

ENGINEERING NOTES
on
Radio Shack Color Computers

June 1986
Vol. 3 No. 5

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PROGRAMS

- * CHORDS (MUSIC PROGRAM)
- * GRAPHICS DRAW PROGRAM
- * MEMORY PEEK & POKE
- * ML ADDITION

INSTRUCTIONAL SERIES

- * ML PROGRAMMING (Part 2)
- * COMPUTER GRAPHICS (Part 16)
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- * NEW PRODUCTS
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DYNAMIC COLOR NEWS is published monthly by DYNAMIC ELECTRONICS, INC., P.O. Box 896, Hartselle, AL 35640, phone (205) 773-2758. Bill Chapple W4GQC, President; Dean 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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*****
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*   DYNAMIC   COLOR   NEWS   *
*
*           June 1986        *
*
*   Editor and Publisher    *
*       Bill Chapple       *
*
*           Secretary       *
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*
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ML PROGRAMMING (Part 2)

In this series we are showing how to write machine language programs. Machine language programs are much faster than basic but are harder to write. To write them you need an assembler. ML programs can be hand assembled by poking values into memory. This is very awkward and slow, but is useful for demonstrating the procedure. We will hand assemble some of our programs. Machine language subroutines can be linked to basic with the EXEC and USR commands. This makes a very powerful programming tool. Basic can be used to organize and control the program. Machine language subroutines can be called whenever they are needed. After they are completed control is returned to basic. Basic handles machine language subroutines just as if they were basic subroutines.

REGISTERS

Last month we discussed the registers. A register holds a numerical value. This value can be from 0 to \$FF (255) for an 8 bit register and from 0 to \$FFFF (65535) for a 16 bit register. The \$ sign preceding a group of characters means that it is a hexadecimal number or hex. Hex numbers work well for assemblers because two characters can represent the value in an 8 bit register, and 4 characters represent the value in a 16 bit register.

Converting decimal to hex with extended basic can be accomplished with the following formula:

A\$=HEX\$(A)

A is the decimal value and A\$ is the hex equivalent.

To convert from hex to decimal use the following extended basic command:

A=&HFF09

A will be the decimal equivalent of \$FF09.

WORKING REGISTERS

The A and B registers can be considered the working registers. By working we mean that the bytes within the register can be modified. For example we can add a value to the register or subtract a value. We can also rotate or shift the bits plus do logical AND and OR operations.

The A and B registers can be considered as one 16 bit register. This is called the D register. For multiplication the values in the A and B registers can be multiplied and the result is contained in the D register. To use a register we have to put a value in it. This is the LD or LOAD command. There are several options for loading a register. These are called addressing modes. They are Immediate, Direct, Indexed, and Extended.

With Immediate addressing we put a numerical value into the register. This is similar to basic where we can write A=50. This lets A take on the value of 50. The operational code (op code) for load A, immediate is \$86. This value will be stored in memory and when the microprocessor sees it, it knows to load A with the next value in memory. The decimal value 50 or \$32 will be in the next memory location. This command requires 2 bytes, one for the op code and one for the value.

The second addressing mode is Direct. The direct page (DP) register contains the 8 most significant bits. With the DP as a reference we can load A with a value stored in memory.

We go to the memory location determined by the DP and the byte stored in memory after the op code. As an example suppose we want to load the A register with the value stored in memory referenced to the DP register +100 (\$64). The op code for load A direct is \$96. So the first memory location will contain a \$96 and the second will contain \$64. To determine the decimal value of the memory from which to load A, just multiply the value of the DP register by 256 and add 100 (\$64) to it.

For indexed addressing, the memory location of the value is determined by the value stored in another register plus an offset. We will discuss this in detail later.

For extended addressing, the two bytes after the op code determine the memory address of the value to load into the register. Suppose we want to put the value stored in memory location 30000 (\$7530) into the A register. The op code for load A extended is \$B6. So the following values would be in our machine language program:

Memory	Hex Value
M	B6
M+1	75
M+2	30

To show how a program is hand assembled, we want to give a demonstration program for adding two numbers. Our procedure will be to go to some memory location and get one number to put in the A register. We will add this number to another number stored in memory and place our result in a third memory location. There are two add commands. One considers the carry bit (ADC) and the other ignores the carry (ADD). We will use ADD. Since we will be getting a value from memory we will need the extended addressing op code for ADDA

which is \$BB. ADDA means add to register A. This will be a 3 byte instruction with the first byte containing \$BB and the next two bytes containing the location.

After we do the add operation we need to store our result in memory. The op code for STA extended is \$B7. Use the extended mode for storing values anywhere in memory. Again this will take 3 bytes with the first containing the DP code and the next two the memory location.

At the end of a ML subroutine we need a Return from Subroutine command (RTS). This op code number is \$39.

Lets reserve location 500 and 501 for our two values and let our machine language subroutine start at 510. The machine language subroutine will take 10 bytes. The memory and values of the machine code is shown in the follow chart:

Memory	Value	Operation
510	B6 (182)	Load A ext.
511	1	MS byte of 500
512	F4 (244)	LS byte of 500
513	BB (187)	Add A ext.
514	1	MS byte of 501
515	F5 (245)	LS byte of 501
516	B7 (183)	Store A ext.
517	1	MS byte of 502
518	F6 (246)	LS byte of 502
519	39 (57)	Return from Sub.

PROGRAM IMPLEMENTATION

There are two obvious ways to implementate the program. We can poke values into memory or we can write a basic program to place the values into memory. We will use the latter approach. The values can be contained in a DATA statement and we can READ and POKE them into memory.

The following basic program loads the ML subroutine and handles the "housekeeping" for running it. The memory pokes

and peeks are accomplished with basic but the actual calculation is performed with the ML subroutine.

ML PROGRAM (ADDS TWO NUMBERS)

```

5 ?"PROGRAM 6-1-86
10 ?"COPYRIGHT (c) 1986
15 ?"DYNAMIC eLECTRONICS inc
20 ?"ML ADD PROGRAM
25 'READ IN THE DATA
30 FOR J=510 TO 519
35 READ A:POKE J,A: NEXT J
40 ?"ENTER VALUES of 100 OR
    LESS
45 INPUT"FIRST VALUE";X
50 POKE 500,X 'STORE VALUE IN
    500
55 INPUT"SECOND VALUE";Y
60 POKE 501,Y 'STORE SECOND
    VALUE IN 501
70 EXEC 510 'CALL THE ML
    SUBROUTINE AT 510
80 A=PEEK(502) 'GET THE SUM
    STORED IN 502
85 ?X"+"Y"="A 'DISPLAY THE SUM
90 GO TO 40
100 DATA 182,1,244,187,1,245,
    183,1,246,57

```

USING AN ASSEMBLER

If you have an assembler then you would probably want to start using it. We used extended addressing for our example. It is necessary to enter the command in mnemonics, the addressing mode symbol, and the value. Refer to your assembler instructions for details. The program will start at 510 or \$1FE.

```

LDA <1F4
ADDA <1F5
STA <1F6
RTS

```

If you have our decimal assembler (DISASM) you would enter:

```

LDA E 500
ADDAE 501
STA E 502
RTS

```

A disassembler is usually included in an assembler package and can be used on the machine language subroutine at 510 after running the basic program. Looking at assembled programs with a disassembler is a good way to observe how programs are written.

Whenever possible we want to give sample ML programs like the preceding addition program. The basic program is not required. You could poke the values of the ML subroutine into locations 510-519. Then poke the values to add in 500 & 501. Next EXEC 510 and PEEK (502) for the sum.

```

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*
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*
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*
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* Randomly picks questions and
* answers.
*
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*
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PAGE -1

Last month we gave a page-1 program that allowed a basic program to be restored after a hard reset. This month we wrote a utility program that allows you to look at values in memory and change them. These short programs are useful when you need to pause from your main program and do something else such as memory peeks and pokes.

To load a page -1 program, save the vectors or values in locations 25-28. Enter the following from the keyboard:

```
FOR J=25 TO 28: ?J; PEEK(J): NEXT
```

Write down these values. Then to load a page -1 program do the following:

```
POKE 25,2: NEW
```

Now load the program. You can run the page -1 program and return to the previous program by restoring the values in 25-28. You can go to the page -1 program by poking 25,2 and return to the main program by putting its value in 25.

The program asks for the starting memory (M). It then gets the value (A) stored in M and prints M, A, CHR\$(A). Line 8 is a subroutine that slows the screen down. We put a delay of 50 but you can change this to some other value to suit you. To change a value press the "C" key and enter the memory location to be changed and then the value. The memory is decreased by 5 so you can see that the change was made. If you want to observe a different memory location just type "M" and the program will start from the beginning.

MEMORY PROGRAM LISTING

The following is the program

listing. For Page -1 operation. Spaces should be left out except within the print statements. This is less than 200 bytes. Do not enter statements 1 and 2. When the program is completed you can run it and try some memory scans. Save it on a disk or tape and use it when you need to look at values in memory.

```
1 'PROGRAM 6-2-86
   COPYRIGHT (c) 1986
   DYNAMIC ELECTRONICS INC.
2 'MEMORY PEEK AND POKE PROGRAM
4 INPUT"MEM";M:PRINT"PRESS C TO
CHANGE VALUE,PRESS M FOR NEW MEM
5 A=PEEK(M):A$=CHR$(A):PRINTM;A;
  A$:GOSUB6 :M=M+1:GOTO 5
6 Y$=INKEY$:IFY$=""THEN8
7 IFY$="M"THENRUNELSEIFY$="C"
  THENINPUT"M=";M:INPUT"VALUE";V:
  POKEM,V:M=M-5
8 FORJ=1TO50:NEXT:RETURN
```

```
* * * * *
*
* Would you like to write a
* page -1 program for us? We
* will pay you $5 if we pub-
* lish your program. Here are
* the rules.
*
* 1. It must be less than 200
* bytes.
* 2. It must be able to oper-
* ate at the page -1 desig-
* nated memory area POKE 25,2.
* 3. Write a short paragraph
* about what your program does.
* 4. Send Program listing.
*
* * * * *
```

+ + +

WRITING PROGRAMS (Part 15)

Last month we started covering the extended basic edit commands. We covered INSERT, DE-

LETE, & LIST. This month we want to add a few more commands and give examples. The EDIT command allows you to change a basic statement without having to retype it. For short statements it is easier to retype them. It saves memory if several commands are chained within a basic statement. Therefore if we need to change something in a long statement, the edit command is very useful.

SKIP

This operation allows you to skip over a number of characters. To use it you type in a number and then press the space bar or the left arrow. The cursor will move to the left or right the number of spaces you typed in. Since one line is 32 characters and you want to move to the middle of the second line then do the following if the statement number is 100:

```
EDIT 100 <ENTER>
```

The statement will be listed with the cursor on the first character. Then type:

48* where * means to press the space bar.

You can move back or forward a few characters to position the cursor over the character you want to change.

SKIP TO A CHARACTER

You can also skip over to a character to edit. If you have several commands they will be separated by a ":". To skip to the next command after entering the edit mode type "S:". The cursor will move to the next ":". If you want to go to the third ":" then put the number before the "S". So "3S:" will skip over the the third ":".

MULTIPLE DELETE

You can delete several characters in a similar manner as the skip was performed. To delete characters type the number and then the letter "D". To delete 20 characters type:

```
20D
```

Care should be taken in deleting characters. If you miscount, then you can delete too many characters. It is easy to delete one character at a time by pressing the "D" key once for each character. If you can easily determine the number of characters then the multiple delete method should be used.

CHANGING CHARACTERS

A character can be changed while in the edit mode by typing a capital "C" and then the new character. As an example let's edit line 10 below.

```
10 A$=.MICROCOMPUTER"
```

After typing "EDIT 10 <ENTER>" move the cursor over to the "." with the space bar or type "S." to skip over to the period. To change the <.> to a <"> type "C"

PROGRAMMING

In this series we have been exploring the basic and extended basic commands. For the past few months we have been looking at writing a separate data file. In Vol. 3 No. 1 we showed how to write a separate text file and save it. Last month we showed how to insert and move text with basic programs.

This month we want to develop a separate file that will involve some calculations as well as contain some string data. Let's consider an inventory program. We will want our program to contain the following:

- (1) Number of items (5 bytes)
- (2) Description (12 bytes)
- (3) Value (8 bytes)

We want our program to describe each item, give its value, the number of items, and the total value. We will reserve 5 bytes for the number, 12 bytes for the description, and 8 bytes for the value.

PROGRAM DEVELOPMENT

We will need to divide the program into 3 parts. The first will be to put the information into memory. The second part will be to display the information. The third section will be to save and reload the data.

ENTERING INFORMATION

As previously discussed data can be below or above the basic program. Since we did an example with the data below the basic program, we will put our data above the program. Now the question is how do we arrange the data?

We will want an identifier for the data. Suppose we are keeping an inventory of items for a store on a monthly basis. Then we would want to load in the data for any month and analyze our inventory. We will also need a vector to show where our data begins and ends. Our control program will not be long so let's let our data start at 9000.

Let's put the vector in 9000-1. We can let the next 16 bytes be for the title. There are two approaches we can use. We could reserve a fixed number of bytes for each item. For example we could reserve 25 bytes for all of the information on each item. This may cost us some memory, but will give us the ability to easily modify our information on each item.

For each 25 bit memory block

we will have the following:

BYTES	FUNCTION
0-4	Number of items
5-16	Description
17-24	Value

The memory blocks will be as follows:

9002-9019	Title
9020-9044	First item
9045-9069	Second item
9070-9094	Third item

Lets write an equation to find the starting memory for any item. If N represents the number of the item then.

$$M = 9020 + 25 * (N-1)$$

The first thing we will need in our program will be a menu. From it we can branch to the section we want to run. Also we will need to move our program down in memory. This can be done with the PLCEAR 1 command for extended basic. If you do not have extended basic then you do not have to worry about moving the program down because it starts up at page 0 or 1536.

Because of the length of the program, this month we are only going to write the part that allows data to be entered. This is an interesting program and we will continue next month with the other parts. Fortunately all of the data can be entered as a string and stored in memory.

This program can be expanded to handle other requirements. We included comments to show what each section does.

INVENTORY PROGRAM LISTING

```
2 PRINT"PGM 6-3-86
3 PRINT"INVENTORY PGM
4 PRINT"COPYRIGHT (c) 1986
5 PRINT"DYNAMIC eLECTRONICS
```

```

INC.
6 PCLEAR 1
7 'DISPLAY OPTIONS
10 PRINT"1 ENTER INFORMATION
15 PRINT"2 DISPLAY INFORMATION
20 PRINT"3 SAVE OR LOAD DATA
25 INPUT"ENTER NUMBER";X
30 ON X GO SUB 1000, 2000, 3000
40 GO TO 10
1000 PRINT"THIS ALLOWS DATA TO
    BE ENTERED.
1002 PRINT"1 CHANGE OR ENTER
    TITLE
1004 PRINT"2 ENTER NEW DATA
1006 PRINT"3 MODIFY DATA
1007 INPUT "ENTER NUMBER";X
1008 IF X=1 THEN 1010 ELSE IF
    X=2 THEN 1030
1009 '
1010 INPUT"ENTER TITLE";T$:
    M=9002:FOR J=9002 TO 9019
        :POKE J,32: NEXT
1012 'CLEAR MEMORY BLOCK
1015 L=LEN(T$):IF L>18 THEN
    PRINT"TITLE TOO LONG":GO
    TO 1010
1020 GO SUB 1900: GO TO 1000
1030 'THIS ENTERS NEW DATA
1032 INPUT"ENTER ITEM NUMBER TO
    START";N: IF N=0THEN N=1
1034 M=9019+25*(N-1): BB=M
1035 FOR J=0 TO 24:POKE M+J,32:
    NEXT 'CLEAR ALL DATA
1040 INPUT"ENTER NUMBER OF
    ITEMS";T$
1045 GO SUB 1900
1050 INPUT"ENTER DESCRIPTION";
    T$
1052 T=LEN(T$): IF T>12 THEN
    ?"TOO LONG": GO TO 1050
1055 M=BB+5 'UPDATE MEMORY
1060 GO SUB 1900
1065 INPUT"ENTER VALUE";T$
1070 M=BB+17 'UPDATE MEMORY
1075 GO SUB 1900
1080 INPUT "ENTER 1 FOR MORE
    ITEMS AND 0 TO RETURN TO
    MENU";X
1085 IF X=1 THEN M=BB+25:BB=M:
    GO TO 1035 'UPDATE MEMORY
    FOR NEW BLOCK
1090 MS=INT(M/256): LS=M-256*MS
1091 'SAVE END OF DATA LOCATION
1092 POKE 9000,MS:POKE 9001,LS
1095 RETURN
1800 '
1900 PRINT"THIS STORES STRINGS
    IN MEMORY

```

```

1915 L=LEN(T$) 'FIND LENGTH OF
    STRING
1920 FOR J=1 TO L 'STORE STRING
    IN MEMORY
1925 A$=MID$(T$,J,1):A=ASC(A$):
    POKE M,A: M=M+1
1930 NEXT J: RETURN
2000 PRINT"THIS DISPLAYS THE
    INFORMATION
2005 'DISPLAY THE TITLE
2010 FOR J=9002 TO 9019:A=PEEK
    (J):A$=CHR$(A):PRINTA$;
2015 NEXT J
3000 PRINT"THIS SAVES OR LOADS
    FILES

```

```

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```

INTERFACING COMPUTERS (Part 5)

In this series we are showing how to interface computers. We have been discussing serial ASCII and have show how it is formatted. We discussed the start bits, stop bits, and parity. Also we mentioned handshaking which is a signal line that interrupts the sending device until the receiving device can process the information received. Last month we showed how to connect two color computers together and gave the pin connections for a standard RS-232 connector.

Let's look at handshaking a little more. If handshaking is required then you must connect the yellow or the wire going to pin 1 of the color computer's connector to the appropriate line of the RS-232 connector. Finding the correct pin on the RS-232 connector is sometimes a problem. You will use either pin 4,5,6, or 20. The instructions for the device you are connecting to the computer should tell which pin is required for handshaking. If you are not sure then you may have to use the trial and error method.

Serial ASCII can be very fast or slow. Most modems process information at 300 baud although 1200 baud is becoming more common. Commercial modems are available that send data at rates exceeding 10000 baud. Programs and data saved to a cassette use approximately 1500 baud. Information sent to a printer can be from about 300 to 9600 baud. At 9600 baud data transfer seems fast. A printer with a large buffer operating at 9600 baud can quickly receive characters from the computer and release the computer for other operations. A spooler is a memory buffer for a printer. Our new

printer has an 8K spooler built in. There are programs available that use some of the computer's memory for a spooler. This frees the computer for the operator to use on a sharing basis.

CASSETTE

While on the subject of serial ASCII we are going to look at storing information on a cassette. We can not store voltages on an audio cassette tape nor can we send voltages over the telephone lines. Voltages representing the ASCII bits have to be converted to audio tones. Two tones are used. One tone represents "1" and another tone represents "0".

The tones for the cassette have a frequency of 2400 hertz for a "1". A "0" has a frequency of 1200 hertz. When you hear a program being saved to or loaded from a cassette, the high pitched sounds are "1" and the lower pitched sounds are a "0". The principle of switching between two tones is called frequency shift keying (FSK). In figure 1 is a graphic representation of 5 bits sent using FSK. These are called sine waves. For information on generating sound see Vol. 1, No. 11. Each cycle represents a "0" or a "1" with the shorter cycle or higher frequency being the "1" and the longer cycle or lower frequency being the "0".

The computer converts the sine waves into ones and zeros by observing the time for a cycle. The longer time is a "0" and the shorter time is a "1".

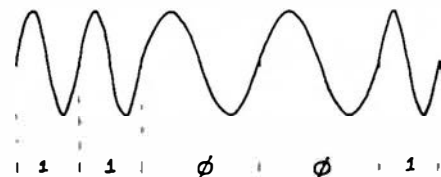


Figure 1

Data could be saved much faster on a stereo recorder. A frequency of 12500 hertz should be easily handled by a stereo recorder. If $R=12500/2500$. Then R would be 5. We should be able to save data at least 5 times faster with a stereo recorder using only one channel. If we use two channels then we should be able to save data 10 times faster than the standard cassette. To do this we would have to rewrite the cassette input/output routines or write a separate routine. Also we would have to decide what information we would put on the two stereo channels.

EDITOR'S COMMENTS

Last month we finished our large memory program series, or at least we thought we had. There is much interest in programs for 256K memories. People seem to get offended when I tell them that 32K is generally all the memory you can use at one time even with a 512K RAM. However this is not a disadvantage. With a ramdisk, files can quickly be brought into the computer. The problem is that most programs are written for a 32K or 64K computer.

If you have a dedicated program such as a word processor or spread sheet, then to modify it for 256K will be a hard task especially if the program is in machine language. We are considering this and maybe we can start a series on 256K programs soon.

The Summer is usually a slack period for computer sales. We are pleased with the support we are receiving and want to thank each of our subscribers. I read in a major computer magazine that there is not much support for the Radio Shack Color Computer and it is not used for business applications. I would have to disagree with this. Although

Tandy advertises the Color Computer as a learning device for kids or a game computer, there are a lot of businesses like ours that keep their records on color computers. Because of the output port, it has become a standard for industrial controls. As for accessories, all you have to do is to look at the advertisements in the magazines to see what is available.

What is depressing to me is the lack of knowledge about the color computers demonstrated by Radio Shack personnel. It sure would be helpful if they would read the Rainbow, Spectrogram, CoCo Ads, and Dynamic Color News. I received a letter from Radio Shack to go by any Radio Shack store and have an update to my OS-9 ordered. I have tried 3 times to get this update and nobody seems to know what I need. They really give me a funny look when I tell them that 512K memories are available for Color Computers.

We still need your letters and comments. If you have a problem or suggestion, please write us. We will publish the answers to letters in our question and answer section. We want to know what subjects you would like for us to cover.

```

+ ++ + ++ + ++ ++ ++ + ++ + ++ +
+
+          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 6/86. +
+
+ + ++ + ++ + ++ ++ ++ + ++ + ++

```

CHORDS MUSIC PROGRAM

Whether you are a musician or not, you will like this exciting program. When run it displays a piano keyboard and lists the chords. When you select a chord to play, it indicates the notes that will be played. You can play all of the chords in all of the 12 keys. The chords can be inverted. This is a very good program to learn chords or to use for entertainment. This program is provided by courtesy of T & D Software and is used by permission. See their advertisement on page 7.

```

0 ' COPYRIGHT (C) T&D SOFTWARE 1
986 * CHORDS *
1 ' .....
2 '          MUSICAL CHORDS          '
3 '          '                        '
4 '          BY: BOB VAN DER POEL    '
5 '          17435-57 AVENUE         '
6 '          EDMONTON ALBERTA       '
7 '          CANADA T6M 1E1         '
8 '          OCT. 18, 1984           '
9 ' .....
10 CLS0:SCREEN0,1
20 CLEAR1000:GOTO700
30 PMODE4:EXECPEEK(&H1B)*256+PEEK
K(&H1C)-&HC47
40 DIMC1(30),KP(36,1)
50 F=0:A=0:FORT=4T0249STEP6:A=A+
1:IFA=6ORA=13ORA=18ORA=25ORA=30T
HENT=T+6
60 F=F+1:IFF=2ORF=4ORF=7ORF=9ORF
=11THENKP(A,1)=25:GOTO80ELSEKP(A
,1)=49
70 IFF=12THENF=0
80 KP(A,0)=T:NEXT
90 GET(0,0)-(100,6),C1
100 C=1:R=1:GOSUB300:GOSUB320:C$
=CHR$(1):GOSUB380:GOSUB360
110 SCREEN1,0
120 'main program starts here
130 I$=INKEY$:IFI$=""THEN130
140 IFI$<>CHR$(8)ANDI$<>CHR$(9)T
HEN180ELSEGOSUB300
150 R=R-(I$=CHR$(9))+(I$=CHR$(8)
):IFR<1THENR=12ELSEIFR>12THENR=1
160 GOSUB300:GOTO350

```

```

170 'root cursor
180 IFI$<>CHR$(10)ANDI$<>CHR$(94
)THEN220ELSEGOSUB320
190 C=C-(I$=CHR$(10))+(I$=CHR$(9
4)):IFC<1THENC=18ELSEIFC>18THENC
=1
200 GOSUB320:GOTO350
210 'inversions
220 IFI$="I"THENIFLEFT$(C$,1)<=C
HR$(24)GOSUB360:C$=MID$(C$,2)+CH
R$(ASC(LEFT$(C$,1))+12):GOSUB360
230 IFI$="U"THENIFRIGHT$(C$,1)>C
HR$(12)GOSUB360:C$=CHR$(ASC(RIGH
T$(C$,1))-12)+MID$(C$,1,LEN(C$)-
1):GOSUB360
240 'play chord
250 IFI$<>"P"THEN130ELSEP$="":FO
RT=1TOLEN(C$):N=ASC(MID$(C$,T,1)
):O=1-(N>12)-(N>24)-(N>36)
260 IFN>12THENN=N-12:GOTO260
270 P$=P$+" ":"+0"+CHR$(O+48)+" ":"
+MID$(STR$(N),2):NEXT
280 PLAY"L20;XP$;XP$;XP$;XP$;XP$
;XP$;XP$;XP$;XP$;XP$":GOTO130
290 'toggle root cursor
300 PUT(R*21-19,78)-(R*21-1,89),
C1,NOT:RETURN
310 'toggle chord type cursor
320 IFC<10THENPUT(2,C*8+87)-(92,
C*8+95),C1,NOT ELSEPUT(127,C*8+1
5)-(230,C*8+23),C1,NOT
330 RETURN
340 'create chord
350 GOSUB360:C$=CHR$(R):ONC GOSU
B380,390,400,410,420,430,440,450
,460,470,480,490,500,510,520,530
,540,550:GOSUB360:GOTO130
360 FORT=1TOLEN(C$):A=ASC(MID$(C
$,T,1)):PUT(KP(A,0),KP(A,1))-(KP
(A,0)+4,KP(A,1)+4),C1,NOT:NEXT:R
ETURN
370 'this is the logic for
      creating the chords
380 GOSUB570:GOTO600 'major
390 GOSUB560:GOTO600 'minor
400 GOSUB380:GOTO630 '7th
410 GOSUB560:GOSUB590:GOTO620 'd
im
420 GOSUB570:GOTO610 '+5
430 GOSUB570:GOTO590 '-5
440 GOSUB570:GOTO620 '6th
450 GOSUB560:GOTO620 'minor 6th
460 GOSUB400:GOTO670 '7th+9
470 GOSUB390:GOTO630 'minor 7th
480 GOSUB400:GOSUB650:GOTO680 '1
3th(-9)
490 GOSUB380:GOTO640 'maj 7th

```

```

500 GOSUB570:GOSUB610:GOTO630 '7
th(+5)
510 GOSUB570:GOSUB590:GOTO630 '7
th(-5)
520 GOSUB400:GOTO660 '9th
530 GOSUB400:GOTO650 '7th-9
540 GOSUB490:GOTO660 'maj7add9
550 GOSUB520:GOTO680 '13th
560 F=3:GOTO690
570 F=4:GOTO690
580 F=5:GOTO690
590 F=6:GOTO690
600 F=7:GOTO690
610 F=8:GOTO690
620 F=9:GOTO690
630 F=10:GOTO690
640 F=11:GOTO690
650 F=13:GOTO690
660 F=14:GOTO690
670 F=15:GOTO690
680 F=21:GOTO690
690 C$=C$+CHR$(R+F):RETURN
700 PCLEAR4:GOTO30

```

COMPUTER GRAPHICS (Part 16)

This is the longest series we have run and it has been an exciting one for us. One amazing thing about graphics is that we can see what we are doing. Last month we started on a graphics program that would allow us to draw the figures we have covered in this series. We wanted a program that would do all of the nice things a good program is supposed to do.

The program is designed around two points. We designate the starting point as we run the program. Then with the arrows we move away from this point. When we want to draw a figure using the two points we press a key to indicate that figure.

In case you forget which key is for which function, we included a "help" file that defines the keys. To use it just press "H" when you are in the draw mode and the file will be displayed. We also included a menu that will let you save your

ADVANCED BASIC PROGRAMMING AID

Now there is a product which integrates the most used utility functions for your COCO. It works with all Extended Color Basic COCOs, 16k, 32k and 64k. Look at the features available, no need for a text processor to create or change programs. Saves disk space and time because programs do not have to be saved in ASCII format.

- * COPY COMMAND: Copy one or more statements in a program
- * MOVE COMMAND: Move one or more statements in a program
- * FIND COMMAND: Find a string and REPEAT FIND for string.
- * MULTIPLE EDITING SESSIONS: You can edit two programs at once and MERGE all or part. This also allows you to RUN one pgm while editing another
- * SCROLLING: Allows for down or up scrolling through pgm.
- * AUTOMATIC EDIT: You can enter edit of current line without specifying the line number.
- * COMMAND KEYS: One keystroke enters most basic commands.
- * REPEATING KEYS: Auto repeat.
- * AUTOMATIC LINE NUMBERING: Set start and increment.
- * BASIC FORMATTING: ON/OFF control, for easier reading of list/print multiple stmts
- * KEYBOARD CLICKER: ON/OFF
- * CLEAR KEY DISABLE: ON/OFF
- * AUTOMATIC MENU LOADER: If you have a favorite menu pgm you can load it automatically.
- * AUTOMATIC PROGRAM EXIT: Run another ML pgm w/no pwr off.

ALSO SUPER PROGRAMMING AID: You get Advanced Programming Aid plus:

- * PROGRAMMABLE COMMAND KEYS: You get a command editing Program to make the keys do what you want, enter up to 250 characters with one key.

ADVANCED PROGRAMMING AID \$24.95
 SUPER PROGRAMMING AID \$29.95
 Upgrade from ADV to SUPER \$14.95

ALSO: GO-THELLO - a popular board game, 1 or 2 players, 3 levels of difficulty on 1 player. \$12.95

BSS DISK MANAGER: copy, move, kill run, rename etc. handy for disk management make it simple: \$14.95

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 Indianapolis, IN 46221

drawing to a cassette or disk, or it will let you load a new drawing.

We used a simple method to determine if you are using a disk or cassette. Extended disk basic initializes with 4 graphics pages cleared as does extended basic. We looked at the value stored in location 25. If it is a 38 then we are using a disk system. We can also determine where our drawing ends by multiplying this value by 256. Four graphics pages is equal to 6144 bytes so our beginning is equal to the ending less 6144. This gives us the parameters for saving our drawing as a machine language subroutine.

We also made a slight improvement over last month's program. In last month's program whenever we went back over a portion of our drawing it erased it. We took care of this problem by using the PPOINT command. This allows us to look at a graphic cell which is our X2,Y2 and assign a variable to retain its state so we could restore it after we left the point. This is in line 95.

With this program you can draw the figures we have covered. You might want to keep this as a reference.

GRAPHICS DRAW PGM

This program draws lines, circles, boxes, and filled boxes. It also erases an area defined by two points. Drawings may be saved or loaded to or from a cassette or disk. The program is menu oriented and includes a "HELP" menu as well as a control menu.

```
10 PRINT"GRAPHICS PROGRAM
12 PRINT"ALLOWS YOU TO DRAW AND
    SAVE YOUR GRAPHICS PICTURES.
15 PRINT"A HELP MENU IS INCLUDED
    AS WELL AS A MENU FOR LOADIN
```

```
    G AND SAVING YOUR DRAWINGS.
18 PRINT
20 PRINT"PROGRAM 6-4-86
30 PRINT"cOPYRITE (c) 1986 BY dY
    NAMIC eLECTRONICS iNC.
40 PRINT"THIS IS DESIGNED AROUND
    USING TWO POINTS P1=X1,Y1
    AND P2=X2,Y2
45 INPUT"PRESS ENTER TO CONTINUE
    ";T
50 INPUT"FIRST POINT";X1,Y1
60 X2=X1:Y2=Y1:PCLS
70 CLS:PRINT@0,"X1="X1;" Y1="Y1;
    "X2="X2;"Y2="Y2
80 INPUT"PRESS A KEY";Y$
85 GO TO 1000
90 PMODE 3,1: SCREEN 1,0'SET UP
    FOR GRAPHICS
92 'SAVE THE STATUS OF X2,Y2
95 W=PPOINT(X2,Y2):XX=X2:YY=Y2
97 'SET AND RESET THE GRAPHICS P
    OINT TO SHOW WHERE YOU ARE
100 X$=INKEY$:GOSUB 300:GOSUB310
    :IFX$=""THEN 100
110 SOUND 150,1:X=ASC (X$)
120 IF X=9 THEN X2=X2+1
125 IF X=93 THEN X2=X2+10
130 IF X=8 THEN X2=X2-1
135 IF X=21 THEN X2=X2-10
140 IF X=10 THEN Y2=Y2+1
145 IF X=91 THEN Y2=Y2+10
150 IF X=94 THEN Y2=Y2-1
155 IF X=95 THEN Y2=Y2-10
170 IF X$="C" THEN GO SUB 320 'D
    RAW A CIRCLE WITH X1,Y1 CENTE
    R AND RADIUS EQUAL TO DISTANC
    E FROM P1 TO P2
180 IF X$="L" THEN GOSUB 260 'DR
    AW A LINE
190 IF X$="N" THEN PCLS 'ERASE D
    RAWING
200 IF X$="I" THEN X1=X2:Y1=Y2 '
    INITIALIZE FIRST POINT TO EQU
    AL THE SECOND
210 IF X$="B" THEN GOSUB 270 'DR
    AW A BOX
220 IF X$="F" THEN GOSUB 280 'DR
    AW A FILLED BOX
225 IF X$="H"THEN 1000
230 IF X$="E" THEN GOSUB 290 'ER
    ASE THE BOX
235 IF X$="M" THEN 500
240 IF X$="P" THEN 70 'PRINT THE
    COORDINATES OF THE POINTS
245 IF W=1 THEN PRESET (XX,YY)
247 IF W=4 THENPSET (XX,YY)
250 GO TO 90
260 LINE (X1,Y1)-(X2,Y2),PSET:R
```



```

ETURN 'DRAW A LINE
270 LINE (X1,Y1)-(X2,Y2),PSET,B:
RETURN 'DRAW A BOX
280 LINE (X1,Y1)-(X2,Y2),PSET,BF
:RETURN 'DRAW A FILLED IN BOX
290 LINE (X1,Y1)-(X2,Y2),PRESET,
BF:RETURN 'ERASE BOX OUTLINE
300 PSET (X1,Y1):PSET (X2,Y2):RE
TURN 'THIS SETS THE POINTS
310 PRESET (X1,Y1):PRESET (X2,Y2
):RETURN 'THIS RESETS THE POI
NTS
320 'SET UP FOR DRAWING CIRCLE
330 G=ABS(X2-X1):H=ABS(Y2-Y1): W
=SQR (G*G+H*H)
340 W=INT (W+.5) 'ROUND OFF RADI
US
350 CIRCLE (X1,Y1),W:RETURN
400 X#=INKEY#:PRINTX#;:A=PEEK(50
0):GO TO 400
500 CLS:PRINT"THESE ARE THE OPTI
ONS
505 AA=PEEK(25)
510 PRINT"1 SAVE THE DRAWING
520 PRINT"2 LOAD A NEW DRAWING
530 PRINT"3 RETURN TO DRAWING
540 PRINT"4 START A NEW DRAWING
545 PRINT"5 LOOK AT PGMS ON DISK
DIRECTORY
550 INPUT"ENTER NUMBER";N
560 ON N GO TO 610,620,90,50,630
610 EN=256*AA+PEEK(26)-1:BE=EN-6
144:EX=BE
611 INPUT"ENTER NAME";N#:IF AA=3
8 THEN SAVEM N#,BE,EN,EX:GO T
O 500
612 IF AA=30 THEN CSAVEM,N#,BE,E
N,EX:GO TO 500
620 INPUT"THIS LOADS A NEW DRAWI
NG. ENTER NAME";N#:IF AA=38 T
HEN LOADM N# ELSE CLOADM N#
625 GO TO 500
630 DIR:INPUT"PRESS ENTER TO CON
TINUE";T:GO TO 500
1000 CLS:PRINT"HELP FILE. WHEN I
N THE DRAW MODEYOU CAN PRESS
THE FOLLOWING KEYSFOR THE IND
ICATED FUNCTION
1005 PRINT"B-DRAWS A BOX THROUGH
P1 & P2
1007 PRINT"C-DRAWS A CIRCLE WITH
THE POINTS AS RADIUS
1010 PRINT"E-ERASES BOX DEFINED
BY P1 & P2
1020 PRINT"F-FILLS BOX DEFINED B
Y P1 & P2
1030 PRINT"I-INITIALIZES P1 = P2
1035 PRINT"H-BRINGS YOU HERE FOR

```

```

HELP
1040 PRINT"L-DRAWS A LINE
1045 PRINT"N-NEW DRAWING ERASES
OLD
1050 PRINT"P-PRINTS COORDINATES
OF P1 & P2
1055 PRINT"SHIFT WITH ARROW KEYS
INCREASES THEIR VALUE BY 10.
1060 INPUT"PRESS ENTER KEY TO RE
TURN";T
1070 GO TO 90

```

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.

ADVANCED BASIC PROGRAMMING AID

When you move from Basic to Extended Basic you pick up many extra features. Going from Extended Basic to Disk Basic adds more. There are always features that you would like that are not included. Advanced Basic Programming Aid from Bangert Software Systems adds those extra features you have always wanted. This is a very complete program and we will give a description of what it does and what you can expect from it.

Auto line numbering allows the beginning and increments for line numbers to be set. After enacting auto line numbering the first number appears and you can enter the commands for that line. When you press the "ENTER" key the next line number appears.

A program can be suspended while working on a second pro-

gram. After working on the second program, the first program can be recovered. The second program can even be merged with the first if its line numbers are larger than those of the first program. A "COPY" command is included that will allow a statement or group of statements to be copied from one part of the program to another. This prevents having to retype lines that are used several times in the program.

If it is desirable to move some lines from one location to another then the "MOVE" command can be used. This is similar to the "COPY" command except the lines are removed from the original location.

To locate the statement containing a word phrase, the "FIND" command can be used. After entering the phrase to be found, the FIND command lists the line number containing the phrase.

A scroll feature is included that allows lines to be scrolled down or up. This means that lines can be listed in ascending or descending order one line at a time. This is activated by pressing the down arrow and the right arrow for upward scrolling and the left arrow for downward scrolling.

An auto repeat key feature is included. This operates by pressing the clear key which repeats the last character. It surely makes editing easier, especially for long lines. It is easy to move to any part of the line being edited by repeating the space bar or left arrow keys.

Another feature is the list formatter. This starts each command on a new line for a statement number containing several commands. The commands are indented so it is easy to read the commands and the statement number.

A key clicker is included. This gives a sound each time a

key is pressed.

Two keystrokes can cause the last listed line to be edited. It is much easier to press two keys than to type "EDIT 820" if 820 was the last line listed.

Since the "CLEAR" key is next to the "ENTER" key, sometimes it is pressed by mistake. A feature is included that allows the "CLEAR" key to be toggled ON or OFF so that in case it is accidentally pressed, the screen will not be cleared.

An automatic menu feature is included. This will load the program M.BAS with a two key entry. The automatic menu loader can be turned on or off with two key strokes.

To save time in entering basic programs, many of the commands can be entered by pressing the down arrow and one key. Since this is very useful, we are listing the key and the characters that are entered when the down arrow and the keys are pressed:

A	AUDIO 0	B	BACKUP
C	CIRCLE(D	DRAW
E	EDIT	F	FOR
G	GOTO	H	GOSUB
I	INPUT	J	JOYSTK(
L	LINE(M	MID\$(
N	NEXT	O	OPEN
P	PEEK(Q	PLAY
R	READ	S	SOUND
T	TIMER	U	LIST
V	DIR	W	POKE
X	INKEY\$	Y	RETURN
Z	CLOAD"		

The Advanced Basic Programming Aid is a superior program and greatly reduces time for writing and editing basic programs.

Bangert Software Systems, P. O. Box 21056, Indianapolis, IN 46221. , \$24.95 + \$2 S/H.

+ + + DCN STAFF + + +

QUESTIONS & ANSWERS

These are questions that have been asked us. If you have a question, write us and we will answer your question here. We will send you an individual reply for \$10.

QUESTION: I have just purchased A drive 1 upgrade (1/2 height to my Radio Shack 26-3129). I need your professional expertise on how to run, save, copy disks from drive 0 to drive 1. I also need information on what disks to place in drive 0 or drive 1. Also how to save programs which I have on disks to new disks for drive 1. I have been getting IO errors.

ANSWER: You need a disk operating manual. This will show you how to copy files and backup disks. Get Radio Shack to order you one if they do not have one in stock. Drive 1 works the same as drive 0. To access drive 1 just type DRIVE 1. A disk will work the same on either drive. If you are getting errors and the new drive is under warranty, Radio Shack should resolve the problem without cost. We have heard of other people having compatibility problems with second Radio Shack drives. If you are considering purchasing a second drive locally, we suggest you take your drive and computer to the store and make sure both work properly together. A Radio Shack Computer center is supposed to be able to resolve these problems.

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