You are now ready to set up your printer file, enter PIO, or RS232.BA=****, and press enter. Next enter the printer commands that will set your printer to print the menu the way you want it. Enter a space between each command, and an asterisk (*) at the end of the commands, ie:(27 19 27 31 *). You are now ready to save your printer file to your disk. Press enter and the file goes to the disk and your main menu reappears.

One more point before I go on to the three working menus, the FCTN keys used with DM 2 are implemented by this program, for example if you press:

- FCTN 4 - Clear current operation
- FCTN 5 - you will return to the main menu
- FCTN 8 - backs you up one screen. (Redo)
- FCTN 9 - backs you up one menu. (Back)

Here are two new commands:

- FCTN 3 - you will return to the main menu, a second press and you are back to the printer selection screen (FCTN 5 to get back).
- FCTN 7 - will print the Catalog.

Now for the menus. If you press 1, the File Utilities menu comes up; this menu has two choices:

1-Copy/Rename/Delete/Change Protection

If you select this option the program presents you with an on screen directory of the disk in the drive you chose. You can now make the following changes, in column one you can enter C,M,N; C means Copy to another disk, M means copy to another disk and delete from this disk, N means No change. If you use the right arrow key (FCTN D) you will now move over to the Program Name column you can now change the name of the program, moving to the right some more you will arrive at the Protection column and you can now Protect or Unprotect the program. (Write protect only)

When you arrive at the bottom of the screen you are asked whether or not you want to make the changes listed. The program gives you a N (no) for default, but it is easily changed to Y (yes) and away we go. All the changes copies etc requested are processed without any further action on your part. Goodbye to sitting in front of the screen saying Y in order to copy a few programs from one disk to another. (At least if you have two disk drives.)

Now for the first major problem I have encountered, if you have more than one screen of programs, and you make changes on screen one, do not I repeat **DO NOT** go to the next screen. You must enter Y at the question do you want to make changes. Then press 1 again and go to the second page and make your changes there. If you don't, Holy Lockup, you will get some wild results. (You can return to the first screen and enter Y for changes and you will get the results you wanted.)

The second choice on File Utilities is the biggest single improvement. It will allow you to recover a deleted file or program. But, you must do it immediately after making the mistake. The reason for this is that if you put another program or file on that disk it will use the space occupied by the just deleted file or program. Just enter 2 from the File Utilities Menu and you will be asked for the drive number and the name of the file, the disk will be searched and if the program or file is there it will be restored.

Main Menu option 2 is DISK UTILITIES, you have six choices here, the first is a catalog of the disk, (Use FCTN 7 to get a printout). The second is a Disk Copy either by Bit Map or Sector (6 passes will do most DSSD disks, and it is a very fast copy program). The third is a Sweep disk which sets sectors 0 and 1 to nulls, effectively making the disk appear to be blank. (The Recover File portion will allow you to restore the files, if you can remember all their names.) The Forth option allows you to rename the disk, the fifth option allows you to Initialize a disk, and the sixth allows you to initialize a box of disks just about as fast as you can put them into the drive.

The Final Menu, Misc Utilities, has five options, the first allows you to Install disk protection, the second removes disk protection, the third removes XB protection. The fourth option sets Copy at menu 2 to Bit Map, which is the faster method of copying a disk. (This appears to be the default if you don't set it here.) The fifth option set the Copy at menu 2 to Sector Copy.

The program is menu driven throughout and you really need little help, I hope therefore that you take advantage of this and the many other programs in the library, come down to the next meeting and pick up a copy of some of the programs. The group is only charging for the disk. If you like and use the freeware please, PLEASE, send the amount of money requested to the author, encourage him to write more programs.

Marshall

 * CENTRAL IOWA USERS GROUP: 07/08 FREEMWARE Summary - by Ron Rutledge *

You have heard enough about FREEMWARE now to know what it is all about. The following list contains every FREEMWARE program I know of, some of which is available in the club library. The advantage of getting it directly from the author is 1) you get the most current version and 2) some authors keep a list and will inform you when enhancements are made or new programs are released. All of the following programs require 32K, at least 1 disk drive, and either Extended Basic or Editor/Assembler. A "*" following the name indicates it is in our library. A "#" indicates the source code is included on the disk. To get a copy from the author send an initialized disk, mailer, and return postage or \$5 to cover the costs. Remember that if you send \$5 that does not pay for the program, it merely covers the cost of getting it to you.

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DM1000 * Bruce Caron Ottawa Users Group (no address available)

A full-featured disk manager which could replace Disk Manager 2 if desired.

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MASSCOPY * Stephen Lawless 2514 Maple Avenue Wilmington, DE 19808

A sector by sector disk copier which can copy in one pass with a 128K card and which will copy to two drives at once. Has disk initialization option.

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X_DISASM Fred Hawkins 1020 N. 6th St. Allentown, PA 18102

An Extended Basic based disassembler with as many or more features than most

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Super Disk Duplicator Tom Knight 7266 Bunion Dr. Jacksonville, FL 32222

A sector copier which lets you specify the starting and stopping sectors.

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TK Writer ## Tom Knight 7266 Bunion Drive Jacksonville, FL 32222

A loader for TI-Writer which does NOT require the command module.

=====

NEATLIST ## Danny Michael Route 9, Box 460 Florence, AL 35630

An program which lists Basic programs in a much more readable format and will generate a cross-reference on request. Very useful for debugging, etc.

=====

SCREENDUMP ## Danny Michael Route 9, Box 460 Florence AL 35630

Loads into the lower 8K of memory and can be used to dump screens to the printer. Also allows dumping of screens from almost any cartridge.

=====

The DIRECTOR Ron Rutledge 1020 3rd Street Waukee, IA 50363

A multi-function XB disk cataloger accompanied by a disk labeling program.

=====

FAST TERM Paul Charlton 1110 Pinehurst Court Charlottesville, VA 22901

A full-featured terminal emulator which supports TEII protocols and XMODEM.

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Sprite Builder Marty Krill 218 Kaplan Avenue Pittsburgh, PA 15227

Does a variety of manipulations with graphics and will write CHAR codes to disk in merge format for use in XB programs. Has pre-defined graphics characters and option speech.

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FACTS and FICTION

The latest rumor on the Myarc "99/8" is that it will be in full production in October, that Futura is writing or converting programs to the new system, and that RYTE-Data who requested \$6.00 for six issues of a newsletter on the 99/8, and then was never heard from, has dug itself out of the avalanche of money and requests and is finally sending out the first of the six newsletters, is doing the promotion for the machine. Oh well, we will see what we shall see.

As for some hard facts we have included in this issue copies of a 32K Matchbox Expansion system that you can make yourself, that is if you're good with a soldering iron. And if you are contact me I'd like one too, but I'm all thumbs when it comes to these types of things.

This expansion system comes from the T.I.U.P., the II-99/4AT 'AB-USERS' of PERTH, WESTERN AUSTRALIA.

We are also including instructions for turning any old cartridge (almost any), into an BK RAM memory and Editor/Assembler Module. With many thanks to Ron Gries and John Clulow of the New Horizons Group.

Well that's it for this months what's happening.

Marshall

Foundation and Morning Star both have CP/M cards; the latter is alleged to run all CP/M items on a 99/4A effortlessly! Price: \$350 or up. Meanwhile, the National Assistance Group is reported to be modifying CorComp's 9900 M.E.S. to allow it to run Z80 2.2 software such as Turbo Pascal. (These comments from MSP 99ers, the St. Petersburg Suncoast Beeper, and the Cin-Day UG Newsletters.)

Two programs out now allow you to set up your own function keys. PCKeys, from Techni-Graphics, 443 Perrie Dr. #302, Elk Grove Village, IL 60007, for \$22.50, and Tarik Isani's Interrupt(-switch)-driven Microkey, from Starsoft, 601 Alleghany St., Blacksburg, VA 24060, (703)953-1490 for \$19.95.

A LETTER WE RECEIVED

You recently furnished our User's Group--Southern California Computer Computer Group(TI99/4A)--a program called Gothic Print.I cannot get it to work with my printer, a C ITOH 8510 Prowriter. In fact, I cannot even get a listing, for whenever I enter LIST "PIO", the listing starts off OK, but soon starts printing in enlarged (double-width) type and eventually just seems to run off in all directions. Other members who own an EPSON FX80 or compatible printer such as the GEMINI 10X, say the program works fine for them.

So, it must be my Prowriter. I am not much of a programmer or could I probably figure out the necessary changes by myself. In lieu of that skill, has any member of group enhanced the Gothic Print program to run with the Prowriter? If so would it be possible to send me the necessary corrections so that I can start playing with my Gothic Print. I would appreciate it very much.

Sincerely,

Don West
6035 Samuel St.
La Mesa, CA 92041

OK FOLKS, CAN ANYBODY HELP HIM?

NEW BBS's IN TOWN

The Atlanta 99/4A Computer Users' Group has a new BBS. It is run by Charles Dupree and is the Club's BBS #1. That is because the club will pay for the phone installation and the monthly bill. Charles will be using his own system plus a few privately owned cards (MBP Clock card and the Foundation 128K card). This will allow the System that the club owns to be brought to the monthly meetings without having to take down the BBS as well. Ed Banovatz has custody of the club system and the cumbersome responsibility of packing it and bringing it to the meetings. We thank Charles Dupree for the use of his system and for taking the time and effort to run the BBS. This BBS will be a TIBBS. The number is 366-1914.

A second BBS that is unofficially sponsored by the club is run by Jim Fairchild. I say unofficial only because he is having to bear the entire cost of running the board out of his own pocket. It would be unfair to say that the club is sponsoring his board when we are not providing him any financial assistance. We will support him any way we can and he is willing to say on the board that he is associated with the A9CUG. This board is Mark Hoogendorn's BBS and the number is 991-6250.

A third board which is fairly new and worthy of mention is Larry Lord's. He is also running a TIBBS and has no actual connection to the club except that he has been very supportive to those with TI's. He is willing to put up club information if we can ever get it to him. His board also has a distinctive HAM RADIO flavor to it which is appreciated by many in this town. That number is 363-1640.

A last board which is new is Jim Foust a former 99er who has written his own BBS which he calls "The No Frills BBS". Alas this is not on a TI99 but Jim is always helpful to us, or anyone for that matter. The BBS number is 289-2050.

SUPER-MODULE :**Adding 8K to Your E/A Module**

by Ron Gries and John Clulow
New Horizons

Questions about this project may be directed to Ron Gries:

(419) 874-1414

The project described here adds 8K of RAM memory to the Editor/Assembler Module. At the present time, a circuit for battery backup is not available. We hope to present one sometime in the near future (when Ron gets time to do it.) But you should find the 8K addition useful even without battery backup and especially so if you do such assembly language programming.

As usual, neither Ron and I nor the New Horizons users group can assume any responsibility for any loss or damage arising from the information presented here. We also do not assume responsibility for its accuracy or completeness. If you decide to attempt this project, you do so entirely AT YOUR OWN RISK.

The memory used is the Hitachi CMOS HM6264P-15 (\$34.95). If you want the capacity for battery backup later on, you'll need the more expensive LP-15 version (\$39.95). Prices on both devices will probably drop in the next few months. One source of the RAM chip is JDR Microdevices, 1224 S. Bascom Ave., San Jose, CA 95128 Ph: (800) 538-5000.

Another required item is TI game module which is foiled on both sides. To determine this, push back the sliding door and see if there is metal showing on both sides of the edge card. Several games have such a board; we happened to use a Munch Man module which was purchased for \$.99.

You'll also need an Editor Assembler module, of course. Because the project involves transplanting the E/A GROM chip, it does involve some risk of destroying the E/A module! It would be a good idea NOT TO TRY IT WITH AN E/A MODULE YOU CAN'T AFFORD TO LOOSE.

The only other parts you'll need are a 1K resistor (e.g., Radio Shack 271-023) and some insulated wire — preferably wire wrap (e.g., 278-501). You'll also need a vacuum-type solder remover, rosin core solder, and a soldering pencil.

We strongly recommend that if you have had no prior experience handling CMOS devices, desoldering components from printed circuit boards, etc. you should ASK SOMEONE WHO HAS TO HELP YOU.

First un-screw the shell of the game module and open it by pulling the case apart at the ends of the slotted side. Remove the PC board while holding the sliding door down. Note the position of the spring device and the grooves it fits into in the sliding door. Note that the spring is on the UNDER-SIDE of the PC board.

Un-solder and remove the GROM and ROM chips. They should be located as shown in FIG. 3. The ROM chip is the larger of the two. To remove them heat each solder connection on the underside of the board and use the vacuum device to remove most of the solder. Then gently pry up on one end of the device while heating pins on the underside of the board at the same time.

A capacitor should be located next to pins 21-24 of the ROM. Desolder the ground end from its soldering pad, leaving the +5V end (nearest the back of the board) attached. With a knife, carefully break the foil between the two adjacent soldering pads where the capacitor was connected — See Fig. 2. Then resolder the ground end of the capacitor to the pad on the right. Finally, solder one end of a short piece of wire to the pad on the left (where the capacitor used to be) and the other end to hole 18 of the removed ROM (See Fig. 1 for ROM pin numbering). This will be the seventh hole from the back of the board on the side closest to the capacitor.

When a command module is inserted, it normally resets the computer. If you want to disable this auto-reset in the new E/A module, remove the resistor at the opposite end of the board (See FIG. 3).

Figure 1 gives a pin diagram of the HM6264 RAM with a typical 4K ROM superimposed. You will note that the actual width of the two chips is identical but the RAM is longer. The ROM is drawn narrower simply for clarity in showing corresponding pin numbers. In the following, all pin numbers will be preceded with "ROM" or "RAM" to indicate which numbers are involved.

In handling the CMOS RAM chip take precautions to minimize static electricity. Don't work on carpet, touch a ground before handling the device, handle it by the plastic body, and touch the pins as little as necessary. When soldering, hold the pencil on the pins for the least time required to make the connection — try not to use more than 1 to 2 seconds. Remove the RAM from its anti-static tube. Figure 1 is a top view. Place the device on its side on a table or other flat, hard surface and move the body of the device to bend the pins closer to a right angle with respect to the body. Do this for both rows of pins, and check to make sure that the pins roughly line up with the holes in the game PC board. Orient the chip as in Figure 1 and bend RAM pins 1 2 20 27 and 28 straight out. Now insert the RAM into the game PC board such that the notched end is flush with the back of the board RAM pin 3 should go into ROM hole 1, RAM pin 26 into ROM hole 24 etc.

With the RAM in place, solder in one pin on each side to hold it. Connect a wire from RAM pin 27 (bent up) to the Write Enable pin on the edge connector. This is the third one from the left looking at the top of the board (see FIG. 3) and it is not connected by foil to the PC board. Connect a wire from RAM pin 2 (bent up) to Address line 12 on the edge connector (7th pin from the left). This edge pin also doesn't have a foil connection to the board.

Solder a short wire from RAM pin 20 (bent up) to RAM pin 22. It will be relatively easy to solder one end of the wire to RAM pin 20 but RAM pin 22 is in a hole and a little more difficult to get at. Solder the wire as close to the board as possible using as little solder as possible. Solder one lead of the 1K resistor in the soldering pad just below the left side of the GROM holes. This pad is in a foil path leading from the gnd end of the capacitor to the right-most edge card pin. The resistor lead can be pushed through the hole. Solder the other end of the resistor lead to RAM pin 20 (bent up).

Solder a short wire from the +5 end of the capacitor lead (nearest the back of the board) to RAM pin 28 (bent up).

Now all that remains is to install the E/A GROM. Open the E/A module and remove the PC board. Unsolder and remove the GROM using the same procedure as

above. Place the E/A GROM on the new board in the holes left by the old GROM with the notched end of the GROM toward the back of the board.



Finally, solder all IC pins in their respective pads for both the RAM and GROM. Place the spring in the BOTTOM of the E/A module case. locate the sliding door properly, put the new PC board in place, and snap the case closed. Then replace the screw.

The first thing to do is make sure your E/A GROM still works OK. Then you can test out your RAM with the following program.

```
100 INPUT "NUMBER 0-255? ";X
110 CALL LOAD(24576,X)
120 CALL PEEK(24576,X)
130 PRINT "MEMORY HAS ";X
140 PRINT
150 GOTO 100
```

When you enter a number from 0 to 255, you should see the same number displayed on the screen having been stored by 110 and read by line 120. If the number the computer returns is different from the one you entered, the device is not working properly. Remove it and retrace all steps above until you find the problem. The address 24576 is >6000. Your new RAM goes from >6000 to >7FFF or in decimal from 24576 to 32767. You may want to check out several addresses in this range to make sure they are working properly.

There are a number of things you can use the new RAM for. In assembly language programs you can use an ADRG >6000 directive to have to loader place your object code in the new RAM. Alternatively, you can change the First Free Address in High Memory (FFAH) to >6000 with a CALL LOAD(8228,96,0) and then load your program with a CALL

LOAD("DSK1.NAME") as usual. If you plan to load other programs, you can change the FFAH back to >A000 by CALL LOAD(8228,160,0).

I have been using the new BK of RAM to hold the DEBUG program when working on assembly language programs. An article by Jon Bannister of 9T9 users group in Toronto described a modification to the speech synthesizer to activate (ground) the LOAD interrupt line on the 44 pin I/O bus. This causes the computer to do a BWP to vector >FFFC where >FFFC contains the Work-space Pointer and >FFFE the Program Counter. So at any time in the execution of a program (like when it inevitably locks up) I press a button and branch to the debugger.

Jon's device is pretty easy to make. You need a momentary contact, normally open push button switch (like Radio Shack 275-1547), a .1 MF bypass capacitor (272-135), and a 2.2K resistor (271-1325). Solder the capacitor across the switch keeping the leads as short as possible. Solder one lead of the resistor to one side of the switch and the other lead to a 7" insulated wire. Connect the other end of the wire to the LOAD pin on the Speech Syn.

This is pin 13 on the I/O bus. Looking at the edge card at the upper right of the console, pin 13 is the seventh pin from the left on the bottom. Jon recommends that you flip the board upside down so that you cannot see any components, and place the black female connector on the right side. Pin 13 LOAD is then the seventh pin from the bottom.

A second 7 in. insulated wire should be soldered to the other side of the switch and then to Ground - leads 11 12 13 and 14 from the bottom with the black connector on the right. You can easily recognize them because they are soldered together.

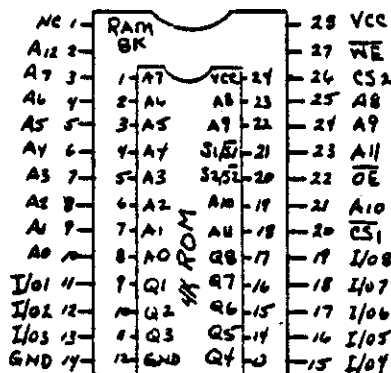
All that remains is to mount the switch inside the speech synthesizer. If you're using the Radio Shack switch, you'll need a 5/16 in. hole.

Now, if you've made it this far, put in your E/A module connect the modified Speech Syn place the E/A disk with DEBUG on it in drive one and run the following program:

```
100 CALL INIT
110 CALL LOAD(8228,96,0)
120 CALL LOAD("DSK1.DEBUG")
130 CALL LOAD(-4,131,224,112,19)
140 CALL LOAD(8228,160,0)
150 PRINT "PRESS Q THEN ENTER"
160 CALL LINK("DEBUG")
170 END
```

This will load the DEBUG utility. Now enter BYE to leave basic and select an option of Editor/Assembler - e.g., Load and Run. When you press the LOAD button on your speech syn. you should be in the debugger. To leave the debugger, use FCTN QUIT.

FIG. 1



HM6264P(LP)-15 (LARGER)
Superimposed ON
Ram IC (SMALLER)

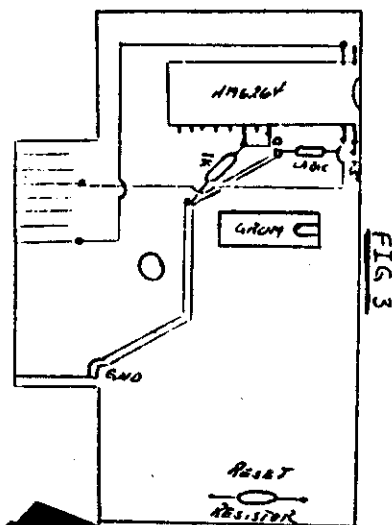


FIG. 3



FIG. 2

SPEEDING UP Infocom LOADING
Dan Eicher, HUGGERS Newsletter, P.O.Box 2222, Indianapolis, IN 46206-2222:

Here is a tip for anybody who plays Infocom games.

If you don't like the time that it takes for a game to load from a disk, do NOT use Extended Basic! Use your Mini-Memory or Editor/Assembler instead. To use these, select the Load and Run option and type DSK1.Boot. When this is finished loading, press Enter until you get Program Name, then type START.

On the Mini-Memory, you will get an error after BOOT loads, but keep pushing Enter, and proceed as above. Here are some comparisons of the load times for the different modules:

Extended Basic	3 minutes
Editor/Assembler	1.25 minutes
Mini-Memory	1.18 minutes

32K MATCHBOX EXPANSION —

Special Feature

THE TI-99/4 AT

(ADVANCED TECHNOLOGY)

PART 1.

32K OF CMOS RAM
INSIDE THE TI-99/4AT
(The 'MATCHBOX' expansion!)

By Bernie Elaner and Phil West.
TI-99/4AT 'AB-USERS' of PERTH,
WESTERN AUSTRALIA. (T.I.U.P.)

THE 'ISADUDD' CLUB.

Anyone using a computer which has been discontinued by the manufacturer, automatically qualifies for free membership of the rapidly expanding International Society of Amalgamated Dodo Users and Dead Ducks. (ISADUDD's)

TISADUDD's are luckier than most. Despite the 'DODO' image, there are some real advantages in belonging to this group.

New, and sometimes 'PRE-LOVED' hardware and software are often available at bargain (DUMPED) prices.

Initial awe and fear of damaging expensive equipment has disappeared. (Who's afraid of a \$49.95 computer ?)

Tons of software, books and technical information are readily available.

Contact with many other users has been established.

Creating useful programs is a lot easier than when you first started.

The 'BANK ACCOUNT' has had a chance to recover some lost condition.

At this stage, like us, you may develop an interest in the computer hardware. Now it operates, how to fix some of the things that annoy you and how to provide extra features.

SUCCESSFUL MODS.

Hardware enhancements that we have added include :-

Installation of a great UTILITY device called 'FINGER PRINT' and the addition of five EXTERNAL dip switches for the TI-(MX 80)-PRINTER. (For changing Baud Rate and 7-8 Data Bits quickly.)

Beefing up the Expansion Box supply to permit the use of two internal, CHINNON low power, double sided, slimline, disk drives, PLUS, two optional external drives and WITHOUT ANY FAN in ELSENER's 'NEBA-CRAZY'



supermod! (Foundation member of 'NOFANS' - The Noise Of Fans is Against Nature Society.)

Installation of a 'BRONOS' load interrupt button. (The MARK 2 'LA-USERS' version.)

Addition of the 'NEW HORIZON'S USERS GROUP' real time (battery backed) clock.

Conversion of a MINI MEMORY to a 'WESTRALIAN INSTRUMENTS' MAXI MEMORY, by replacing the 4K ROM and 4K RAM with an 8K RAM chip. Retaining the ROM PROM and battery backup circuit. The ROM data can be restored from cassette with a w-1 routine (or from disk, using a CDCOMP DD disk controller card. (To be featured in Part 2.)

Location of 'CONSOLE ROM' in an 8K (battery backed) RAM CHIP on the 8 bit data bus. Slowed things down by 25% but has some interesting potential.

Expansion of CPU memory with a 'MATCHBOX' 32K CMOS RAM EXPANSION inside the TI-99/4AT. (Described in this article.)

These last three mods were made possible by substantial price reductions of a great memory chip, the :-

HITACHI HM6264LP-15

This is a 28 pin - 8K x 8 bit CMOS RAM chip. A Big brother to the 2K x 8 bit HM616LP-4 used in the MINI MEMORY.

There are several versions of the chip. The one we used is LP (for Low Power - which is required if you intend to use battery backup) and 15 (for 150 nanoseconds) which is plenty fast enough for ol' TORTOISE-TI....

A year ago, in PERTH, the chip would have cost you \$140.00 and two months ago it varied in price from \$42.00 to \$75.00. It is now available, in sticks of TEN chips from :-

'PRIMARY ELECTRONICS'

P.O. Box 381,
CROMS NEST, NSW 2065. or,

P.O. Box 115,
MUNAWADING, VIC 3131.

For \$256.00 (\$25.60 per chip.)
(This includes 20% sales tax and \$4.00 for postage!)

The HM6264 chip is just made for the TI-99/4AT hacker. It is STATIC RAM which does not need the complex refresh circuitry etc. of DYNAMIC RAM and the size is just right for the 8K blocks of CPU RAM.

ON THE DRAWING BOARDS.

We are developing several other enhancements for the TI-99/4 AT. All components will be mounted on a board INSIDE the computer. (An additional external power supply will be required later.)

The projects will include :-

Extensive CRU decoding to allow for new facilities.

Provision of a CRU selectable 8K CMOS RAM chip in the DSR area of CPU RAM from >4000->5FFF.

Console ROM to be hardware switchable between ROM and battery backed CMOS RAM.

(We just might end up with an 80K computer, or better!)

Installation of an EPROM copier-programmer in the computer. Two Zero Insertion Force sockets to be mounted above the ventilation slots at the rear, right hand side of the console. (That'll really COOK em!)

Provision of a GROM and ROM selector for access to external module cards.

Some of the mods will require M/L routines and we will list those when appropriate.

VAPOUR WARE.

Other improvements to be investigated (straight from the DREAM TIME) include :-

A RAM DISK, large enough to load a full, double sided, double density disk (1440 sectors or 368640 bytes.) Hmm....that's 45 HM6264 chips which would cost \$1197.00! Well maybe next year. Just think, they might even come down to \$4.95 ea. That would be about \$80 for a 65-80 RAM DISK or \$250 for a DS-DD RAM DISK.

(cont. over page)

32K Matchbox Expansion (cont.)

Relocation of the 32K CMOS RAM expansion on the 16 bit data bus to eliminate the 16 to 8 bit bus conversion for operations in CPU RAM. (Too fast for existing software ???)

Replacing the VDP processor with a TMS 9228 and building VDP RAM up to 256K. WOW! An 80 column MULTICOLOUR text mode. A bit map mode where every pixel can be any one of 16 colours from a palette of 512 colours. Sixteen sprites in any row.....

Replacing the TMS9900 with a TMS9995 running at 12 MHz. (We've done a ROM & RAM 'BRAIN' exchange, why not a 'HEART' transplant too ???)

This would be tough. The experts say it's IMPOSSIBLE but having acquired a TMS 9995 processor in some recent 'horse trading' we might just be crazy enough to try. After all, the experts didn't tell us we could put 32K of CPU RAM into the console.....

If we ever get this far, Phil will have re-written just about all the TI software and we will change the name of the computer to the 'WESTRALIAN INSTRUMENTS'.

'TURBO TI-99/4 AT+'

IMPORTANT DISCLAIMER.

These articles are written by 'AMATEUR COMPUTER HOBBYISTS'. (Amateurs by our definition are happy souls who learn less and less, about more and more, as distinct from experts, who rarely smile and learn more and more about less and less.)

We cannot guarantee that any modifications or enhancements described will work on YOUR computer.

We develop our projects on old equipment and accept the risk that it may be damaged. If you have never taken your computer apart, handled CMOS chips or used a soldering iron you should NOT attempt any of the projects described (unless you can obtain assistance from someone who has.)

By modifying your equipment you will void any manufacturers' warranties still in force.

```

##### WARNING #####
$
$ IF YOU ATTEMPT ANY OF THE $
$ MODIFICATIONS DESCRIBED IN $
$ THIS SERIES OF ARTICLES YOU $
$ DO SO AT YOUR OWN RISK !!!!! $
$
#####

```

32K MATCHBOX EXPANSION.

Our 32K matchbox expansion works fine with the major software packages. (This article is being written with TI-WRITER using the prototype.)

EXTENDED BASIC, TI-WRITER, TI-MULTIPLAN, TI-LOGO 1 & 2, TI-FORTH, EDITOR ASSEMBLER and

the RS232, P-UNIT, TI-DISK CONT., CDCOMP DD DISK CONT. cards, have all been used without any 'APPARENT' problems. However, we pause for another important message :-

```

##### SOFTWARE WARNING #####
$
$ Mating CPU RAM into the $
$ computer is a major change $
$ to the TI-99/4A expansion $
$ system and may cause some $
$ software problems. Machine $
$ language programs that use $
$ SPEECH or are dependent on $
$ critical timing, MAY NOT $
$ operate correctly.
$
#####

```

This project should be regarded as a 'BUDGET' MEMORY EXPANSION for the unexpanded TI-99/4A user rather than as a replacement for existing 32K expansion cards!

If you wish to add the 32K expansion but don't have a disk drive or controller, you should also be aware that the extra memory is not fully useable by cassette based users.

For instance, you may only SAVE Extended Basic programs up to 12K in size to cassette, though the programs will have a much larger operating space for arrays etc. (You could for example, read a 12K Text file into a 12K program - If you're the patient type....)

If you have a MINI MEMORY module the project has some interesting potential, using EXPMEM1 and EXPMEM2 and also for Machine Language programs.

Later, using the 'Westralian Instruments' MAXI MEMORY and with a battery backed 32K memory expansion on board, it will be possible to create a TI-BASIC program that utilises a 24K data file located in EXPMEM2 assisted by 8K of M/L routines ('Display At', 'Accept At' etc.) located in the 'MAXI MEMORY'. If the TI-Basic program was less than 8K in size it could be saved in EXPMEM1.

EVERYTHING WOULD BE INSTANTLY AVAILABLE ON POWER UP AND WOULD OPERATE WITH THE ACCESS SPEED OF A RAM DISK!

(Although not documented, it is possible to save programs to EXPMEM1, before doing so, you must CALL LOAD(0192,90,165). EXPMEM1 can also be used for data files by loading similar values to those used for EXPMEM2 into location 0194.)

Whilst pondering these 'fringe' ideas we kept hearing a ghostly chorus crying in the distance.

"TI.....OH.....TI.....WHY.....DIDYOU.....DESERT.....US.....?"

PROTOTYPE.

The project was developed on an old TI-99/4 (without case) and the four RAM chips were ALL 'PIGGY-BACKED' in one 28 pin socket! It was suprisingly easy to do and and took up an

unbelievably small amount of space. Hence the name 'MATCH BOX' expansion. (TI's 32K memory expansion card uses 33 chips.)

To make it more reliable we mounted the four RAM chips in two sockets on a small piece of strip board soldered to the ground extender. This made a tight fit in the space where the speaker used to be in the old TI-99/4 computer.

To allow for future projects we have decided to mount everything on a single piece of STRIPBOARD, 23 cm. wide by 9 cm. deep and up to 2.5 cm. high, which can be mounted on (self adhesive) NON-CONDUCTING stand-offs, on top of the shielding covering the main computer board. (In the empty space between the keyboard and the back of the computer.)

For 'ONE OFF' construction, stripboard is faster to use than printed circuits and cheaper than wire wrap or other connection methods. It is also permanent enough for use, whilst allowing quick alterations if necessary.

Whether you end up with a 'RATS NEST' or a neat job, depends on the care you take. If you work carefully and neatly the whole project can be finished in a few hours. Much less time than it takes to write (or read) this article.

Only a small portion of the board is needed for the 32K expansion and you may find it easier to mount the four RAM chips in separate sockets. This would increase the amount of wiring required but eliminate the tricky PIGGY-BACK soldering.

PARTS REQUIRED.

4 HITACHI HM6264LP-15 RAM Chips. (For M/L use you may add them one at a time as required.)

1 piece of copper strip board. (34 strips wide and 23 cm. long, if you intend to add other projects later.)

2 (or 4) 28 pin Chip sockets.

1 22 uF Tantalum Capacitor.

An edge connector or small plug & socket for 30 or more wires. (We will need more wires for future projects, so use larger connector if available.)

Several Non-conducting standoffs or a sheet of insulating material to separate the strip board from the metal shielding around the computer

Coloured lengths of thin, insulated, single conductor wire for use on the stripboard

Lengths of thin, multi-stranded wire or ribbon cable to provide flexible connections between the board, Ground Extender and main computer board.

Solder, fine tipped iron, etc.

(cont. over page)

FIG. 1 shows a simplified block diagram of the memory expansion. Thirteen lines of the address bus (A3 - A15), eight lines of the data bus (D0 - D7), the \overline{W} line, +5V and Earth, are all obtained by soldering wires to the back of the BRAM EXTENDER.

(This is the 'GIZMO' that connects modules to the main computer board and causes all those Extended Basic lockups when not making proper contact.)

Five other lines are obtained from the TI-99/4AT Mother Board.

Believe it or not, all the decoding to separate the EIGHT 8K blocks of CPU ram is already done in the computer! The lines for the 32K expansion were just left unused.....Shooooooooosh!

Four chip select lines are required for the blocks :-

- LOWMEM - >2000 to >3FFF
- HIMEMAB - >A000 to >BFFF
- HIMEMCD - >C000 to >DFFF
- HIMEMEF - >E000 to >FFFF

One other line required is DBIN (Not DBIN) and this is also obtained from the main board.

The 'easiest' way to connect to five lines is to solder wires (with a fine tipped iron) directly on to the pins of the console chips. We know this is crude but it sure is easy!

What else do you expect from a TIN-POT outfit like 'WESTRALIAN INSTRUMENTS' ??? (When the cover is back on, no one will ever know and it will work just fine....)

To make future mods easier, bring all lines through some type of connector. One with as many pins as you can find for future projects. (Sixty wires should be enough....) If you can only obtain smaller connectors, you can use more than one.

Mount the connector at the rear of the STRIP BOARD and use flexible wires or ribbon cable to connect between the groo extender, main computer board and the edge connector. (It is a good idea to anchor them somehow (?) to prevent movement breaking connections.)

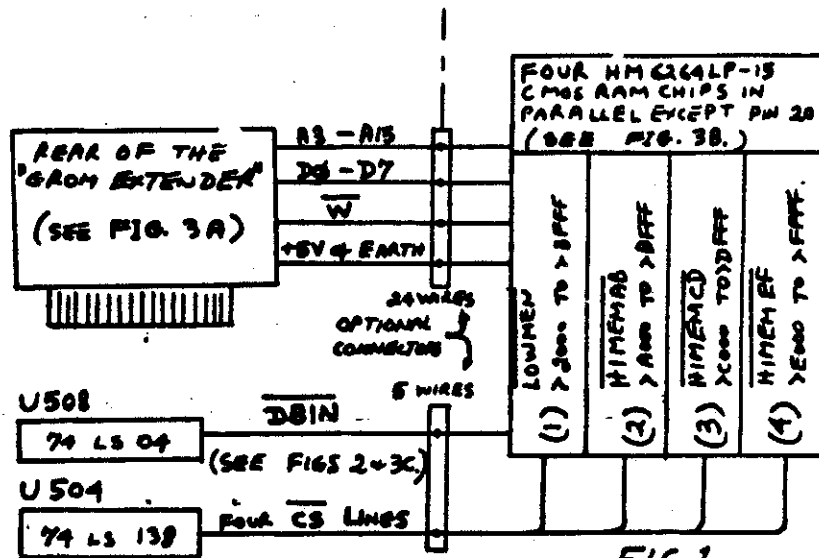
FIG. 2 shows where to connect the 5 wires on the TI-99/4AT and FIG. 3A shows the numbering of the pins at the back of the groo extender.

The complete expansion is shown in FIGS. 3A,3B,3C and tables A & B list the 29 wires needed to connect the various bus lines to the RAM sockets.

The exact layout to use is up to you. Just keep sockets as compact as possible while still allowing access for connections.

Cut the strip board where necessary to isolate active lines and be as neat as you can with your wiring. (Thin, single conductor wires are easiest to keep neat.)

32K Matchbox Expansion (cont.)



EXISTING
TI-99/4A
COMPUTER

FIG. 1.
"THE 32K MATCH BOX"
EXPANSION.

BERNE ELSNER AND PAUL WEST.
"WESTRALIAN INSTRUMENTS."

"GIP"

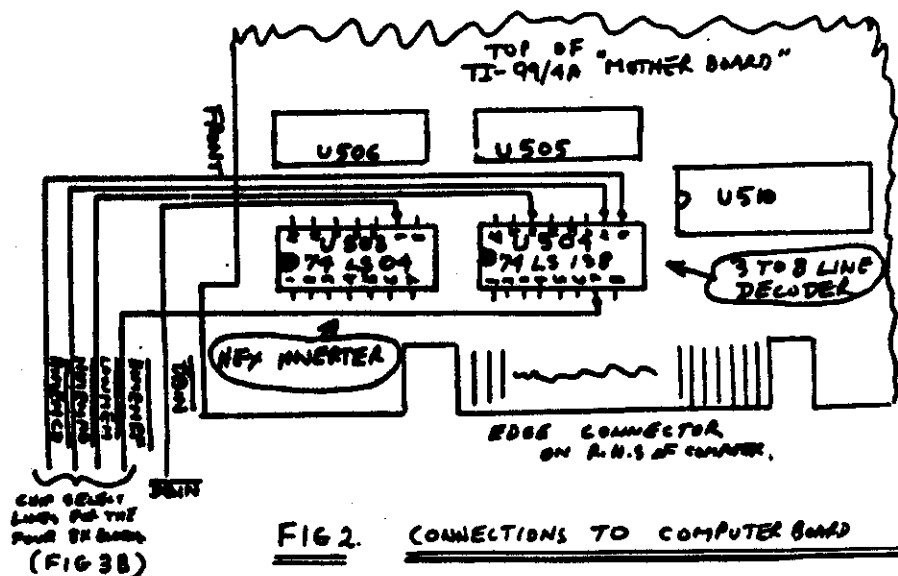


FIG. 2. CONNECTIONS TO COMPUTER BOARD

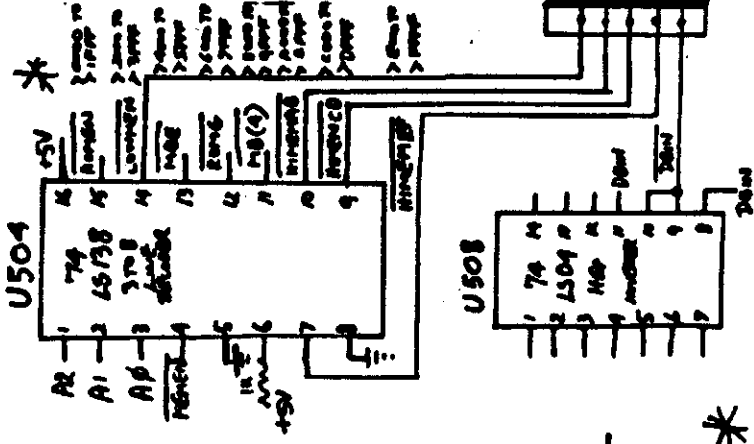
8 | 7 | 6 | 5 | 4 | 3 | 2 | 1

FIG. 3C.

EXISTING

TI-99/4(A)

"MOTHER BOARD"

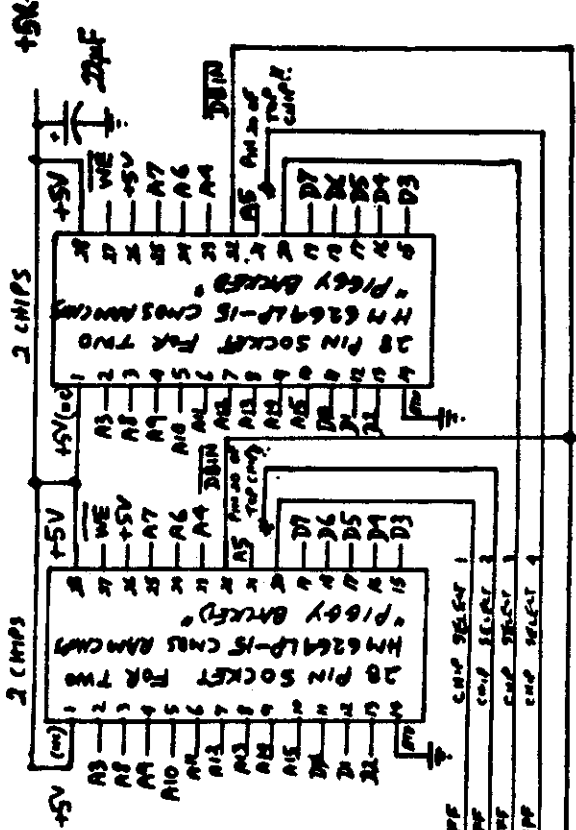


* REAR VIEW OF GROM 'EXTENDER' SHOWING PIN NUMBERS AND FUNCTION OF THE WIRES ACQUIRED BY THE MEMORY CHIPS.

WE	AM	AS	AG	A3	A7	A8	A9	A10	A11	A12	A13	A15	+
34	33	30	28	27	26	25	24	23	22	21	20	19	1
				AM				D1	D2	D3	D4	D5	DC
35	33	31	29	28	27	25	24	23	22	21	20	19	1
								D1	D2	D3	D4	D5	DC
								5	4	3	2	1	

* REAR VIEW OF GROM EXTENDER. A - INDICATES ADDRESS BUS. D - INDICATES DATA BUS.

CONNECT THE WIRES MARKED IN HEAVY OUTLINE TO THE APPROPRIATE WIRES OF THE TWO SOCKETS BELOW.



32K EXPANSION

FIG. 3B.

A	REDRAW SCHEMATIC 25-2-85	1
B	FORMAL RELEASE	✓
REVISIONS		
		1
		2

CONNECTIONS TO REAR OF GROM EXTENDER

FIG. 3A.

ITEM NO	PART NO	DESCRIPTION	MATERIAL	QTY
		PHIL WEST		
		BERNIE ELYNER		
		T.I.U.P. - W.A.		
		WESTALIAN INSTRUMENTS		
		PROJ-01	TI-99/4 AT	
		32K. MATCHBOX EXP.		
		108539716842		

32K Matchbox Expansion (cont.)

TABLE - A.

WIRE NAME AND FUNCTION TI'S BUS	PIN NO. ON REAR OF THE GROM EXTENDER	PIN No. ON BOTH RAM CHIP SOCKETS	WIRE NAME ON HITACHI RAM CHIP
+5 VOLT	19	28, 26, 1	VCC, CS2, NC
↓ EARTH	2	14	GND
WE ^{WRITE} ENABLE	32	27	WE
A3	29	2	A12
A4	30	23	A11
A5	28	21	A10
A6	26	24	A9
A7	22	25	A8
A8	20	3	A7
A9	18	4	A6
A10	16	5	A5
A11	14	6	A4
A12	12	7	A3
A13	10	8	A2
A14	28	9	A1
A15	8	10	A0
D0	17	11	I/O1
D1	15	12	I/O2
D2	13	13	I/O3
D3	11	15	I/O4
D4	9	16	I/O5
D5	7	17	I/O6
D6	5	18	I/O7
D7	3	19	I/O8

18 WIRES OF THE ADDRESS BUS

8 WIRES OF DATA BUS

TABLE - B.

WIRE NAME + FUNCTION	FROM COMPUTER CHIP NUMBER + PIN No.	TO RAM CHIP No. + PIN No.	WIRE NAME ON HITACHI RAM CHIP
<u>DATA IN</u>	U502/9 or 10	22 ON ALL.	OE
<u>LOWMEM</u>	U504/14	20 ON CHIP 1	CS1
<u>HIMEMAB</u>	U504/10	20 ON CHIP 2	CS2
<u>HIMEMCB</u>	U504/9	20 ON CHIP 3	CS3
<u>HIMEMED</u>	U504/7	20 ON CHIP 4	CS4

- NOTES
- (1) PIN No 1 ON RAM CHIPS NOT USED (CONNECT TO 15V)
 - (2) PINS 1, 4, 6, 21, 25, 27, 29, 31 AND 33 TO 36 ON GROM EXTENDER NOT USED HERE.
 - (3) TEXAS INSTRUMENTS NUMBER THEIR BUS LINES IN REVERSE ORDER TO MOST OTHER MANUFACTURERS!
 - (4) DATA IN IS AVAILABLE ON GROM PIN 25 BUT WOULD NEED TO BE INVERTED TO GET DATA IN
 - (5) RAM CHIPS ARE "PIGGY BACKED" IN PAIRS. OR MOUNTED INDIVIDUALLY.

(cont. over page)

32K Memory Expansion (cont.)

Although we didn't use one on our prototype (slack) it is probably a good idea to add a 22 uF Tantalum capacitor between +5V and earth, at the sockets, to decouple the power supply.

Don't plug any RAM chips in until everything is completed and checked. Leave connection of the chip select lines (pin 20) for the TOP TWO (piggy-back) chips till last.

Which chips eventually connect to which chip select lines doesn't matter although it's an idea to use some system so you can fault find if necessary.

When you have connected all the wires except for the two chip select lines mentioned earlier,

\$
\$ CHECK EVERYTHING - TWICE! \$
\$

Check that every termination is correct and that there are no short circuits between adjacent pins or tracks.

Would you back yourself for \$100 not to make at least one mistake in 150 odd connections ???

***** ANOTHER WARNING *****
\$
\$ NEVER MAKE ANY CONNECTIONS \$
\$ OR CHIP CHANGES WITH POWER \$
\$ CONNECTED TO, OR TURNED ON \$
\$ AT, THE COMPUTER, ALLOW TIME \$
\$ AFTER SWITCHING THE POWER \$
\$ OFF FOR ALL CAPACITORS ON \$
\$ THE POWER LINE TO DISCHARGE. \$
\$

DON'T use all four chips at once, just try low memory on its own. If that works OK you can proceed with the others. (ONE BLOWN CHIP IS CHEAPER THAN FOUR!)

Various precautions are advised for handling CMOS chips. We've never had problems with static electricity or lost any chips but it is probably a good idea to acquaint yourself of the correct procedures before handling your own chips.

The quickest way to try each 8k block is with 'EASY BUG' in the MINI MEMORY. If you don't have a MM then you can use Extended Basic or Editor Assembler to 'CALL INIT', 'CALL LOAD' and 'CALL PEEK' into each block of memory. If you don't have those, why go on ?

If the first block tests OK, you can 'PIGGY-BACK' the top two chips and connect their CS lines. Carefully bend pin 20 of each upper chip out at right angles and solder the CS line direct to the pin.

Do a minimum of bending to the pins and use as little solder as possible, you might want to use the chips again elsewhere.

As mentioned previously our original prototype had all four chips 'PIGGY-BACKED' in one socket. Initially the chips were NOT SOLDERED, their pins were carefully bent to exert just the right amount of tension to make firm contact with the chip below. They were then carefully aligned and placed on top of each other. Finally the chip select lines were soldered to pin 20 of each chip.

Yes I know, this article gets worse and worse as you go along. Want to buy my 32k card ???

When you have tested all four blocks, carefully solder the 27 pins (not pin 20) of the top chip, to the matching pins of the lower chip of each pair.

This is the most difficult part of the whole job. If possible, practise with some cheaper chips to get the idea. Use a fine tipped soldering iron, take your time and be careful. Shaky hands are out. If you spread solder between adjacent pins use 'solder wick' to remove it.

If any pin fails to make contact with its lower partner or short circuits to a neighbour you will end up with some nasty faults to find...or worse...COOKED CHIPS!

That was added just to get your hands shaking.....

POWER CONSUMPTION.

The +5V power supply of OUR TI-99/4 & 4A computers proved to be capable of supplying the extra load of the 32k expansion. If you modify your computer you should verify that YOUR power supply can also support the added load.

CMOS RAM chips mainly use power when they are being 'ACCESSED' or 'CHANGING STATE' therefore only ONE chip at a time, will present any significant load to the power supply.

Data sheets for the HM6264LP RAM chips state that the typical operating current consumption is 60 mA (110 mA MAX.)

Load on the +5V supply varies depending on whether the SPEECH SYNTHESIZER is attached, which module is plugged in, (the Extended Basic module appears to use most power) and which particular function is being performed by the processor.

We measured current drain on the +5V supply with a digital meter to get some idea of the average (NOT PEAK) current consumption and obtained the following results.

Bare Console	925 mA
Extended Basic Module	90 mA
Speech Synthesizer	45 mA

Total	1060 mA

We then measured the 'apparent' extra current used by the 32k memory expansion, whilst using the computer for some typical tasks. (When idle the 32k

expansion produced a negligible load of 25 Micro Amps.)

Using Disk Manager ---	1 to 4 mA
TI-WRITER Loaded, Idle ---	2 mA
" " " Loading Text ---	7 mA
" " " Key Pressed ---	19 mA
" " " Finding Strings	21 mA
Ext. Basic Run Music Prog.	19 mA
M/L Program 'Locked up' --	28 mA

At no stage did the measured EXTRA current exceed 30 mA or 3% of the maximum total unexpanded consumption.

Whilst these figures are not claimed to be comprehensive or accurate, they indicate that the power supply of the computer should be able to cope with the extra load of the RAM chips for most applications.

In our next article we will provide details of a reliable non-corrupting, self charging battery backup for the full 32k expansion.

CONCLUSION.

We would like to hear from other TI-99/4A users who have created useful mods for their computers and expansion systems or from anyone with ideas for other hardware improvements, in the 'PRACTICAL - TO - CRAZY' range.

In return we will put you on the mailing list for details of our future projects. Write to :-

'WESTRALIAN INSTRUMENTS.'
P.O. Box 246, Mt. Lawley,
WESTERN Australia. 6050.
(Home of the America's Cup!)

TEL.092718642. SOURCE-ID TI0147

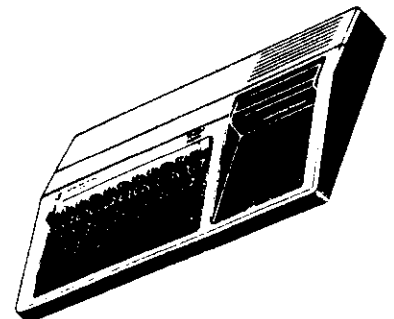
This project provided a great deal of enjoyment for the staff at WESTRALIAN INSTRUMENTS and we hope that anyone attempting it, will receive the same thrill we did, when we typed 'SIZE' in Extended Basic and received the message :-

13928 Bytes of Stack Free
24488 Bytes Program Space Free

Not to mention the satisfaction from being able to use TI-LOGO with 'JUST' a console, monitor and cassette recorder.

GOOD LUCK !!!

Bernie Elsner and Phil West.



TIPS FROM THE TIGERCUB

#16

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156 Collingwood Ave.,
Columbus OH 43213

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These Tips are being mailed, together with my new catalog #5, to every Users Group that I know of. I hope that you will make both the Tips and the catalog available to your membership. I am sorry that I cannot take out paid ads in your newsletters, but to advertise in each one of them would cost me more than I have made in the past 6 months, and I would not get enough business to break even.

If you would like to continue receiving these Tips, put me on the mailing list for your newsletter, and give me some indication that my Tips are really reaching your members and not going into someone's private file. If I receive enough business from this mailing to pay for its cost, I will then continue to send you my Tips. If not, this will be the last issue of the Tips from the Tigercub.

Copies of my catalog are available for \$1.00, which is deductible from your first order. I have over 130 absolutely original quality programs in Basic, many of them now also available in XBasic, on cassette or disk for only \$3.00 each plus \$1.50 per order for cassette, package and postage, or \$3.00 for diskette, package and postage (higher overseas). I give one-day service, I give bonuses for repeat orders, I give bonus programs on diskette orders.

In addition, any User's Group member who mentions his/her users' group when sending me an order before 1 Jan. 1985 may deduct 10% from the cost of the programs.

Tips from the Tigercub #1 thru #14 are now available, with more added, as a diskfull of 50 programs, routines and files for only \$15 postpaid.

I have also now completed my NUTS & BOLTS disk of 100 XBasic utility subprograms in MERGE format, ready to merge into your own programs, for just \$19.95 postpaid.

In The last Tips, I mentioned that I wished I knew who to credit for that remarkable routine to redefine the cursor. Dave Peden has written me that credit should be given to Terry L. Atkinson of 28 Savona Ct., Dartmouth, NS B2W 4R1 CANADA.

And I would like to strongly recommend that you support the 99's Users Group Association, 3535 So. W st., #93, Bakersfield CA 93304. They are a strictly non-profit group, devoting a lot of time and effort to helping us all, and they publish a great newsletter..

Every Tips must include a bit of music, and my grandson has requested that I pass this one on to all other two-year olds.

```
100 !ALPHABET SONG - by Jim Peterson
110 DIM N(21)
120 CALL MAJORSKALE("C",N())
130 CALL SCREEN(5):: DISPLAY
  AT(24,1)ERASE ALL:"READY -
  TYPE THE ALPHABET" :: CALL M
  AGNIFY(2)
140 CALL KEY(3,K,ST):: IF (S
  T<1)+(K<65)+(K>90)THEN 140 :
  : CALL SPRITE(01,K,16,96,120
  ):: IF K=87 THEN GOSUB 220 E
  LSE GOSUB 200
150 IF (K=90)*(FLAG=0)THEN 1
  60 ELSE 140
160 FLAG=1 :: M#="C11556605C
  443322D1" :: T=150
165 FOR J=1 TO 18 :: CALL SP
```

```
RITE(0J,64+J,INT(1118RND*6),9
6,128,J*5,J*5)
170 X=ASC(SE6$(M$,J,1)):: IF
  X>58 THEN T=150*(X-64):: 60
  TO 190
180 X=X-48 :: CALL SOUND(T,N
  (X),0)
190 NEXT J :: FLAG=0 :: CALL
  DELSPRITE(ALL):: GOTO 140
200 Y=VAL(SE6$("115566544332
  22215543325332",K-64,1))
210 CALL SOUND(500,N(Y),0)::
  RETURN
220 CALL SOUND(500,N(5),0)::
  CALL SOUND(500,N(5),5):: CA
  LL SOUND(500,N(4),0):: RETUR
  N
230 SUB MAJORSKALE(K$,N())
240 F=VAL(SE6$("110123131147
  165175196",POS("ABCDEF6",K$,
  1)*3-2,3))
250 C$="101011010101010101
  010110101010101"
260 FOR J=1 TO 36 :: IF SE6$
  (C$,J,1)="0" THEN 280
270 X=X+1 :: N(X)=F*1.059463
  094^(J-1)
280 NEXT J :: SUBEND
  Lines 230-280 of that routine
  are an example of the kind of
  handy-dandy subprograms you will find
  on my Nuts & Bolts disk.
  We haven't had a Tigercub
  Challenge for some time, so -
  How can you store a hundred or
  more values of any size, positive or
  negative, integer or non-integer,
  even in exponential notation, without
  dimensioning an array or opening a
  file?
  Now, how can you link your
  program to another by a RUN
  statement, thereby losing all data,
  and recover those values? Yes, I know
  you can save them on the screen and
  read them back, but can you find a
  better way?
  Here's a little demo program of
  how motion can be created by the
  repetitive redefinition of
  characters. I call it ETERNITY.
  100 CALL CLEAR :: CALL SCREE
  N(2):: CALL COLOR(1,16,1)::
  CALL CHAR(33,"",34,"",35,"",
  36,"")
  120 FOR R=1 TO 12 :: CALL HC
```

TIPS FROM THE TIGERCUB

#25

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TIGERCUB SOFTWARE
156 Collingwood Ave.
Columbus, OH 43213

Distributed by Tigercub Software to TI-99/4A Users Groups for promotional purposes and in exchange for their newsletters. May be reprinted by non-profit users groups, with credit to Tigercub Software.

The entire contents of Tips from the Tigercub Nos. 1 through 14, with more added, are now available as a full disk of 50 programs, routines and files for just \$15.00 postpaid!

Nuts & Bolts is a diskfull of 100 (that's right, 100!) XBasic utility subprograms in MERGE format, ready for you to merge into your own programs. Contents include 13 type fonts, 14 text display routines, 12 sorts and shuffles, 9 data saving and reading routines, 9 wipes, 8 pauses, 6 music, 2 protection, etc., and now also a tutorial on using subprograms, all for just \$19.95 postpaid!

And I have about 140 other absolutely original programs in Basic and XBasic at only \$3.00 each! (plus \$1.50 per order for cassette, packing and postage, or \$3.00 for diskette, PPM) I will send you my descriptive catalog for a dollar, which you can then deduct from your first order.

Many of the users groups are taking a summer break, so I thought I would do the same. I'm going to mail out the July and August issues of the Tips in June (imagine, a TI publication

AHEAD of schedule!!) and then go fishing. However, if anyone should by any chance decide to send me an order during the summer, they will still get my same-day service.

It seems that I had better clear up a few misunderstandings. The "freeware" offers I have mentioned in past Tips are NOT available from me - send your disk and returnable mailer AND RETURN POSTAGE to the author of the program.

And, my copyrighted Tigercub Software programs are NOT freeware. They can only be legally obtained by mail order from me - if you copy them from anyone else, you are stealing!

As for the programs which I write and publish or distribute without copyright, they are also not Freeware, they are FREE. I don't want to be paid for them, and I don't think anyone else should be paid for them.

Some users groups are putting my copyrighted programs, and those of other programmers, in their software library, "for use but not copying" or "for review and evaluation only". Who do you think you're kidding? I know I won't sell any software to members of pirate clubs, so why should I support them?

If you didn't solve the Long Division Puzzle in Tips #24, try dividing 230709 by 835. As for the solution to the Tigercub Challenge, it was right on the same page! Try creating those DATA statements with the LINEWRITER routine. I don't know why it works, but it does.

I've been asked to print more information on the "program that writes a

program". I don't have room for a detailed account, but here are the basics. If you tried my TOKENLIST routine in Tips #23 you already have a list of the token codes you will need.

I won't go into the way that the computer squishes a program line number into only two characters, but you can accomplish it with DEF L\$=CHR\$(INT(LN/256))&CHR\$(LN-256*INT(LN/256)), where LN has been predefined as the value of the line number.

If you need to refer to a program line in a statement, as in GOTO 500, use DEF R\$=CHR\$(201)&CHR\$(INT(RN/256))&CHR\$(RN-256*INT(RN/256)), RN being the line number.

To print a statement or command, simply print its token character. For instance, the token for DATA is 147, so you would print CHR\$(147). Note that all the punctuation marks used in programming, such as { and +, are also represented by token codes which are NOT the same as their keyboard ASCII value.

To print a variable name, either numeric or string, just enclose it in quotes, "A" or "A\$".

To print a value, or an unquoted string (as in a DATA statement), or the word which follows a CALL, you must print CHR\$(200) followed by a token giving the number of characters to follow, such as CHR\$(5) for a 5-character word such as CLEAR, then the value in quotes. For instance, the token for CALL is 157, so CALL CLEAR is CHR\$(157)&CHR\$(200)&CHR\$(5)&"CLEAR".

You can simplify that by predefining DEF U\$(V\$)=CHR\$(200)&CHR\$(LEN(V\$))&V\$, and then simply print CHR\$(157)&U\$("CLEAR").

A quoted string is handled in the same way

except that it is preceded by token 199 instead of 200, so you can predefine it as DEF Q\$(V\$)=CHR\$(199)&CHR\$(LEN(V\$))&V\$ - the computer will take care of the quote marks.

Each program line must end with CHR\$(0), and the last record you print must be CHR\$(255)&CHR\$(255).

A MERGE format file is D/V 163, so open the file with OPEN #1:"DSK1.MERGEFILE", VARIABLE 163.

Don't print more than 163 characters in a record or the computer will blow its mind! You can print multiple-statement XBasic lines, but be sure to use the double-colon token CHR\$(130) as the separator, not two of the CHR\$(181) colon tokens.

Any errors you make will usually not show up until you try to MERGE or use the program you have created. I/O ERROR 25 means that you forgot the final 255 & 255; DATA ERROR or SYNTAX ERROR probably means that you left off a CHR\$(0) or gave the wrong count of characters after CHR\$(200).

Here's a bit of psychedelic blues - -

```
100 REM - FRANKIE & JOHNNIE
      by Jim Peterson
110 DIM S(12)
120 CALL SCREEN(2)
130 FOR R=1 TO 12
140 CALL COLOR(R+1,1,1)
150 FOR T=R TO 25-R
160 CALL HCHAR(T,R,32+R*8,34-2*R)
170 NEXT T
180 NEXT R
190 DATA 262,294,311,330,349
    ,392,440,494,523,587,40000
200 FOR N=1 TO 11
210 READ S(N)
220 NEXT N
230 FOR J=1 TO 110 STEP 2
240 CALL COLOR(A+1,1,1)
250 READ T,A
260 CALL COLOR(A+1,A+2,A+2)
```

```

HAR(R,R+4,33,26-R*2):: NEXT
R
150 FOR R=13 TO 24 :: CALL H
CHAR(R,29-R,34,(R-12)*2):: N
EXT R
180 FOR C=5 TO 16 :: CALL VC
HAR(C-4,C,35,34-C*2):: NEXT
C
210 FOR C=17 TO 28 :: CALL V
CHAR(29-C,C,36,C*2-33):: NEX
T C
225 FOR J=0 TO 7 :: A$(J+1),
B$(8-J)=SEB$("00000000000000
",1,2*J)*"FF" :: NEXT J
230 C$(1),D$(8)=RPT$("80",8)
:: C$(2),D$(7)=RPT$("40",8):
: C$(3),D$(6)=RPT$("20",8)::
C$(4),D$(5)=RPT$("10",8)
240 C$(5),D$(4)=RPT$("08",8)
:: C$(6),D$(3)=RPT$("04",8):
: C$(7),D$(2)=RPT$("02",8)::
C$(8),D$(1)=RPT$("81",8)
250 FOR C=2 TO 15 :: FOR J=1
TO 8 :: CALL CHAR(33,A$(J),
34,B$(J),35,C$(J),36,D$(J)):
: NEXT J :: CALL SCREEN(C)::
NEXT C :: GOTO 250

```

Next, I would like to share with you a gem of a "why didn't I think of that" routine which John Taylor sent me.

```

100 ! 28 COLUMN TEXT ROUTINE
IN EXTENDED BASIC (EASILY
CONVERTED TO BASIC) BY JULIE
PACK, B.U.G., P.O. BOX 1402
PALM BAY, FL 32906
110 ! ENHANCED BY JET
SHOALS 9Y'ERS, P.O. BOX 2928
MUSCLE SHOALS, AL 35662
120 CALL CHAR(64,"00282828")
130 ! PROGRAM TO COPY STARTS
HERE
140 CALL CLEAR :: X=-1
150 RESTORE
160 IF X>=21 THEN X=1 :: CAL
L WAIT
170 READ MESS$
180 IF MESS$="P" THEN DISPLA
Y AT(X+2,1):Z$ :: X=X+4 :: Z
$="" :: GOTO 160
190 IF MESS$="ZZZ" THEN DISP
LAY AT(X+2,1):Z$ :: CALL WAI
T :: END
200 IF LEN(Z$)>0 THEN MESS$=
Z$&" *MESS$
210 X=X+2
220 IF X>=21 THEN X=1 :: CAL
L WAIT

```

```

230 IF LEN(MESS$)<29 THEN DI
SPLAY AT(X,1):MESS$ :: Z$=""
:: GOTO 160
240 FOR A=1 TO 29
250 I=POS(MESS$," ",A)
260 IF (I=0 OR I>29) AND A=1
THEN A,J=29 :: GOTO 290
270 IF I=0 OR I>29 THEN A=29
:: GOTO 290
280 J,A=I
290 NEXT A
300 IF X>=21 THEN DISPLAY AT
(X,1):SEG$(MESS$,1,J-1):: X=
-1 :: CALL WAIT :: GOTO 320
310 DISPLAY AT(X,1):SEG$(MES
S$,1,J-1)
320 IF SEG$(MESS$,J,1)=" " T
HEN I=1 ELSE I=0
330 Z$=SEG$(MESS$,J+1,163)::
MESS$=Z$ :: IF LEN(Z$)>28 T
HEN X=X+2 :: GOTO 240
340 GOTO 160
350 DATA "THIS SHORT ROUTINE
WILL ENABLE YOU TO WRITE LO
NG TEXT MATERIAL IN YOUR DAT
A STATEMENTS SO YOU WON'T HA
VE TO WORRY ABOUT COUNTING"
360 DATA "THE LENGTH OF YOUR
SENTENCES ALL THE TIME. TH
IS ROUTINE WILL AUTOMATICALL
Y EDIT YOUR TEXT TO FIT A 28
COLUMN SCREEN."
370 DATA "A SUGGESTION- IT I
S A GOOD IDEA TO PUT A QUOTE
AT THE BEGINNING AND END OF
THE DATA STATEMENTS SO YOU
WON'T HAVE TO WORRY ABOUT"
380 DATA "COMMAS LIKE THIS ,
,, AND THEY WILL REMAIN IN Y
OUR TEXT PROPERLY."
390 DATA "THIS ROUTINE WILL
ALSO CLEAR THE SCREEN (WHEN
FILLED) AND CONTINUE READING
YOUR DATA AND DISPLAYING YO
UR TEXT ON THE NEXT SCREEN."
400 DATA P
410 DATA " TO START A NEW P
ARAGRAPH ENTER THE LETTER @P
@ AS A SEPERATE DATA STATEME
NT, THEN INDENT YOUR TEXT ON
YOUR NEXT NEXT DATA"
420 DATA "STATEMENT 2 OR 3 S
PACES (IF DESIRED).",P,"TO S
KIP LINES",P,"JUST ENTER @P
@",P,"WHERE EVER YOU WANT TO
",P,"SKIP."
430 DATA P,"MAKE SURE THAT Y
OUR VERY LAST DATA STATEMENT

```

```

IS @ZZZ@. AND JUST REPLACE
THESE DATA STATEMENTS WITH"
440 DATA "YOUR DNM.",P,"YOU'
LL ALSO FIND THIS ROUTINE IS
MOST USEFUL WHEN CONCATENAT
ING STRINGS, E.G., @ELIZAE T
YPE PROGRAMS-",P
450 DATA "AN EXAMPLE:",P,"A$
=@JACK AND JILL WENT UPE",B
$=@THE HILL TO FETCH A@,"C$
=@PAIL OF WATER.@",D$=A$&B$
&C$&D$,"PRINT D$",P
460 DATA "JACK AND JILL WENT
UP THE HILL TO FETCH A PAIL
OF WATER.",P,P,P,"HAPPY PRO
GRAMMING!"
470 DATA ZZZ
480 SUB WAIT
490 DISPLAY AT(24,8):"PRESS
ANY KEY"
500 CALL KEY(0,K,S):: IF S=0
THEN 500 ELSE CALL CLEAR
510 SUBEND

```

Thank you, Julie and John. This is becoming one of the most useful routines on my utility disk. I was preparing a disk of PD programs for our UB library. Some of them needed extra instructions, so I typed them out on TI-Writer, so that people could run them off on their printer. Then I remembered that some folks don't have printers. So -

```

50 CALL CLEAR :: INPUT "FILE
NAME? DSK1."?:F$
60 DIM B$(150):: OPEN #1:"DS
K1."&F$.INPUT, DISPLAY .VAR
TABLE 80
70 A=A+1 :: LINPUT #1:B$(A)
80 IF EOF(1)=1 THEN B$(A+1)=
"ZZZ" ELSE 70
and change line 170 to -
170 @=@+1 :: MESS$=B$(@)

```

And there you have a quickie program to check out those DIS/VAR BO files that show up on your disks under filenames that you can't remember using.

MEMORY FULL IN LINE 32767


```

270 FOR TT=1 TO T
280 CALL SOUND(-999,S(A),0)
290 NEXT TT
300 NEXT J
310 RESTORE 330
320 GOTO 230
330 DATA 2,1,2,2,2,4,2,7,1,1
1,1,7,2,6,4,4,2,1,1,11,13,1
340 DATA 2,1,2,2,2,4,2,7,1,1
1,1,7,2,6,4,4,12,1
350 DATA 1,11,3,1,2,5,2,6,2,
7,2,9,1,11,1,9,2,10,4,7,1,9,
1,11,7,9
360 DATA 4,7,2,8,2,9,1,11,3,
9,1,11,1,9,4,8,2,7,6,6
370 DATA 4,4,1,11,3,4,4,3,16
,2,1,11,4,7,2,6,4,7,4,6,20,1
,8,11

```

You can too have a blank space in your disk filenames! Just use FCTN V for the blank, instead of the space bar. You can even have a diskfull of 10 programs with invisible filenames consisting of 1 to 10 of those FCTN V's.

However, those invisible characters can do strange things when you list your disk catalog to a printer.

If you want to INPUT a string with leading and/or trailing blanks, just enclose the whole works in quotation marks. Try this -

```

100 INPUT A$ !type TEST
110 PRINT A$;LEN(A$)
120 INPUT A$ !type " TEST "
130 PRINT A$;LEN(A$)
140 GOTO 100 !you can even
input a blank string of 136
characters

```

I really shouldn't tell you this, but if you want to make it difficult for someone to LIST your program, just insert a garbage line, every 5th line or so until you run out of memory, consisting of REM followed by 4 or 5 lines of random characters typed with the CTRL key held down.

Here's a program that

```

can actually read your mind!
100 CALL CLEAR
110 PRINT "TIGERCUB MIND READER PROGRAM":
120 PRINT "I'll bet you a dollar I can guess what you are thinking.":
130 GOSUB 440
140 PRINT "And I'll bet another dollar I can tell if what you are thinking is correct.":
150 GOSUB 440
160 PRINT "And I'll bet another dollar I'm right BOTH times.":
170 GOSUB 440
180 PRINT "And I'll bet one more dollar I can guess what you'll be thinking a minute from now.":
190 GOSUB 440
200 PRINT "OK....":
210 GOSUB 480
220 PRINT "You're thinking that a computer can't possibly know what you are thinking.....right?":
230 GOSUB 480
240 PRINT "So I told you what you were":"thinking.....right?":
250 GOSUB 480
260 PRINT "You owe me a buck.":
270 GOSUB 480
280 PRINT "And you're absolutely right..I can't read your mind.":
290 GOSUB 480
300 PRINT "So I told you correctly that":"what you were thinking was":"correct.....right?":
310 GOSUB 480
320 PRINT "You owe me another buck.":
330 GOSUB 480
340 PRINT "So I was right BOTH times...right?":
350 GOSUB 480
360 PRINT "That makes three bucks you owe me.":
370 GOSUB 480
380 PRINT "And now it's a minute later":"and you're thinking you've":"been played for a sucker....":"...right?":

```

```

390 GOSUB 480
400 PRINT "...so you owe me four bucks.":
410 GOSUB 480
420 PRINT "NEVER NEVER bet against a computer!!"
430 END
440 PRINT "Want to bet? Type Y(Yes)":
450 CALL KEY(3,K,ST)
460 IF (ST=0)+(K<>89)THEN 450
470 RETURN
480 FOR D=1 TO 800
490 NEXT D
500 RETURN

```

Since the manual doesn't mention it, some folks don't know that you can use IMAGE and PRINT USING for output to the printer. Try this -

```

100 OPEN #1:"PIO"
110 INPUT "NAME? ":N$
120 INPUT "AMOUNT? ":A
130 PRINT #1,USING "#####
#####
.##":N$,A
GOTO 110

```

Of course, you could also add a line -

```

105 IMAGE "#####
#####.##"

```

And change line 130 to

```

130 PRINT #1,USING 105:N$,A

```

John Taylor has written the most complete and versatile SPRITE BUILDER utility program that I have ever seen. It has 22 different options available with a single key press, including rotation and animation. And along with it comes a diskfull of preprogrammed sprites designed by a professional artist. This is being distributed as Freeware. Send two single-sided or one double-sided disks to John Taylor, 2170 Estaline Drive, Florence AL 35630, in a returnable mailer WITH RETURN POSTAGE, at least - and I hope you'll also include something more!

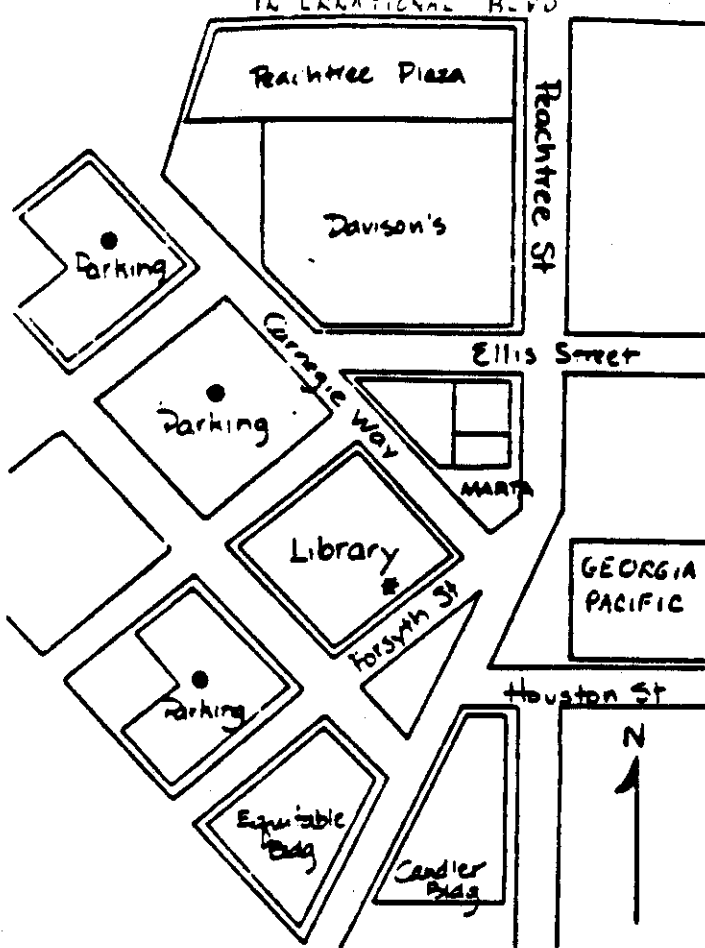
Attention, assembly programmers! Fred Hawkins of the Lehigh U6 is trying to coordinate a project of documenting the operating system by breaking the console ROM down to pages of 256 bytes so that each individual or group can work on just one page. Only those who participate will share in the results! All this is far beyond me, but if you want in, send an SASE and a SSSD disk with return postage and mailer to Fred Hawkins, 1020 N 6th St, Allentown PA 18102 - soon!

If you have a program on disk which is so long that you must type CALL FILES(1) before you can load it, add several program lines to it consisting of REM and any key you want to hold down for 5 lines. Then SAVE it back to the disk; it will now be in INT/VAR 254 format and will load without CALL FILES(1). If you then need sometime to make a cassette copy, just delete those lines and SAVE it back to disk again.

If a program loads, but gives you a MEMORY FULL IN LINE ... when you try to run it, it has used up all available memory while reading DATA into arrays or performing other internal calculations. If it runs for some time and then gives you the MEMORY FULL message, it is because you have repeatedly jumped out of a FOR...NEXT loop with an IF...THEN...GOTO before the loop is completed. This rarely happens but it can, especially when you repeatedly jump out of the innermost of several nested loops.

MEMORY FULL

Jim Peterson



Atlanta
99/4A
Computer
Users
Group

NEXT MEETING:
SUNDAY, SEPT. 15
ATLANTA PUBLIC LIBRARY
3:00 P.M.

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