

ENGINEERING NOTES
on
Radio Shack Color Computers

August 1985
Vol. 2 No. 7

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- * 256K ROMDISK REVIEW
- * ADDRESS FILE PROGRAM
- * STUDY PROGRAM
- * LINE DEMO PROGRAM

- * LARGE MEMORY PROGRAMS (Part 7)
- * WRITING PROGRAMS (Part 6)
- * OPERATING HINTS

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- * NEW PRODUCTS
- * PRODUCT REVIEWS

DYNAMIC COLOR NEWS is published monthly by DYNAMIC ELECTRONICS, INC., P.O. Box 896, Hartselle, AL 35640, phone (205) 773-2758. Bill Chapple, President; Alene Chapple, Sec. & Treas.; John Pearson, Ph. D. Consultant; Bob Morgan, Ph. D., Consultant.

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The purpose of this newsletter is to provide instruction on Basic & Machine Language programming, Computer theory, operating techniques, computer expansion, plus provide answers to questions from our subscribers.

The submission of questions, operating hints, and solutions to problems to be published in this newsletter are encouraged. All submissions become the property of Dynamic Electronics if the material is used. We reserve the right to edit all material used and not to use material which we determine is unsuited for publication.

We encourage the submission of Basic and Machine Language Programs as well as articles. All Programs must be well documented so the readers can understand how the program works. We will pay for programs and articles based upon their value to the newsletter. Material sent will not be returned unless return postage is included. Basic & ML programs should be sent on a tape or disk & comments should be sent as a DAT or BIN file.

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*   DYNAMIC   COLOR   NEWS
*
*       August 1985
*
*   Editor and Publisher
*       Bill Chapple
*
*       Secretary
*       Deanne Hill
*
*****
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*****
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* VR-1M Plug in module mounts under VDG chip. $24.95 *
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EDITOR'S COMMENTS

The other day I heard some hams on my ham radio set talking about how great it is that Commodore has come out with a 128K computer. Two years ago this Fall we introduced 128K memory expanders for color computers. Now we are using a 256K upgrade which we purchased. The point I want to make is that accessories for color computers are available to make them do anything that other computers will do. There is not much advertised publicity about these accessories because Radio Shack has not promoted their color computers except as a game or beginner's computer. If you don't believe this go to your nearest Radio Shack store and ask them when a 128K or 256K memory upgrade will be available. The answer you get will vary depending upon which store you are in. They have "OS-9" plus many other fine programs but this fact is not well known to the average person. The impression I get from them is that color computers are OK for beginners and to use in classrooms, but you need a more powerful computer for other serious applications. There is very much support for Commodore computers in visual locations such as discount stores and magazines. Nearly all of the hams I talk with use Commodore computers and I believe that it is because of its publicity.

We know that the color computers can do what the Commodores can and usually much faster. The 6809E microprocessor in the color computers is hard to beat for speed and ease in writing assembly language programs. I am not against the Commodore computers but feel like someone should have done a better job of promoting the Radio Shack Color Computers.

If you need more than your computer does, don't trade it in. Look through the magazine advertisements and you will probably find exactly what you need as an accessory for your computer.

We have received several products for review. Spectrum Projects was the first and sent us three products a few weeks before anyone else. This is the reason that we review one of their products last month and another one this month. Next month we will have several product reviews.

Also we received products to review from Tom Mix Software, Computer Systems Distributors, and CoCo Devices. I want to thank each of these companies for their support.

We are continuing with our programming instruction, large memory programs, and graphics series. Since it is time to think of school again we are including a study program. This will help you memorize facts for your classes.

We are combining several programs from the last few issues into a single tape or disk so you don't have to do the typing. This will include the programs for using the other 32K memory bank, the 64K all ram program, the character generator program, plus a few more of the shorter programs. Look for our advertisement in this issue if you want these programs.

I want to thank the companies who have placed advertisements with us. If you buy from them, let them know that you saw their advertisement here so they will continue. This helps us and will allow us to expand the newsletter to offer you more.

Dealers we are looking for mailing lists. We would be interested in a joint mailing effort where we will mail your catalogs or brochures with our newsletter using our bulk rate mail permit. If you will send

us at least 200 names of people who have inquired about or purchased your products and your catalog or brochures, we will mail them for you. Either send printed address labels or send the names as an ASCII file so we can print the labels with our computer.

We need letters from you telling us what you would like for us to cover. Without your input we can only guess. So take a few seconds and tell us what you would like.

WRITING PROGRAMS (PART 6)

This is a series on how to write programs. Each month we will cover new material and give examples to show how to use the material.

ARRAYS

We have been discussing putting information in arrays. We can think of an array as being composed of rows and columns. An example we used was for a teacher with a grade book. The names of the students would be in the first column and the grades in the other columns. A dimension (DIM) statement is required for arrays. Within the DIM statement the number of elements in each array has to be defined. Following is a DIM statement

```
10 DIM X$(100), X(50), W(200)
```

Statement 10 defines a string array with 100 elements plus two numerical arrays of 50 and 200 elements. The advantage for using arrays is the small amount of programming required to use the information in the arrays. A FOR - NEXT loop can be used to recall the information for calculations or printing to the screen or to a printer.

IF - THEN TESTS

We use IF - THEN tests to compare things. If the test is not true then we go to the next statement. If the test is true then we do the rest of the commands within the statement. This is very powerful.

```
20 IF A=B THEN C=100: K=K+1:  
W=0: GO TO 500
```

For statement 20, if A is not equal to B then the program would go to the next statement after 20. If A=B then all of the commands in statement 20 would be executed. Then the program would go to statement 500.

SUBROUTINES

A subroutine is just a small program within a program. Subroutines are used when it is necessary to repeat an operation many times. To write a subroutine just start at the statement number and write the statements like you would any basic program. The last statement in a subroutine is the "RETURN" command.

To call a subroutine at statement 2000 just enter "GO SUB 2000".

```
30 GO SUB 2000  
40 ?"THESE ARE THESE RESULTS"
```

Subroutines are very easy to use and we will show how they are used in our example address file program.

ADDRESS FILE PROGRAM DEVELOPMENT

Last month we discussed a method of generating an address file. We also discussed how the file could be searched for an unknown address. This month we want to continue and give a working address file program.

In designing any program it

is necessary to define what the program is to do and how the information is to be presented. Let's define the following for our address file:

1. Person's first & last name N\$(X).
2. The street or post office box A\$(X).
3. The telephone number T\$(X).
4. The city C\$(X).
5. The state S\$(X).
6. The zip code Z\$(X).

We will carry the information in READ and DATA statements. When using DATA statements it is required that the information be perfectly ordered. Therefore we will use one data statement for all of the information for one address. A typical data statement will be as follows:

```
2000 DATA Jim Jones, 225 First
      Street, (205) 773-7575,
      Hartselle, AL, 35640
```

Notice that the six data elements are separated by commas.

PRINTER

For those who have a printer it will be desirable to print addresses. To print to a printer use a statement similar to the following:

```
50 IF P=1 THEN ?#-2, N$(J)
```

An option in the first menu will set the printer status. If P=0 then the printer is off and if P=1 then the printer is on. Therefore we can write the program to work with or without a printer.

PRINT SUBROUTINE

Our program will look for a match comparing a telephone number, zip code, city, or state. Rather than include the print commands in each of these sec-

tions we wrote one print subroutine that we call whenever we want to print the information for an address.

EMPTY STRING

An empty string is a string with no characters. This is used to force the computer to wait for a keyboard key to be pressed. An example follows:

```
30 W$=INKEY$: IF W$="" THEN 30
```

When statement 30 is reached the computer will stay in statement 30 until a key is pressed. This forces the computer to wait for you.

ADDRESS FILE PROGRAM

This is a useful address program that will print mailing labels, search for an address by comparing a name, telephone number, zip code, city, or state. Comments are included to explain what each section does.

ADDRESS FILE PROGRAM LISTING

```
10 'ADDRESS FILE PROGRAM
20 'PROGRAM 8-1-85
30 'COPYRIGHT (c) 1985
40 'DYNAMIC eLECTRONICS INC.
50 'SET UP FOR ARRAYS
60 X=100
70 DIM N$(X),A$(X),T$(X),
    C$(X),S$(X),Z$(X)
80 'READ THE DATA
90 FOR J=1 TO X
100 'THE NEXT STATEMENT CHECKS
110 'FOR THE LAST ENTERED NAME
120 READ N$(J): IF N$(J)="
    THEN 160
130 'READ THE REST OF THE
    INFORMATION
140 READ A$(J),T$(J),C$(J),
    S$(J),Z$(J)
150 NEXT J
160 'SAVE THE NUMBER OF
    ADDRESSES IN THE FILE
170 Y=J
```

```

180 CLS:PRINT"SELECT THE
    FEATURE YOU WANT
190 ' SET PRINTER TO 0 IF P>1
200 IF P>1 THEN P=0
210 'DEFINE PRINTER STATUS P$
220 IF P=1 THEN P$="ON" ELSE
    P$="OFF"
230 'P$ IS FOR THE PRINTER
    STATUS
240 'THIS IS A MENU
250 PRINT"PRINTER IS "P$
260 PRINT"1 CHANGE PRINTER
    STATUS
270 PRINT"2 PRINT ALL ADDRESSES
280 PRINT"3 SEARCH FOR
    ADDRESSES
290 'WAIT UNTIL A KEY IS
    PRESSED
300 V$=INKEY$:IF V$="" THEN 300
310 'V$=KEY PRESSED (STRING)
320 'ADD 1 TO P TO CHANGE THE
330 'PRINTER STATUS
340 IF V$="1" THEN F=P+1: GO TO
    180
350 IF V$="2" THEN 370
360 IF V$="3" THEN 460
370 PRINT"THIS PRINTS ALL
    ADDRESSES
380 FOR J=1 TO Y
390 'GO TO SUBROUTINE TO PRINT
400 'THE ADDRESSES
410 W=J: GO SUB 790
420 NEXT J
430 PRINT"PRESS A KEY TO
    CONTINUE
440 K$=INKEY$: IF K$="" THEN
    440
450 GO TO 180
460 'THIS SEARCHES FOR A MATCH
470 PRINT"1 TELEPHONE NUMBER
480 PRINT"2 ZIP CODE
490 PRINT"3 CITY
500 PRINT"4 STATE
510 INPUT"ENTER NUMBER";N
520 'THIS IS THE EASY WAY TO DO
530 'BRANCHING. IF N=1 GO TO
540 'THE FIRST NUMBER, IF N=2
550 'GO TO THE SECOND
    NUMBER,ETC
560 ON N GO SUB 600,660,710,750
570 PRINT"PRESS A KEY TO
    CONTINUE
580 P$=INKEY$:IF P$="" THEN 580
590 GO TO 180
600 PRINT"SEARCH FOR TELEPHONE
    MATCH
610 INPUT"ENTER TELEPHONE
    NUMBER";T$
620 FOR W=1 TO Y
630 IF T$=T$(W) THEN GO SUB 790
640 NEXT W
650 RETURN
660 PRINT"ZIP CODE SEARCH
670 INPUT"ENTER ZIP CODE";Z$
680 'CHECK FILE FOR MATCH
690 FOR W=1 TO Y:IF Z$(W)=Z$
    THEN GO SUB 790
700 NEXT W: RETURN
710 'THIS SEARCHES FOR A CITY
    MATCH
720 INPUT"ENTER CITY";C$
730 FOR W=1 TO Y: IF C$(W)=C$
    THEN GO SUB 790
740 NEXT W: RETURN
750 'THIS SEARCHES FOR A STATE
    MATCH
760 INPUT"ENTER STATE";S$
770 FOR W=1 TO Y: IF S$(W)=S$
    THEN GO SUB 790
780 NEXT W: RETURN
790 'THIS PRINTS THE ADDRESSES
800 'RETURN IF EMPTY ADDRESS
810 IF N$(W)="" THEN RETURN
820 'FOR EACH PART OF THE
    FOLLOWING PRINT STATE
    MENTS, PRINT TO THE
    PRINTER IF P=1
830 PRINTN$(W): IF P=1 THEN
    PRINT#-2,N$(W)
840 PRINTT$(W): IF P=1 THEN
    PRINT#-2,T$(W)
850 PRINTA$(W): IF P=1 THEN
    PRINT#-2,A$(W)
860 PRINTC$(W);: IF P=1 THEN
    PRINT#-2,C$(W);
870 'PRINT THE COMMA BETWEEN
    CITY AND STATE
880 PRINT",,": IF P=1 THEN
    PRINT#-2,",,";
890 'ADD A SPACE AFTER THE
    STATE
900 PRINTS$(W)+" ";: IF P=1
    THEN PRINT#-2,S$(W)+" ";
910 PRINTZ$(W): IF P=1 THEN
    PRINT#-2,Z$(W)
920 PRINT: IF P=1 THEN
    PRINT#-2,CHR$(13)
930 RETURN
940 'DATA CAN BE ANYWHERE IN
    THE
950 'PROGRAM. PUT INFORMATION
    IN
960 'THE FOLLOWING ORDER.
970 'NAME,STREET, PHONE,CITY
980 'STATE, ZIP CODE
990 'PUT ALL INFORMATION FOR AN

```

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```

1000 'ADDRESS IN ONE DATA
1010 'STATEMENT FOR YOUR
      BENEFIT
1020 DATA Jim Jones,225 First
      Street,(205) 773-7575,
      Hartselle,AL,35640
1030 DATA Sam Stephens,1005
      Timberlake,(916) 388-7999,
      Tarytown, NJ, 01155
1040 'PUT AN EMPTY DATA STATE
      MENT AT THE END
1050 DATA , ,
    
```

```

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LARGE MEMORY PROGRAMS (Part 7)

In this series we have been looking at methods of utilizing large memories. For a standard 64K color computer only half of the memory can normally be used. We showed how to use the other 32K for basic programs. Also we gave an address file program where we stored addresses in the other 32K memory bank.

To use the second 32K memory bank, it is necessary to initia-

lize the memory bank for basic. This can be accomplished by transferring each byte from the first bank to the second bank. When we desired to use the second bank we exchanged all information in the two banks. This means that the first bank's information goes to the second bank and the second bank's information goes to the first bank. The reason we did this is that some of the features will not work in the second bank. For instance when you type commands from the keyboard, they are not displayed on the screen. However if you just want to go to the second bank and run the program in that bank, then this can be accomplished by a simple memory poke.

We also showed how a basic program can be continued in the second bank. The variables can not be transferred unless they are stored in memory somewhere. For example suppose we have a large finance program that requires more than 32K of memory. It is menu oriented and we can divide the program into 2 parts. Put one part in the first bank and the second part in the second bank. When you select features that are in the second bank, then the banks can be exchanged by the machine language subroutines we gave. This takes less than a second. The total length of your program can be about 55K or more depending upon whether you have extended or disk basic.

To save or load the program each half has to be saved and loaded separately. This is no problem since we can load one half, exchange banks, and then load the other half. For saving our results, we save one bank, exchange banks, and then save the other bank.

128K & Larger Memories

The procedure will be the

same for larger memories. There are two ways of handling large memories. The first way is to go to another memory bank and run the program or programs in that bank. That is the method we have been discussing for using the second bank in a 64K computer. If the larger memory is arranged so that different 64K segments can be selected, then do the memory pokes to select the desired section of memory. If you can run basic in any of the memory sections, then the techniques we have presented can be utilized.

A very good advantage of this method is that there is no additional software required. The basic that comes with the computer is the only software needed. All you have to do is the memory pokes to select the memory bank you want.

The second method is similar to a disk drive. With a disk drive the computer is always using the same memory. Information is brought from the disk drive into the computer's memory or taken from the computer's memory and placed on a disk. This requires quite a bit of software plus some RAM for the disk drive. A total of 8K of memory is allocated in the ROM area for the disk operating software.

RAM DISK DEVELOPMENT

Let's again look at the second 32K memory bank for a 64K computer. Suppose we just want to use it as a "RAM DISK" for storing programs. Let's look at writing an operating system. There are two types of programs which are basic and machine language. If we are to store programs in the second bank what do we have to know about them?

Basic programs have vectors that point to the beginning and ending of the program. The beginning is in 25 and 26, and the ending is in 27 and 28.

Also we would want to save the name of the program and have a menu that will tell us what programs are saved similar to a disk directory.

Machine language programs require 3 vectors which are the beginning, ending, and execution addresses. These values are located in memory at 487, 126, and 157. Basic programs can operate almost anywhere within the memory map but most machine language programs are designated for one memory location.

If the second 32K memory bank for a 64K computer is to contain programs it also needs to know where the programs are stored. Therefore we need to know where it begins and where it ends. So our program directory will need the following:

1. Beginning of program (2)
2. Ending of program (2)
3. Execution address (2)
4. Program name (8)

5. Beginning RAM (2)
6. Ending RAM (2)

The numbers in parenthesis are the bytes required. The total is 18 so if we allow 20 bytes for each program then we can easily keep up with what we have.

We might have a number of small programs that we would want to store in the second bank. Since each program will require 20 bytes, if we had a maximum of 20 programs then this would require 400 bytes which is not very much.

The machine language subroutines for linking the two banks will be less than 200 bytes. These we presented in earlier editorials.

This month we want to point out what is needed to write our own RAM disk to use the second 32K memory bank for program storage. Since basic is easier than machine language we will

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use basic for our control program. This program can be in either bank. If it is in the first bank then we don't have to initialize the second bank for basic and can use all of the RAM for storage. This is the approach we want to take.

There is much interest in this subject and we want to develop our RAM disk program with sufficient detail so that our readers can understand how it works.

STUDY PROGRAM

Since it is time to think about school again, we developed this program to help students with their studies. The program allows the student to list questions and answers in DATA statements. The computer can randomly pick the questions and the student give the answers or it can give the answers and the student give the questions.

The dimension(DIM) statement allows for 100 questions and answers but this number can be increased. Students don't worry about your studies as this program will help you.

```

10 CLS
20 PRINT"-- - STUDY PROGRAM - -
30 PRINT"PROGRAM 8-2-85
40 PRINT"COPYRIGHT (c) 1985
50 PRINT"dYNAMIC eLECTRONICS
   INC.
60 PRINT"ENTER QUESTIONS &
   ANSWERS
70 PRINT"USE FIRST PART OF A
   DATA
80 PRINT"STATEMENT FOR THE
   QUESTION
90 PRINT"& THE SECOND PART FOR
   THE ANSWER
100 DIM Q$(100),A$(100)
110 'READ QUESTIONS & ANSWERS
120 FOR K=1 TO 100
130 READ Q$(K),A$(K)
140 IF Q$(K)="" THEN 160

```

```

150 NEXT K
160 N=K-1 'N IS THE NUMBER OF
   QUESTIONS
170 PRINT"1 QUESTIONS THEN
   ANSWERS
180 PRINT"2 ANSWERS THEN
   QUESTION
190 INPUT"ENTER NUMBER";W
200 IF W=2 THEN 290
210 PRINT:X=RND (N)
220 PRINTQ$(X)
230 INPUT "ENTER ANSWER";A$
240 IF A$=A$(X) THEN PRINT
   "CONGRATULATIONS YOU GOT IT
   RIGHT":GO TO 210
250 CLS:PRINT"THE QUESTION WAS
   "Q$(X)
260 PRINT"YOU MISSED IT. THE
   CORRECT ANSWER IS "A$(X)
270 PRINT"YOU SAID "A$
280 GO TO 210
290 PRINT:X=RND (N)
300 PRINTA$(X)
310 PRINT"WHAT WAS THE
   QUESTION?"
320 INPUTQ$
330 IF Q$=Q$(X) THEN PRINT"YOU
   GOT IT RIGHT": GO TO 290
340 CLS:PRINT"YOU MISSED IT"
350 PRINT"THE ANSWER WAS "A$(X)
360 PRINT"THE QUESTION WAS
   "Q$(X)
370 PRINT"YOU SAID "Q$
380 GO TO 290
390 GO TO 210
400 DATA ATLANTA,GEORGIA
410 DATA JACKSONVILLE,FLORIDA
420 DATA BIRMINGHAM,ALABAMA
430 DATA CHICAGO,ILLINOIS
440 DATA SAN DIEGO,CALIFORNIA
450 DATA HOUSTON,TEXAS
460 DATA CHARLSTON,SOUTH
   CAROLINA
470 DATA MACON,GEORGIA
480 DATA NASHVILLE,TENNESSEE
490 DATA ,,

```

COMPUTER GRAPHICS (Part 7)

In previous issues we have been developing character generators using graphics. Last month we gave a character generator program that allowed

characters of 3 different sizes to be displayed on the screen. This would be useful for displaying messages and for many other displaying requirements.

Now we want to look at some of the extended basic graphics commands and learn how to plot graphs. A graph is a visual representation of results from an experiment or from events. We can plot mathematical equations. The boundary of physical surfaces can be represented by mathematical equations.

THE LINE

A line requires two points which we can designate as (X1,Y1) and (X2,Y2). The X components are for locations across and the Y components are for locations up and down the screen. To understand the way graphics is designed for color computers, let's define the following corner points:

- (0,0) Upper left point.
- (255,0) Upper right point.
- (0,191) Lower left point.
- (255,191) Lower right point.

THE LINE COMMAND

CC Basic has a command that draws lines on the screen. It has the following format.

```
LINE (X1,Y1)-(X2,Y2),PSET
```

For the preceding equation if the X components are the same value then the line is vertical, and if the Y components are the same then the line is horizontal. This is relatively easy to learn and implement. We are including a program that draws vertically, horizontally, and diagonally on the screen. Next month we will continue and look at more of the extended basic graphics commands.

```
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```

LINE DEMO PROGRAM

The following program will demonstrate drawing lines on the screen.

```
10 PRINT"LINE DEMONSTRATION
PROGRAM
20 PRINT"?COPYRITE (c) 1985
30 PRINT"DYNAMIC ELECTRONICS
INC.
40 PRINT"PROGRAM 8-3-85
50 CLS
60 PRINT"THIS DRAWS HORIZONTAL
LINES
70 GO SUB 330
80 GO SUB 310
90 FOR Y=0 TO 192 STEP 2
100 LINE (0,Y)-(255,Y),PSET
110 NEXT Y
120 FOR J=1 TO 2000: NEXT J
130 CLS
140 PRINT"THIS DRAWS VERTICAL
LINES
150 GO SUB 330
160 GO SUB 310
170 FOR X=0 TO 255 STEP 4
180 LINE (X,0)-(X,255),PSET
190 NEXT X
200 CLS:PRINT"THIS DRAWS
DIAGONAL LINES
210 GO SUB 330:GO SUB 310
220 FOR W=1 TO 191 STEP 2
230 LINE (0,W)-(W,0),PSET
240 NEXT W
250 GO SUB 330: GO SUB 310
260 FOR W=190 TO 0 STEP -2
270 LINE (W,0)-(0,W),PSET
280 NEXT W: GO SUB 330
290 END
300 'SET GRAPHICS MODE
310 PMODE 4,1:SCREEN
```

```

1,0:PCLS:RETURN
320 'DELAY SUBROUTINE
330 FOR P=1 TO 1000: NEXT
P:RETURN

```

```

+ ++ + ++ + ++ ++ ++ + ++ + ++ +
+
+      RENEWAL TIME?      +
+
+ The date beside your name on +
+ the address label indicates +
+ the last issue you will re- +
+ ceive. Send in your renewal +
+ if you want to continue re- +
+ ceiving technical informa- +
+ tion on Color Computers. +
+ This is the last issue for +
+ those with 8/85.      +
+
+ ++ + ++ + ++ ++ ++ + ++ + ++ +

```

PRODUCT REVIEWS

This section is open to all producers and dealers of color computer products. We will review your product free of charge and write an editorial on the product. We do not use a rating system but will explain what the product does, and what can be expected from it. Any comments about the review from the firm submitting the product will be printed in a later issue.

**THUNDER RAM (T-RAM)
256K Upgrade for D,E
& 285 computers**

Spectrum projects has introduced the first 256K RAM upgrade for Color Computers. It installs inside the computer and has many useful features. We will explain what the product does and what you can expect from it. Following is a summary of its features:

* It can be used as a "ram-disk" to serve the same purpose as an additional disk drive with

a speed of from 3 to 30 times faster.

* It can switch the video screen address to any bank allowing 30 or more h-res screens in memory at one time.

* Have up to 4 Basic 32K programs in memory at one time and chain back and forth between them.

* Perform machine language ramdisk I/O using Thunder-RAM.

* Move data into Thunder RAM without using any disk structure.

* Run machine language programs from any 32K bank and interface to basic.

* A printer buffer or spooler is included for up to 60K characters.

INSTALLATION

The package contains a circuit board, a set of 256K memory chips, a disk, and an instruction manual. It is advisable to read the instructions before attempting to install the kit.

The first thing is to remove several capacitors. A drawing is included that shows where the capacitors are located for the various models. These capacitors have to be cut and removed from the circuit board on the computer.

Next the 6809E microprocessor is removed and the T-RAM circuit board is plugged into its socket. The 4164 memory chips are removed and 256K chips are installed in the 4164 sockets. Under one of the chips a socket is installed that interfaces with the T-Ram circuit board. The 6883 SAM chip has to be removed and one pin bent out. A clip from the circuit board is connected to this pin. A clip

is also connected to pin 40 of the output connector. The wire on the clips is small and care must be taken not to break it.

OPERATION

Once the kit is installed the Thunder-Ram software can be enabled by poking &HFFFF,4 and then EXEC &HF000. A menu appears which gives the following options:

- 1) INITIALIZE RAMDISK
- 2) CHANGE DEFAULT DRIVE
- 3) CLEAR RAMDISK
- 4) START SPOOLER
- 5) RESET SPOOLER
- 9) RETURN TO BASIC

Thunder RAM requires one disk drive so this will be drive 0. The ramdisk can be initialized as any drive from 0 - 3. For a one drive system you would want to select the ramdisk as drive 1. So select 1 from the menu and then select a 1 when it asks for the drive number. Then select 9 from the menu to return to Basic. As a quick test enter

```
? DIR 1
```

and the same information will be printed to the screen as appears when a disk is just formatted.

RAMDISK FEATURES

The speed of the ramdisk is advertised to be from 3 to 30 times faster than a normal disk drive. We noticed quite an increase in the speed for loading and running some of our programs. For a one disk drive system you can backup a disk without any disk swaps. The disk needs to be copied into the ramdisk and then a copy of the ramdisk can be made onto a new disk. To copy a disk into the ramdisk just enter "BACKUP 0 TO 1".

The disk drive will come on and after about a minute or 2

the screen prints OK. You can then enter "DIR 1" and the contents of the ramdisk will be printed on the screen just like it is for a regular disk drive.

Now to make a copy of the ramdisk insert a formatted disk and enter "BACKUP 1 TO 0". After "OK" appears on the screen, a new disk with the ramdisk programs is ready.

Programs can be copied from the ramdisk to a disk and from a disk to the ramdisk. You can use this feature for cleaning up disks. This procedure is given in the disk operating manual.

The ramdisk works very nicely and performs the same as a disk drive at a much faster rate.

PRINT SPOOLER

The Thunder-RAM software called TDOS allows part of the memory to be used as a printer spooler. The instructions state that about 20K is reserved for this purpose. To check out the spooler we loaded an 8K basic program and went to the TDOS software by EXEC &HF000. We selected the "START SPOOLER" option and returned to basic. Then we started listing the program to our printer. Our printer has a 2K buffer and accepts characters at 9600 baud. In just a short time the printer's buffer will fill up. It took just a few seconds until the familiar "OK" appeared on the screen indicating that the printing task was completed. The TDOS buffer was obviously working. How nice it is to have a 20K printer buffer. This is a real time saver especially when you do a lot of writing.

"SEGMENTING" BASIC PROGRAMS

Instructions are included for reserving 4 banks of 32K each for basic programs. You can start a program in one bank and then continue it into another bank. All 4 banks can be linked

together with this approach.

We tried this with good results. There was an error in the instructions but the first page of the instructions gave information for correcting it. After we made the correct memory pokes the bank linking worked correctly.

This could be very useful if you had a long basic program. It would have to be broken into 32K sections and each section loaded when the appropriate bank is selected. Variables are not transferred between the banks. So the program would have to be designed so that each section is completed before going to another bank.

THUNDER RAM STORES GRAPHICS

Instructions are included for storing graphic pages in memory. With the instructions about thirty 6K graphics screens can be stored and recalled instantly.

T-RAM DISKETTE

A diskette is included which contains complete technical information on T-RAM. It is especially useful for those interested in assembly language programming. The instructions can be printed on a printer. We printed part of these instructions and they are very clear, informative, and complete. The author did not try to hide anything.

SUMMARY

We have enjoyed using T-RAM. As an experiment we loaded information into the ramdisk, installed a reset cartridge in the second port on our computer, and enabled our battery backup (UPS) system. We wanted to see how long we could retain data within the ramdisk without

having to turn off the computer.

When the computer latched up, which happens sometimes we used our reset cartridge to give a hard reset. This does not reset the ramdisk. So this took care of the reset problem which we normally perform by turning the computer off and then back on. We operated this way for a couple of weeks until we destroyed the ramdisk by a bad command. This happens sometimes to a normal disk so there should always be a backup disk available. The experiment was a success. It is quite an experience to load programs from the ramdisk without having the disk drive come on.

We did several dumps from disk to ramdisk and from ramdisk to disk. Also we copied files back and forth between the ramdisk and the disk. All of these worked with no errors. The T-RAM is definitely a plus for color computers with at least one disk drive.

Spectrum Projects, P. O. Box 21272, 93-15 86th Dr., Woodhaven, NY 11421 \$119.95

DCN STAFF

NEW PRODUCTS

This section is available free for producers and dealers of color computer products. These products have not been reviewed by us but are included for our reader's information. Send a description of new products to:

New Products
Dynamic Electronics Inc.
P. O. Box 896
Hartselle, AL 35640

The Zellerback Group in San Francisco, CA announce the manufacture/ distribution of a

preceeding month. Ex. Nov
ad closing is Oct. 1.

quality-Line of 'prototype' P. C. Boards. These Boards conform to the Color Computer's cart-ridge slot, and are 8" long. They are made of UL approved 'FR4' laminated epoxy-glass, and feature gold plated card-edge Connector contacts. The 'EXTENDER' Board is 4.25" wide with 40 pin Connector, the 'PROTOTYPE' Boards are 3.875" wide with 40 & 35 pin Connectors, the 'P' Board is a 3.4" x 5" grid of holes on .1" centers, and the 'L' board is a 5.8" row pattern for 600 / 300 MIL DIPs with VCC and Ground Traces.

Data Sheets and P. C. Boards are available now from the Zellerbach Group, unit 216, 1335 Pacific Ave, San Francisco, CA 94109; (415) 673-3485. These boards are expected to sell for \$20.

CoCo Devices has announced the release of its new product, a Full Character Set Board, for either the CoCo or CoCo2. The FCS Board is an easy to install, completely assembled board that provides all 96 standard ASCII characters, upper and lower case characters. (NO inverse video), true lower case descenders, braces, and vertical bar characters, slashed zero, plus several other features. The FCS Board has NO effect on any memory in the CoCo and requires NO software drivers. For more information contact CoCo Devices, P. O. Box 677, Seabrook, TX 77586 (713) 474-3232. (See ad in this issue)

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OPERATING HINT

One of the easiest ways to determine if part of your computer is not working is by substitution. For example if you have disk drive problems the problem could be either the controller or your drive. Borrow a good drive and controller and you can find out which is giving the problem by substituting the good parts one at a time. Also if you suspect you have a bad chip, replace your chips one at a time and you can determine which one is bad. It is a good idea to have a spare chip of each type for this purpose. The newer computers do not have sockets, but the old ones do and this technique works very well. Since the prices of computers has dropped, it is a good idea to have a spare computer, especially if you use it a lot.

ATTENTION DEALERS: We can provide newsletters with your product reviews. Let us know how many you can use.


```

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