

ENGINEERING NOTES  
on  
Radio Shack Color Computers

February 1986  
Vol. 3 No. 1

\$1.95

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PROGRAMS

- \* FILE DEMO PROGRAM
- \* DRAW DEMO PROGRAM
- \* BOUNCING BALL GAME

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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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*****
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*   DYNAMIC   COLOR   NEWS
*
*       February 1986
*
*   Editor and Publisher
*       Bill Chapple
*
*       Secretary
*       Deanne Hill
*
*****
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# WRITING PROGRAMS (Part 11)

## Seperate Data Files

In this series we have been showing how to write programs. Many programs require data. Check book, inventory, word processors, spread sheets, address files, and geneology programs all require data. As we have shown the data can be contained within the program as data statements or as string variables. What will we have to do to have a seperate data file? First we will have to reserve some memory for the file. This means that we will have a vector that points to the beginning of the data. We also need to know where the data ends. If we are looking through the data, we need a pointer or vector to designate our position in memory. Let's define these vectors as follows:

BE=Beginning of data  
EN=Ending of data  
PT=Memory location of  
pointer.

Remember that a vector points to a memory location and requires two bytes. So we will need 6 memory locations to contain the 3 vectors for our data.

### Choosing File Memory

The vectors for basic are in memory locations 25-28. The beginning of basic vector is in 25 & 26 and the ending is in 27 & 28. A file can be established either below or above the basic program. Let's look at what is required for files below basic.

If you do not have a disk drive then your file can start at 1537 (6,1). We will use the notation (M,L) to indicate the most significant and least significant values of vectors.

So 1537 is equivalent to  $6 * 256 + 1$  or (6,1). If you have a disk drive, it uses memory from 1536 to about 3500. So the beginning of your file can be at (15,1).

### Using PCLEAR Command

To have a file in lower memory, we need to move the basic program to upper RAM. The extended basic PCLEAR Command can be used for this purpose. The format is:

PCLEAR N

where N is the number of graphics pages to reserve. We will not be needing graphics pages for graphics, but can use this memory for our files. N can be any number from 1 to 8. So let N be 8 to reserve the most memory for your file.

### End of File

For files below the basic program, the end of file must end before the basic program starts. Since basic starts at PEEK (25),PEEK(26), we can set an end limit for our file.

### File Pointer

The file pointer will show where we are in memory as we load or review data in the file. As we start with data it will point to the same memory location as the beginning vector.

### Saving Files

Since anything can be saved as a machine language program, we will use this technique to handle our files. We can easily load and save files to a cassette or disk using this method.

### Programming Tools

What tools do we need to put data in memory. We can not

store strings in memory unless we convert them to numbers. Remember that computers only work on numbers. Last month we showed how to break a long string down into one character strings. This was accomplished with the MID\$ command. Next we have to convert the character to an ASCII value. Remember that ASCII defines a numerical value for each character. As an example an "A"=65 and a "1"=49. After converting the character to its ASCII value we will need to store it in memory. We can do this with the POKE command.

This month we want to develop a program for storing text in RAM. Let's reserve the following memory locations for our vectors:

```
500-1 BE
502-3 EN
504-5 PT
```

To store characters in memory, we need to enter the character as a string, convert it to an ASCII value, store the ASCII value in memory indicated by our pointer, and increase the pointer value by one.

To review the characters in memory the procedure will be to get the ASCII value from memory with the PEEK command, convert it to a string, and print it on the screen. Of course we will have to increase our pointer's value after each character.

There is much material we can cover on this subject. All of the commands we are going to use have been covered in this programming series. So now that we have covered the material, we are giving applications for using the commands.

## FILE DEMO PROGRAM

We wrote the following program to show how a separate file can be created. This program stores the ASCII value of char-

acters in memory. The memory can be from 3500 to about 10000. The principles shown here can be used for other types of files. We did not include a text editor, but if you make a mistake in typing, you can use the left arrow to erase it. Text files can be saved or loaded from a cassette or disk. This might be a useful way to save notes. Comments are included within the program to show what each section does.

```
10 PRINT" PROGRAM 2-1-86
20 PRINT"RAM FILE PROGRAM
30 PRINT" COPYRITE (c) 1986
40 PRINT"dYNAMIC eLECTRONICS
   INC.
50 A$(1)="BE":A$(2)="EN":A$(3)
   ="PT":PRINT
60 GO SUB 4150
65 'SET UP A MENU
70 PRINT"1 WRITE TEXT TO RAM
80 PRINT"2 REVIEW TEXT IN RAM
90 PRINT"3 SAVE TEXT
100 PRINT"4 LOAD TEXT
110 PRINT"5 SET TEXT BUFFER
    VECTORS
120 INPUT"ENTER NUMBER";X
130 'BRANCH TO SUBROUTINE
140 ON X GO SUB 1000, 2000,
    3000, 4000, 5000
150 GO TO 20
1000 CLS:INPUT"THIS WRITES TEXT
    TO RAM. USE THE @ KEY TO
    EXIT THIS SECTION. PRESS
    ENTER AND START TYPING
    YOUR CHARACTERS";P
1010 CLS
1015 'WAIT FOR A PRESSED KEY
1020 A$=INKEY$:IF A$="" THEN
    1020
1030 PRINTA$;
1035 'BACKUP POINTER IF KEY IS
    LEFT ARROW
1040 IF A$=CHR$(8) THEN A(3) =
    A(3)-1:GO TO 1020
1050 A=ASC(A$): IF A$="@ " THEN
    1090
1060 POKE A(3),A:A(3)=A(3)+1
1070 'STORE CHARACTER IN POINT-
    ER DESIGNATED MEMORY A(3)
    And INCREASE POINTER BY 1.
1080 GO TO 1020
1090 PRINT:PRINT"WRITING
```

```

TERMINATED
1100 X=A(3): F=A(3) - A(1):
      PRINT"FILE IS "F"
      CHARACTERS LONG"
1110 'SAVE POINTER IN 502
1120 GO SUB 5100:POKE 502,MS:
      POKE 503, LS:RETURN
2000 'THIS REVIEWS CHARACTERS
      IN RAM
2010 PRINT"PRESS THE @ KEY TO
      ESCAPE
2020 PRINT"PRESS THE M KEY TO
      PRINT THE          VALUE OF
      THE POINTER
2030 INPUT"PRESS ENTER TO
      CONTINUE";P
2040 M=500:GOSUB 5090
2050 CLS
2060 A=PEEK(X): A$=CHR$(A):
      PRINTA$;
2070 K$=INKEY$
2080 IF K$="M" THEN
      PRINT"MEMORY="X
2090 IF K$="@" THEN 2120
2100 IF X>=A(2) THEN 2120
2110 X=X+1:GO TO 2060
2120 PRINT:PRINT"YOU STOPPED
      AT"X
2130 PRINT"THE FILE IS "X -
      A(1)" CHARACTERS LONG
2140 GO TO 70
3000 '
3010 PRINT"THIS SAVES TEXT":GO
      SUB 4150
3020 INPUT"ENTER PROGRAM
      NAME";N$
3030 PRINT"ENTER C FOR CASSETTE
      OR D FOR DISK
3035 'WAIT FOR KEYBOARD ENTRY
3040 R$=INKEY$:IF R$="" THEN
      3040
3045 'BRANCH FOR CASSETTE OR
      DISK
3050 IF R$="C" THEN 3080
3060 IF R$="D" THEN 3100
3070 GO TO 3000
3080 CSAVEM N$ ,A(1),A(2),A(3)
3090 RETURN
3100 'SAVING FILE TO DISK
3110 SAVEM N$,A(1),A(2),A(3)
3120 RETURN
4000 PRINT"THIS LOADS TEXT
4010 INPUT"ENTER PROGRAM
      NAME";N$
4020 PRINT"ENTER C FOR CASSETTE
      OR D FOR DISK
4030 R$=INKEY$:IF R$="" THEN
      4030
4040 IF R$="C"THEN 4060 ELSE IF
      R$="D"THEN 4100
4050 GO TO 4040
4060 PRINT"LOADING FROM A
      CASSETTE
4070 CLOADM N$
4080 GO TO 4110
4090 PRINT"LOADING FROM A DISK
4100 LOADM N$
4102 'THE FOLLOWING GETS THE
      VECTORS FROM 487,126, AND
      157. THESE ARE THE BEGINN-
      ING, ENDING, AND EXECUTION
      VECTORS FOR ML PROGRAMS.
      WE NEED TO MOVE THEM TO
      500 -505 FOR OUR USE
4110 R=PEEK(487): S=PEEK(488):
      POKE 500,R:POKE501,S
4120 R=PEEK(126):S=PEEK(127):
      POKE502,R:POKE503,S
4130 R=PEEK(157): S=PEEK(158):
      POKE504,R: POKE505,S
4140 RETURN
4150 PRINT"THIS SETS FILE
      VECTORS
4160 FOR J=1 TO 3:M=500+2*(J-1)
4170 GO SUB 5090: A(J)=X:NEXT
      J:RETURN
4990 'PRINT VECTORS
5000 FOR J=1 TO 3: M=500 + 2 *
      (J-1): GO SUB 5090: A(J) =
      X: PRINTJ;A$(J)+" "A(J):
      NEXT J
5010 INPUT"ENTER NUMBER TO
      CHANGE";Y
5020 IF Y=0 THEN RETURN ELSE IF
      Y>3 THEN 4150
5030 'DEFINE THE MEMORY FOR THE
      VECTOR
5040 M=500 + 2 * (Y-1)
5050 INPUT"ENTER NEW VALUE";X
5060 GO SUB 5100
5070 POKE M,MS:POKE M+1,LS
5080 GO TO 4150
5090 X=256*PEEK(M) +
      PEEK(M+1):RETURN
5100 MS=INT(X/256):LS =X - 256
      * MS: RETURN

```

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# BASIC BASIC

One of my jobs as "Head Honcho" at Owls Nest Software is to answer the day to day questions about program operation etc. I have discovered that most of us "Old Timers" (an old timer being someone who paid over \$500.00 for a 16K battleship grey Color Computer) often assume everyone knows the really basic ins and outs of the Co-Co. Most publications today have advanced beyond the point that is easily grasped by the many newcomers. That is what we will be trying to do with "BASIC BASIC". Give you not new revolutionary ways to operate your computer but cover the real basic tips and tricks that you may not be aware of. We encourage questions and will print some of general interest. Time will not permit individual replys. Questions or tips may be addressed to Norman R. Shelton C/O Owls Nest Software P.O. Box 579 Ooltewah, TN 37363. O.K. here goes -

*ROM and RAM - what the heck do they mean?* ROM is "Read Only Memory" and is the operating system your computer uses. It is "non-volatile" memory that is not lost when you turn your computer off. The commands written by Micro-Soft for Radio Shack that your computer uses are all stored in your ROM. Radio Shack has used several versions of the ROM over the past few years. Some bugs in the earlier versions were corrected and some minor routines changed. You can determine the version of ROM you have by typing - EXEC41175 <ENTER>. RAM is "Random Access Memory". This is the area that your programs and data are stored in. This is volatile information that can be changed if desired and is lost when the power is turned off.

*My favorite cassette is giving I/O errors HELP!* O.K. - an I/O error is an "Input/Output" error that occurs when you are "reading" (taking in) information) or "writing" (sending out information). With a tape the I/O error usually occurs when the computer gets some information it doesn't understand. It can be a stray noise on the tape caused by a wrinkle, static electricity or so

many other things you wonder how a program ever does load. First make sure you didn't start in the middle of a program. The recorded program has "start" and "stop" markers to let the computer know when a program begins and ends. If you start in the middle the I/O error is saying "HEY! where is the beginning?". Don't forget you have a volume control. Programs recorded on different recorders may require different volumes to load. Also if there is a "glitch" on your tape turning the volume down may allow the computer to still "hear" the program but reduce the "glitch" level to a point it will slip by. Try running the tape fast forward and rewinding. That may make it load. This may sound silly but turn your recorder on it's side and try it. Now upside down. What you are doing is letting the weight of the tape cause the heads of the recorder to contact a slightly different area. When you get it loaded BACK IT UP! ALWAYS backup programs. The time required pales into oblivion when your original develops a glitch. Backup all non-protected purchased software and store the original in a safe place. Make sure you remove the tabs. Most commercial software will have them removed but check them anyway. You can always stick a bit of Scotch tape over the slot if you do need to record on the tape. Don't whine when your super duper 12 for a buck "NO-NAME" tapes cause you problems. You are getting what you pay for. You can get good C-06 computer tapes for seven or eight bucks a dozen. Use them and put a single program on each. Now you aren't risking 25 other programs each time you load a tape. You also don't have to search forever to find the program you want. For your information a C-06 will just hold 32K of data. We do recommend a bulk eraser if you re-use tapes a lot but don't use it within 10 feet of other recorded tapes and do keep your tapes away from magnetic fields like the one produced by the transformer in the TV you have your tapes stacked beside.

Until next month - - - -





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 + if you want to continue re- +  
 + ceiving technical informa- +  
 + tion on Color Computers. +  
 + This is the last issue for +  
 + those with 2/86. +  
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## EDITOR'S COMMENTS

This marks the beginning of our third year of publication. Over the past two years we have covered many subjects and developed numerous software programs. Last year we started our basic programming, large memory programs, and computer graphics series. We felt that these were subjects that would be of the most interest to our readers. We are continuing these subjects and are adding more this year.

In this issue we are starting a series on interfacing computers. Color Computers are a natural for controlling devices and are used in industry for this purpose. We will explain what is required to connect a computer to printers, other computers, and telephone lines. Can programs be exchanged between computers? If you have identical computers this is fairly easy to do. Did you know that programs can be also be exchanged between different type computers? We will discuss how to do this.

This month we are pleased to announce that Mr. Norman Shelton of Owl's Nest Software will be writing a monthly editorial for us. The title of his editorial is "BASIC BASIC" and he will be

giving information that is useful especially for the beginner. If you have a question or subject you would like for him to discuss, then I am sure he would like to hear from you.

Dealers we need someone to write editorials on OS-9. We would be willing to trade advertising for editorials. If you are interested in this send us a sample copy. We are also interested in other subjects and would like to receive sample editorials. Remember our objective is to explain computer subjects so that they can be understood by nontechnical readers.

+++++

## COMPUTER GRAPHICS (PART 12)

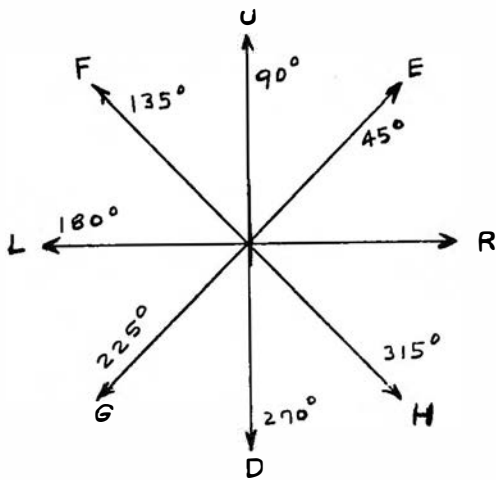
In this series we have been learning the extended color graphics commands. We developed character generators, learned to draw lines, boxes, circles and ellipses. This month we want to look at the draw command.

The draw command is similar to the line command in that it allows lines to be drawn. The line command requires coordinates of the two points through which the line is to be drawn. The draw command works by specifying a direction and length. For example we can say draw to the right 10 units or draw left 15 units. So the draw command is relative to our starting point.

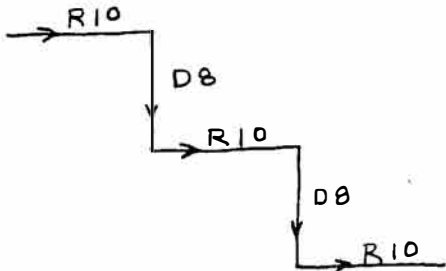
Letters are used to designate the direction for the draw command. These letters with their associated directions are shown in Figure 1. The format for the draw command is:

DRAW "X\$"

where X\$ is a string defining the various directions and lengths. As an example let's assume we want to draw steps



DRAW DIRECTIONS  
FIGURE 1



DRAWING STEPS  
FIGURE 2

with a width of 10 units and a height of 8 units. If we have 2 steps the command will be:

`DRAW "R10;D8;R10;D8;R10"`

A sketch of our steps is shown in figure 2.

### MOVING the CURSOR

It is necessary to be able to move the cursor to different positions without drawing. If you draw with a pen or pencil, you need to pick up your pen and move it to another place to continue with your drawing. Another feature that we would like is to be able to draw a line and then return to the beginning point. These features are included in the draw commands and are as follows:

### MOTION COMMANDS

M=Move the Cursor  
N=No Update (return to starting point)  
B=Draw a blank line.

If we want to move the cursor to location 64,100 then we can use the following command:

`DRAW "BM64,100"`

The M means to move to the coordinates 64,100 and the B means to draw a blank line. Notice that we have two formats for the DRAW command. The first uses a string to designate a direction and the second requires coordinates of the point separated by a comma. Let's take another example. In this example we want to draw the letter "T" and have it start at 100,50. Our commands will be:

```

5  MOVE THE CURSOR TO 100,50
10 DRAW"BM100,50"
15  DRAW TO THE RIGHT 5
    POSITIONS
20 DRAW"R10;"
25  DRAW DOWN 30 POSITIONS AND
    RETURN TO THE STARTING
    POSITION.
30 DRAW"ND30;"
35  DRAW LEFT 5 POSITIONS
40 DRAW"L5"

```

### The Angle Command

The angle command can be used for executing repetitive commands at angles of multiples of 90 degrees. The format is [AW] where W=0,1,2, or 3 and represents angles of 0, 90, 180, or 270 degrees.

Suppose we want to draw the image shown in Figure 3. Let's define the draw command for the right section. The right part can be defined by going right 25 units, up 5 units and return, and down 5 units. The draw command will be

`DRAW "R25;NU5;D5"`.

Now if we let A\$="R25;NU5;D5".  
Then the draw command is

DRAW A\$.

The following program segment will draw the figure in the 4 quadrants.

```
10 A$="R25;NU5;D5"
20 DRAW "A0"+A$
30 DRAW "A1"+A$
40 DRAW "A2"+A$
50 DRAW "A3"+A$
```

### DRAW DEMO PROGRAM

The following program shows what is required to implement the draw commands. This program draws the figures discussed in the previous section. Comments are included to show what each section does.

```
10 'DRAW DEMO PGM
20 'PGM 2-2-86
30 'COPYRIGHT (c) 1986
40 'DYNAMIC eLECTRONICS INC
50 'SET UP FOR GRAPHICS DISPLAY
60 'RESERVE 8 GRAPHICS PAGES
70 PCLEAR 8:CLS
80 PCLS 'THIS CLEARS THE GRAPHICS SCREEN
90 PRINT"THIS DRAWS THE STEPS SHOWN IN FIGURE 1": INPUT "PRESS A KEY TO CONTINUE";A$
100 'THE NEXT STATEMENT SETS THE COMPUTER FOR THE GRAPHICS MODE
110 PMODE 3,1:SCREEN1,0
120 'THE SUBROUTINE AFTER THE DRAW COMMAND GIVES A DELAY SO YOU CAN SEE WHAT IS HAPPENING
130 DRAW "R10;":GO SUB 410:DRAW "D8;":GOSUB410:DRAW"R10;":GO SUB 410:DRAW"D8;":GO SUB 410:DRAW"R10":GO SUB 410
140 GO SUB 410
150 DRAW"ND30;"
160 CLS:PRINT"THIS DRAWS A T"
170 INPUT"PRESS ENTER TO CONTINUE";P
180 'ERASE OLD GRAPHICS AND
```

AGAIN SET UP FOR GRAPHICS MODE

```
190 PCLS:PMODE 3,1:SCREEN 1,0
200 'MOVE THE CURSOR TO 100,50
210 DRAW"BM100,50"
220 'DRAW TO THE RIGHT 8 POSITIONS
230 DRAW"NR8;":GO SUB 410
240 'DRAW DOWN 30 POSITIONS AND RETURN TO THE STARTING POSITION.
250 DRAW "ND30":GO SUB 410
260 'DRAW LEFT 8 POSITIONS
270 DRAW"L8":GO SUB 410
280 FOR J=1 TO 1000:NEXT J
290 CLS:PRINT"THIS SHOWS HOW TO USE ANGLES FOR ROTATING THE DRAWING
300 INPUT"PRESS ENTER TO CONTINUE";P
310 PCLS:PMODE 3,1:SCREEN 1,0
320 A$="R25;NU5;ND5;L25"
330 DRAW "A0"+A$
340 GO SUB 410
350 DRAW "A1"+A$
360 GO SUB 410
370 DRAW "A2"+A$
380 GO SUB 410
390 DRAW "A3"+A$
400 GO SUB 410:END
410 FOR J=1 TO 1000:NEXT J: RETURN
```

+++

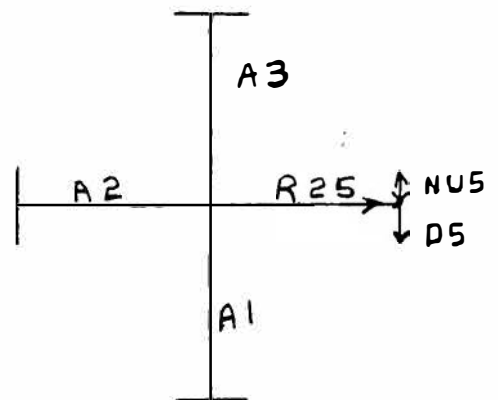


FIGURE 3

## LARGE MEMORY PROGRAMS (PART 12)

### RAM DISK PROGRAM DELETE

In previous editorials we have shown how to use the second 32 K memory bank for 32K computers. We have been developing a RAM disk program for using the second bank for program storage. The RAM disk program was given in our Nov/Dec issue. The ability to delete programs was not included and we are adding this feature this month.

Last month we looked at what is required to delete programs. The programs in the second bank need to be moved to cover the area occupied by the deleted program. Also we need to delete the program from our directory in the first bank and update the vectors for the programs in the second bank.

We used the variable "S" to indicate the start of our directory. Program information is contained in blocks of 20 bytes. K represents the program number so the directory for the Kth program starts at  $S + 20 * K$ . The vectors for the program location in the second bank is contained in bytes 9-12. After the programs are compacted in the second bank, these vectors have to be changed.

The number of programs is contained in 32000 and the last memory used is contained in 32001-2. Both of these values have to be updated when we delete a program.

### RAM DELETE SUBROUTINE

For the delete feature we reserved 3000-3999 in our RAM disk program in our Nov/ Dec 1985 issue. Comments are included to show what each section does.

```

10 ^RAM DELETE SUBROUTINE
20 ^COPYRIGHT (c) 1986
30 ^DYNAMIC eLECTRONICS iNC.
30 ^PROGRAM 2-2-86
3000 PRINT"THIS DELETES A
      PROGRAM":GO SUB 1000
3010 INPUT"ENTER PROGRAM NUMBER
      TO DELETE";K
3020 GO SUB 1500
3030 PRINT"DELETE "N$" Y-YES
      N-NO
3050 K$=INKEY$:IF K$="" THEN
      3050
3060 IF K$="N" THEN RETURN
3070 ^V=START OF PGM TO DELETE
3075 AV=V:M=AV+9:GO SUB 990
3076 BE=V:M=M+2:GO SUB 990
3077 EN=V:AN=EN-BE^AN IS LENGTH
      OF PROGRAM TO DELETE
3080 PRINT"PGM IS "AN" BYTES
      LONG
3090 LT=PEEK(32000)^GET NUMBER
      OF PGMS
3100 ^MOVE THE DATA IN THE
      OTHER BANK
3110 M=AV+29: A=PEEK(M): POKE
      474,A: B=PEEK(M+1): POKE
      475,B ^PUT BEGINNING
      VECTOR IN 474-5
3120 POKE 476,117:POKE477,47
      ^THIS PUTS 29999 IN 476-7
3130 A=PEEK(AV+9): POKE478,A:
      B=PEEK(AV+10):POKE479,B
      ^PUT NEW LOCATION VECTOR
      IN 478
3140 EXEC32140: PRINT"DATA IS
      MOVED IN THE SECOND BANK
3200 ^THIS COMPACTS PROGRAM
      DIRECTORY
3205 ^BD=BEGINNING OF DIRECTORY
      TO MOVE, ED=END OF
      DIRECTORY
3210 BD=S+20*K:ED=S+20*LT
3220 FOR J=BD TO ED
3230 A=PEEK(J): POKE(J-20),A:
      NEXT J
3300 ^UPDATE THE PROGRAM
      LOCATIONS IN THE DIRECTORY
3310 FOR J=K TO LT
3315 ^DECREASE THE PROGRAM
      BEGINNING BY AN BYTES
3320 M=S+20*K+9:GO SUB 990: V=
      V-AN: GO SUB 980: POKE M,
      MS:POKE M+1,LS
3325 ^DECREASE PROGRAM ENDING
      BY AN BYTES
3330 M=M+2:GO SUB 990:V=V-AN:GO
      SUB 980 :POKE M,MS:POKE

```

**NEW**

**NEW**

## CoCo Comm-4 Begins The CoCo **Multi-Tasking** Era

### 4 Channel Serial Communication Interface

COMM-4 allows serial I/O capabilities. Board supports full modem control. Enhances **multi-tasking** and/or **multi-user** features of OS-9.

**Typical System Configuration\*:**

- Terminal
- Letter Quality Printer
- Modem
- High-speed Printer

\*NOTE: The configuration shown above is only one of the several possible configurations with a **single** COMM-4 unit. Virtually any serial device compatible with the CoCo can be used with COMM-4.

The COMM-4 unit comes **completely assembled** in a plug-in cartridge. The cartridge plugs into any slot of a buffered, powered expansion device (not provided). The commercially available expansion devices (such as Multi-Pak) are required for COMM-4 operation.

Each of the four (4) serial channels is controlled by an **independent** serial controller. These serial controllers are part of the unit hardware and allow multi-tasking and/or simultaneous I/O applications **without** the use of software timing loops.

Communications are **interrupt-driven**. Standard communication baud rates from 50 to 19,200 are supported by COMM-4. The COMM-4 unit provides for the use of a "break key" (keyboard interrupt system). Connections to COMM-4 are made via DB-25 plugs for any RS-232 compatible serial device.

With the COMM-4 unit installed in the expansion device slot, COMM-4 is **always** enabled regardless of hardware/software slot selection methods. The COMM-4 unit will not interfere with existing device(s) in any other expansion slot.

The COMM-4 unit is configured so that **two (2) COMM-4 units can be installed on the same expansion device**. In the dual COMM-4 configuration, the available, interrupt-driven serial communications channels become eight (8). In order to operate properly, the two COMM-4 units must be interconnected with a jumper cable which is provided when ordered in the dual COMM-4 configuration. In the COMM-8 configuration, all features of the COMM-4 are available (but for all 8 channels).

**Items supplied with a COMM-4 unit:**

- 1) COMM-4 cartridge
- 2) Users Manual
- 3) Interrupt cable (and jumper cable if ordered as COMM-8)

**Installation of COMM-4 is accomplished in two phases as follows:**

- 1) Hardware installation
  - a. Power down on CoCo and expansion device
  - b. Plug COMM-4 into any slot on expansion device
  - c. Plug interrupt cable into COMM-4 cartridge
  - d. Plug other end of interrupt cable into serial I/O port on CoCo
  - e. Plug user serial cables into DB-25 connectors on COMM-4
  - f. Power up entire system
- 2) Software installation (the following installation instructions are general and will vary with some systems due to user configuration).
  - a. Install COMM-4 disk (35 track, single-sided, double density)
  - b. Load device descriptors and drivers

**OR**

Merge device descriptors and drivers into boot files using OS-9 procedure files

  - c. Note: Disk contains commented course code and object code and procedure files
  - d. For basic users, a sample basic program will be provided in users manual (not on disk). (Note: Color basic will not support multi-tasking.)

**The documentation included with COMM-4 provides:**

1. Hardware theory of operation
2. Software theory of operation
3. Installation instructions
4. Applications examples
5. Commented program listings
6. Schematic diagrams
7. Parts lists
8. Assembly drawings

If dual COMM-4 (COMM-8) units are to be installed, it will be necessary to specify, with order of second COMM-4, in order for necessary jumper cables to be supplied (no extra charge).

**CoCo COMM-4**

**Price.....\$108.00**

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Easy to install board adds:

- All 96 Standard ASCII Characters
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See our Review in  
Oct '85 HOT COCO



**CoCo Devices**  
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713-474-3232



```

M+1,LS
3400 'REDUCE THE NUMBER OF PGMS
      BY ONE
3410 LT=LT-1:POKE 32000,LT
3420 'REDUCE PROGRAM BYTES IN
      32001-2 BY AN
3430 V=256 * PEEK(32001) + PEEK
      (32002): V=V-AN: GO SUB
      980 :POKE32001,MS:
      POKE32002,LS
3500 RETURN

```

+++++

## INTERFACING COMPUTERS

(Part 1)

How do you get information into and out of your computer? We are familiar with the cassette recorder and disk drives for saving and loading programs. Also a printer and joysticks can be plugged into appropriate jacks on your computer. Games and programs can be put into a cartridge and plugged into the expansion port on color computers.

How do these external devices work? What about exchanging information between two computers? Can programs be exchanged between different type computers? For example can programs from an IBM PC, Commodore, Kaypro, or Apple computer be run on a Radio Shack Color Computer? These are some of the questions we want to answer in this series.

### COMPUTER THEORY

To be able to understand what can be done we will need to cover some computer theory. When we mention computer theory, people sometimes put up a barrier and think that the material is going to be too complex. No complex mathematics will be used. In fact we will use the simplest math which is binary arithmetic.

Hexidecimal (HEX) arithmetic is a grouping of binary numbers. Most of the time we will use decimal arithmetic because this is what Basic uses. Don't worry about the math because we will give you a program that will do math conversions when this is needed.

### MEMORY MAP

A memory map shows where everything is located within the memory. For color computers the map is divided into 32K sections with the upper 32K reserved for read only memories (ROM) and the lower 32K for random access memories (RAM). For a 64K computer, the memory can either be partitioned as two 32K banks or one 64K continuous memory. We have covered the use of these two configurations in detail in our large memory program series.

### ASCII

The ASCII code is a standard that is used for serial transferring of data between a computer and another device. The second device can be a printer, modem, or another computer. We need to look at the ASCII code and explain how to use it. During this series we will develop software you can use to transfer programs from one computer to another.

### Computer Electronics

We will need to cover some electronics theory. Suppose you want to store voice or music in your computer's memory. Voice and music generate analog voltages. Computers use digital logic. So we need to convert the analog voltages into a form that the computer can use. Before a device can be interfaced to a computer, it is necessary to know the type signals it generates or requires from the

computer. This may look simple but can become a nightmare if not handled properly.

Next month we will take a subject dealing with interfacing and look at it in detail. As stated earlier, we will develop the interface software that will be needed so our readers can operate their own external devices. Perhaps you are wondering "what kind of software"? Let's take an example that should be of interest to everyone. Would you like to dial up a friend and exchange programs with him? This can be done with a modem and a terminal program. But how do these work? We will explore these in detail in future editorials.

+ + +

## BOUNCING BALL GAME



This exciting game requires a joystick. You press the fire button on the joystick and try to shoot down the bouncing balls without letting them hit you. You get points for each ball you shoot down. At the end of the game your total score is displayed with the high score from previous games. You can then replay the game to see if you can beat the high score.

This program is provided by courtesy of T & D Software (advertisement on page 7) and is used by permission.

```

1 REM COPYRIGHT (C) T&D SOFTWARE
  1985
5 GOTO2000
10 PMODE3,1:F=RND(-TIMER):CLS:GO
SUB900:*****SQUEEZE*****
BY MIKE MOORE,2 AURORA CRESCENT
  NEPEAN,ONT,CANADA.
20 GOSUB60:ONF GOSUB250,100:ONB(
J)GOSUB300,130:J=NJ(J):ONF GOSUB
250,100:GOTO20
60 I=U(JOYSTK(Z)*CS):EJ=PPOINT(X
+SX+A*SGN(I),Y):X=X+I:IFX<LE THE
NX=LE ELSEIFX>RT THENX=RT
65 IFEJ=TW THEN800
70 PUT(X,Y)-(X+WD,Y1),S,PSET:RET
URN
100 LINE(BX,BY+SV)-(BX,BY),PRESE
T
110 IFFPOINT(BX,BY-FV)=W THENBY=
BY-A:LINE(BX,BY+SV)-(BX,BY),PSET
:RETURN
120 F=W:IFFPOINT(BX,BY-A)=4THENP
LAY"AAA":RETURN ELSE490
130 IFPEEK(P(J)+DP(J))THEN200
140 LINE(X(J),Y(J))-(X(J)+SV,Y(J
)+SX),PSET,BF
150 P(J)=P(J)+DP(J):X(J)=X(J)+H(
J):Y(J)=Y(J)+V(J):ONJ GOTD170,18
0,190
160 PUT(X(J),Y(J))-(X(J)+SV,Y(J
)+SX),S4,PSET:RETURN
170 PUT(X(J),Y(J))-(X(J)+SV,Y(J
)+SX),S1,PSET:RETURN
180 PUT(X(J),Y(J))-(X(J)+SV,Y(J
)+SX),S2,PSET:RETURN

```

<b>TOTHIAN SOFTWARE</b>	
-- 32K ECB PROGRAMS --	
TEACHER PAK PLUS	Includes Teacher Pak and CoCo Testem described below.....\$47.95
COCO TESTEM	Make multiple choice, matching, true/false, completion, and short answer tests. Requires printer with underline ability. Works with tape or disk.....\$19.95
COCO-LIFE II	The living patterns game....\$19.95
-- 16K ECB PROGRAMS --	
TEACHER PAK	Weighted & regular grading, seating charts, alphabetizing, statistical analysis. 4 programs. Works with tape or disk...\$34.95
TIME MASTER	Calendars, biorhythms, more. Fun at parties. Printer optional.....\$19.95
COCO GARDENER	Printer preferred.....\$19.95
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SCHOOL DAYS	Rainbow review 9/85.....\$19.95
LISSAJOUS ART	Educational computer art. Printer with graphic ability optional.....\$19.95
SOUND GENERATOR	Rainbow review 10/85.....\$19.95
-- 16K ML PROGRAMS --	
COCO ECHO	Rainbow review 10/85.....\$9.95
SCREEN INVERTER	Rainbow review 9/85.....\$9.95
All programs sold on tape. Send check or money order (no cash - Pa. residents add 6%) to:	
	Tothian Software Box 663 Rimersburg, Pa. 16248
	
All of these programs carry the Rainbow Seal.	



```

190 PUT(X(J),Y(J))-(X(J)+SV,Y(J)
+SX),S3,PSET:RETURN
200 I=PEEK(P(J)+DP(J)):IFI=255TH
ENDP(J)=H(J)/4-DP(J):V(J)=-V(J):
ONJ GOTO130,230,130,130
210 IFI=170THENH(J)=-H(J):DP(J)=
DP(J)+H(J)/4:GOTO130
220 IFI AND85THENGOSUB140:BY=BY+
A:F=W:GOTO490 ELSEGOSUB140:GOTO8
00
230 IFY<>Y(J)THENRETURNELSEFORI=
Y1 TOY STEP-1:LINE(LE,I)-(RT+WD,
I),PSET:PLAYSTR$(W+Y1-I):NEXT
240 FORI=Y TOY1:LINE(LE,I)-(RT+W
D,I),PRESET:PLAY(STR$(W+Y1-I):NE
XT:NS=NS-1:IFNS THEN80ELSE1010
250 IFPEEK(JB)=255THENRETURNELSE
F=TW:BX=X+SX:BY=152:GOTO110
300 IFRND(TW)=W THENRETURNELSEN(
J)=N(J)+W:IFN(J)>B(0) THENB(J)=Z
:I=J:GOSUB540:RETURN
310 Y(J)=Y(Z):X(J)=LE+A*RND(W1):
V(J)=A:B(J)=TW:I=SGN(1.5-RND(TW)
):H(J)=I*A:P(J)=P(Z)+INT((X(J)-L
E)/A):DP(J)=256+I
368 IFPEEK(P(J))THENONJ GOSUB170
,180,190,160:GOTO490ELSEONJ GOTO
170,180,190,160
490 EJ=PPPOINT(BX+TW-(BX AND SV),
BY-SX):B(EJ)=W:FORI=Z TO3:PLAY"B
CD":LINE(X(EJ)+I,Y(EJ)+I)-(X(EJ)
+SV-I,Y(EJ)+SV-I),PRESET,B:NEXT:
SC=SC+LV
500 SC$=STR$(SC):L=LEN(SC$):LINE
(Z,10)-(A*L,18),PRESET,BF:DRAW"B
MO,10":FORI=TW TOL:DRAWN$(VAL(MI
D$(SC$,I)):NEXT:RETURN
530 NJ(4)=NJ(W):I=4:IFB(I)>Z THE
N550
540 IFI=W THEN530ELSENJ(I-W)=NJ(
I):I=I-W:IFB(I)=Z ANDN(Z)<3THEN5
40
550 N(Z)=N(Z)+W:IFN(Z)<4THENRETU
RNELSEN(Z)=Z:FORI=W TO4:NJ(I)=I+
W:N(I)=Z:B(I)=W:NEXT:NJ(4)=1:J=Z
:FL=1+FL:ONFL GOTO560,560,580
560 IFLV>30THENFL=0:RETURN
570 P(Z)=P(Z)+256:COLOR4:LINE(LE
,Y(Z))-(LE+A*W1+SV,Y(Z)+SV),PSET
,BF:COLOR2:Y(Z)=Y(Z)+A:RETURN
580 LV=LV+5:FORI=176TONS*10STEP-
2:PUT(I,184)-(I+WD,191),S,PSET:N
EXT:B(Z)=B(Z)+W:NS=NS+W
590 FL=0:COLOR3:LINE(LE,Y(Z))-(L
E+SV,Y1),PSET,BF:LINE(LE+A*W1,Y(
Z))-(LE+A*W1+SV,Y1),PSET,BF:LE=L
E+A:W1=W1-TW
600 RT=RT-A:P(Z)=P(Z)+1:COLOR2:R

```

```

ETURN
800 NS=NS-1:X=X+SX:FORI=W TOSV:C
IRCLE(X,Y1),I,4,1,.5,1:PLAY"05CD
":NEXT:X=X-SX:IFX<LE THENX=LE
802 LINE(X,Y(J))-(RT+WD,Y1),PRES
ET,BF:PLAY"04":IFNS=Z THEN1010
805 FORJ=1TO4:NJ(J)=J+W:B(J)=W:N
(J)=Z:LINE(X(J),Y(J))-(X(J)+SV,Y
(J)+SX),PRESET,BF:NEXT:NJ(4)=W:J
=W:N(Z)=Z
810 X=10*NS:FORI=182TO172STEP-2:
PUT(X,I)-(X+WD,I+9),S,PSET:NEXT:
FORX=10*NS TO118STEP2:PUT(X,172)
-(X+WD,181),S,PSET:NEXT
820 FORI=174TO154STEP-2:PUT(X,I)
-(X+WD,I+9),S,PSET:NEXT:COLOR4:L
INE(X,160)-(X+WD,167),PSET,BF:CO
LOR2:RETURN
900 PCLS:PLAY"L25504":DIMB(4),NJ
(4),X(4),Y(4),H(4),V(4),P(4),N(4
),U(5),DP(4),N$(9),S(3),S1(1),S2
(1),S3(1),S4(1):W=1:TW=2:Z=0:FV=
5: SX=6:SV=7:A=8
905 PRINT:PRINT" SHOOT DOWN THE
BOUNCING BALLS BY USING THE F1
RE BUTTON ON THE JOYSTICK (O
R SPACEBAR). MAKE SURE THE B
ALLS DON'T HIT YOU.":PRINT" DO
N'T LET THE ALL YELLOW BALL HI
T THE BOTTOM - OR ELSE!":PRINT
910 DRAW"C2BM2,ODGDNR3DF2RE2U2H2
":GET(0,0)-(7,6),S1,G:A$="BM2,2R
2Bt2L2":DRAWA$:GET(0,0)-(7,6),S2
,G
915 PRINT" AFTER EACH WAVE THE R
OOF OR WALLS WILL SQUEEZE IN
ON YOU. YOU GET BONUS MEN EVE
RY 3 0 WAVES. AFTER EACH SUC
CESS, THE WAVES GET LONGER."
920 DRAW"C3"+A$:GET(0,0)-(7,6),S
3,G:DRAW"C4"+A$:GET(0,0)-(7,6),S
4,G:LINE(0,0)-(7,6),PRESET,Bv
930 DRAW"C3BM5,5D2R3U2GC2U4":GET
(0,0)-(13,7),S,G:LINE(4,0)-(9,7)
,PRESET,BF:DRAW"BM4,0L2GD2FRFD2G
L2BR11L2HU6ER3BR5GD6FREU6BM+5,-1
D5ND3NF3R2EU3HBR6NR3D4NRD4R3"
940 DATANR5D8R5U8BR3,BR4ND8BR4,"
R3FD3L3D3FR3BM+3,-8","R3FD2GNL2F
D2GNL2BM+5,-8","D4R4ND4U2BM+4,-2
","NR4D4R3FD2GL2BM+7,-8","D8R4U4
NL3BM+4,-4",R4ND8BR4,D8R4U4NLU4L
BR5,D4R4ND4U4LBR5
950 FORI=0TO9:READN$(I):NEXT:U(Z
)=-4:U(W)=-2:U(4)=2:U(5)=4:CS=.0
952:X(Z)=4839:IFPEEK(188)=6THENX
(Z)=X(Z)-2048
960 FORJ=1TO3:Y(J)=32:NJ(J)=J+W:

```

```

NEXT:NJ(J)=W:Y(4)=32:NJ(Z)=W:B(Z)
)=2
970 JB=345:Y1=159:Y=152:WD=13:CO
LOR4:LINE(56,24)-(207,31),PSET,B
F:LINE(56,160)-(207,167),PSET,BF
:COLOR3:LINE(48,24)-(55,167),PSE
T,BF:LINE(208,24)-(215,167),PSET
,BF
975 PRINT@480," press fire (spac
ebar) to start";
976 IFPEEK(JB)=255THEN976
980 LINE(0,10)-(80,18),PRESET,BF
:SCREEN1,0:P(Z)=X(Z):Y(Z)=32:FOR
NS=1TO4:PUT(10*NS,184)-(10*NS+WD
,191),S,PSET:NEXT:NS=NSDIM1:GOSU
B805
990 RT=194:F=1:FL=0:FORJ=1TO4:B(
J)=W:NEXT:LV=5:LE=56:W1=18:J=W:R
ETURN
1010 N(Z)=Z:LINE(56,32)-(206,Y1)
,PRESET,BF:CLS:FORI=0TO999:NEXT
1020 CLS:PRINT@202,"CORE"SC:IFS
C>HS THENPRINT@256,"PREVIOUS HIG
H SCORE"HS:HS=SC ELSEPRINT@261,"
HIGH SCORE"HS
1030 SC=0:PRINT@352,"PLAY AGAIN?
(Y/N)":A$=INKEY$
1040 A$=INKEY$:IFA$=""THEN1040EL
SEIFA$="Y"THEN980
1050 IFA$="N"THENEND ELSEPLAY"CC
CCCCC":GOTO1040
2000 PCLEAR4:GOTO10

```

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### 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

Microcom Software announces the introduction of a monthly software magazine on floppy disk and tape. The magazine offers users of the Tandy Color Computer a variety of programs like Utilities, Business Applications, Home Management, Educational, Tutorials, Programming Tips & Hints, Free buy'n sell ads. from members, and many other useful programs. These programs can save the subscribers about \$1500 annually on software. The magazine does not include any games. The annual and 6-month subscribers are entitled to many benefits including free advice/help on their programs, 10% discount on all MICROCOM software/books, and submission of programs for the magazine. The annual subscription rate is: Disk \$75, Tape \$65; the 6-month

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149	150	Baud
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0	6	4800
0	1	9600
0	1	*19200

\*Use High Speed POKE

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### 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.

1. 10 cents a word, \$3 minimum.
2. Name, Address, & Telephone listed free.
3. Send payment with ad.
4. Closing date 1st of the preceeding month. Ex. Nov ad closing is Oct. 1.

\*\*\*\*\*

### DISPLAY ADS

(Rate sheet 2 - March 1986)

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Pages	1 time	2 times	3 times
*2	\$25	\$23	\$22
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1/2	23	20	18
1/4	15	13	12

\* We can use colored paper at no extra charge if ads are on both sides.

We can do ads in Red, Blue, or Brown. No all one color ads will be accepted. For color ads send artwork for each color. Add 40% for each color. Example: One page black and red for 3 times costs \$25 + 10 = \$35 each month.

### OPERATING HINTS

Double Speed: You can double your computer's speed by POKE 65495,0. All features of your computer may not work at this rate. To return to the normal rate POKE 65494,0.

Baud Rates: The baud rate is the rate the computer sends characters to a printer, modem or another computer. It is controlled by the values in 149 and 150. The following chart shows values for these locations for different baud rates.

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