

# RADIO SHACK COLOR COMPUTER MAGAZINE

Sept. 1987  
Vol. 4 No. 7

\$1.95



Ham Radio  
ML Programming  
Hardware Interface  
Games

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

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The purpose of this magazine 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 magazine 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 magazine. 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   *
*
*       Sept  1987       *
*
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# INTRODUCING DYPRINT

## Color Computer 2

These accessories work on the color computer 2 and the earlier color computers.

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A 64K computer can only access 32K. The MEMORY MANAGER contains a complete set of software for managing the second 32K memory bank in 64K computers. Run Basic programs in each bank or use the Ramdisk for program storage. Available free with our memory upgrades. \$21.95 Disk or Tape.

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ME-12: Upgrade 8-chip 4164 type 64K computers to 128K. \$39.95

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Now you can print LARGE signs for special occasions such as birthdays, parties, or yard sales. Even make your own FOR SALE signs when you need to sell that old car or lawnmower. Banner uses standard print characters and is compatible with any printer. The characters are formed by a 21 x 27 dot pattern and are printed sideways across the paper. The basic character can be expanded up to 4 times for making large characters up to a full page.

The printer parameters can be used to expand the size and quality of the signs. For example high density signs can be printed with printers that use compressed characters. Darker signs can be printed by using double strike.

## MAXPRINT

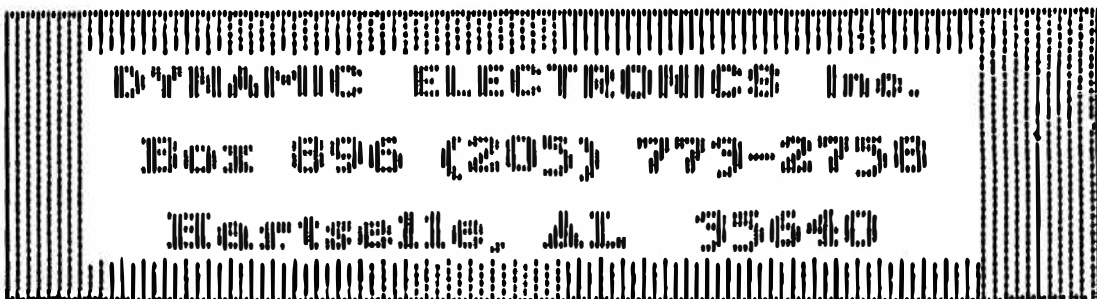
MAXPRINT allows graphics to be blown up and printed on a standard printer. Any PMODE 4 picture generated by COCOMAX, MAGIGRAPH, VIDEO DIGITIZERS, or BASIC can be printed. This allows a large picture or poster to be made. The program supports all 8 graphics pages for a total of 12288 bytes. MAXPRINT prints 8 characters per byte for a total of 98304 characters.

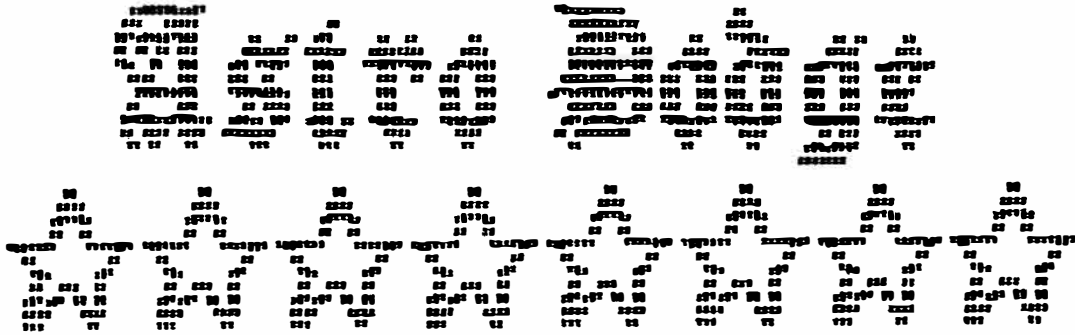
The graphics picture is 256 characters wide and is printed with 2 passes for the 128 character per line mode or 8 passes for the 32 character per line mode using large characters. The results from each pass can be trimmed and taped together to form a large blown up picture.

Use MAXPRINT to blow up pictures of friends and family and make posters announcing sales or special events.

The DYPRINT package contains both BANNER and MAXPRINT. The cost is only \$19.95 plus \$3 shipping for tape or disk.

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This Basic - Machine language hybrid game requires quick reflexes as you dodge the fast moving obstacles. Disk users must PCLEAR 0 before loading this game. To do this, enter POKE 25,14: POKE 26,1: POKE 3584,0\* NEW before loading the program. This program is provided as a courtesy of T & D Software (See their advertisement on page 8), and is used by permission.

```

0 REM COPYRIGHT (C) T&D SOFTWARE
  1986   astrododge
1 CLEAR800,15999:CLS0:PRINT@230,
  "ONE MOMENT PLEASE...";
2 FORI=16000TO16356:READA$:A=VAL
  ("&H"+A$):POKEI,A:NEXT'ASTRO
  DODGE BY BRUCE MOORE
  MAY 1986
3 A=PEEK(27)*256+PEEK(28):D=A-61
  44:A1=D:A2=D+1700:R1=D+1750:R
  2=R1+1450:G1=R2+10:G2=G1+1500
  :P1=G2+10:P2=A
4 DEFUSR0=16000:DEFUSR1=16058:DE
  FUSR2=16082:DEFUSR3=16126:DEF
  USR5=16310:A$=""
5 READA:IFA<127THENREADD:FORI=1T
  OA:A$=A$+CHR$(D):NEXT:ELSEIFA
  =999THEN7
6 IFA=999THEN7ELSEA$=A$+CHR$(A):
  GOTO5
7 READA:IFA<127THENREADD:FORI=1T
  OA:B$=B$+CHR$(D):NEXT:ELSEIFA
  =999THEN9
8 B$=B$+CHR$(A):GOTO7
9 PRINT@68,A$;:PRINT@228,B$;:D=I
  NT(A1/256):POKE73,D:POKE74,A1
  -D*256:D=INT(A2/256):POKE118,
  D:POKE119,A2-D*256:A=USR5(0)
10 A$=CHR$(128):B$=A$+"astro"+A$
  +A$+"dodge"+A$:PRINT@393,"by"
  ;A$;"bruce";A$;"moore";:PRINT
  @453,"press";A$;"any";A$;"key
  ";A$;"to";A$;"start";:A=USR0(
  0)
11 CLS:PRINT@16,STRING$(16,175);
  :PRINT@80,STRING$(16,175);:PR
  INT@48,CHR$(175)+B$+CHR$(175)

```

```

;:PRINT@145,"SCORE: 0";:PRINT
@209,"SHIPS:";:POKE1240,51
12 PRINT@273,"BONUS:";:POKE1304,
  48
13 PRINT@339,"AVOID THE":PRINT@
  370,"ASTEROIDS BY":PRINT@401,
  "USING JOYSTICK":PRINT@437,"T
  O FLY":PRINT@497,"BY BRUCE MO
  ORE";:A=USR1(0)
14 B=1471:C=16:E=142:G=47:H=5:J=
  151:S=5:K=500:W=7:HS=0'G=1
15 IFZZ=1THEN19
16 PRINT@224,"instructions";:PRI
  NT@237,"y"+CHR$(124)+"n";
17 D$=INKEY$:IFD$=""THEN17
18 IFD$="Y"THENGOSUB44ELSEA=USR1
  (.)
19 GOTO24
20 A=USR3(.):IFA<>.THEN23ELSEIFF
  >1THEN22
21 POKEB+RND(C),E+RND(G):F=W:S=S
  +H:PRINT@J,S;
22 A=USR2(.):F=F-1:IFINT(S/K)*K=
  S THEN36ELSE20
23 IFPEEK(1240)=48THEN26
24 D=INT(R1/256):POKE73,D:POKE74
  ,R1-D*256:D=INT(R2/256):POKE1
  18,D:POKE119,R2-D*256:A=USR3(
  0)
25 FORI=1TO3:PLAY"T9L4DDEEFFGG":
  NEXT:PLAY"L1CT2":A=USR5(0):PL
  AY"P4":PRINT@209,"SHIPS":D=R
  ND(-TIMER):GOTO20
26 D=INT(G1/256):POKE73,D:POKE74
  ,G1-D*256:D=INT(G2/256):POKE1
  18,D:POKE119,G2-D*256:POKE124
  0,PEEK(1304):POKE1304,48
27 PRINT@209,"ships:";:PLAY"T2L8
  GGGL4D":IFPEEK(1240)>48THEN23
28 IFS<5000ORHS=1THENA=USR5(0):G
  OTO31
29 H1$="HIGH"+A$+A$+A$+"SCORE":H
  2$="high"+A$+A$+A$+"score":D=
  3
30 D=D-1:PRINT@50,H1$;:FORI=1TO1
  2:PLAY"T20;N=I;T2":NEXTI:PRIN
  T@50,H2$;:FORI=1TO12:PLAY"T20
  ;N=I;T2":NEXTI:IFD>0THEN30ELS
  EHS=1:POKE1240,49:PRINT@48,CH
  R$(175)+B$;:GOTO24

```

```

31 FORI=1TO3:PLAY"T9L4GGFFFEEDD":
NEXT:PLAY"L1CT2"
32 D=INT(P1/256):POKE73,D:POKE74
,P1-D*256:D=INT(P2/256):POKE1
18,D:POKE119,P2-D*256
33 PRINT@224,"play";:PRINT@229,"
again";:PRINT@235,CHR$(123)+"
y"+CHR$(124)+"n"+CHR$(125)::A
=USR5(0):ZZ=1
34 D$=INKEY$:IFD$=""THEN34
35 IFD$="Y"THEN11ELSEIFD$="N"THE
N END ELSE33
36 W=ABS(W-1):IFINT(S/1000)*1000
=S THEN37ELSESE=S+H:GOTO20
37 S=S+5:FORI=1TO16:A=USR3(0):IF
A<>.THENS=S-5:GOTO23
38 A=USR2(0):PRINT@0,"galactic";
:PRINT@9,"barrier";:PLAY"P150
":S=S+5:PRINT@151,S;:NEXT
39 FORX=1TO3:FORI=1TO40+RND(40):
A=USR3(0):PLAY"P60":NEXT
40 PRINT@448,STRING$(16,(RND(128
)+127)OR1):FORI=1TOW+3:POKE14
72+RND(14),32:NEXT
41 FORI=1TO16:A=USR3(0):IFA<>.TH
EN23
42 A=USR2(0):PLAY"P70":NEXTI:S=S
+(10-W)*100:PRINT@151,S;:NEXT
X
43 FORI=1TO60:A=USR3(0):PLAY"P60
":NEXT:GOTO20
44 READX$:IFX$="*"THENRETURNELSE
PRINT@448,X$;:FORI=1472TO1487
:IFPEEK(I)=96THENPOKEI,32:NEX
T:ELSENEXT
45 A=USR2(0):FORI=1472TO1487:POK
EI,32:NEXT:PLAY"P8"
46 GOTO44
47 DATA C6,82,8E,4,0,8D,2A,E7,89
,1,E0,E7,80,8C,4,1F,26,F3,8D,
1D
48 DATA E7,80,E7,84,30,88,1F,8C,
5,FF,26,F2,F7,5,FF,8E,B,B8,BD
,A1
49 DATA C1,26,E,30,1F,26,F7,20,D
1,C1,E6,23,3,C6,82,5A,5C,39,1
2,8E
50 DATA 4,0,86,20,C6,10,A7,80,5A
,26,FB,8C,5,F0,27,5,30,88,10,
20
51 DATA EF,39,12,8E,4,20,10,BE,3
F,19,86,10,E6,80,C1,16,27,7,E
7,88
52 DATA DF,C6,16,E7,A4,4A,26,F0,
8C,5,F0,27,5,30,88,10,20,E4,3
1,A8
53 DATA E0,86,20,A7,A4,39,12,AD,
9F,A0,A,B6,1,5A,81,15,23,7,81
,2A
54 DATA 24,7,5F,20,A,C6,FF,20,6,
C6,1,20,2,4,27,BE,3F,19,C1,FF
55 DATA 26,5,BD,3F,4C,20,1,3A,8C
,4,21,24,5,BE,3F,19,20,1E,8C,
4
56 DATA 2E,23,19,BE,3F,19,20,14,
10,BE,3F,19,86,20,A7,A4,86,16
,A7,84
57 DATA BF,3F,19,39,30,1F,39,39,
A6,84,81,20,26,9,A6,88,20,81,
20,26
58 DATA 2,20,DD,81,16,27,F3,81,A
F,27,6C,8D,34,86,20,10,BE,3F,
19,A7
59 DATA A4,CE,A8,5C,10,8E,3,E8,4
F,A7,84,4C,81,FF,26,F9,E6.CO,
F7,FF
60 DATA 20,4F,31,3F,26,EF,B6,4,D
8,4A,B7,4,D8,BD,3E,BB,4F,CC,0
,1
61 DATA BD,B4,F4,39,12,B6,FF,1,8
4,F7,B7,FF,1,B6,FF,3,84,F7,B7
,FF

```

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- 62 DATA 3,B6,FF,23,8A,8,B7,FF,23  
.39,12,8D,E4,9E,49,A6,80,C6,8  
.48
- 63 DATA 76,FF,20,10,8E,0,6,31,3F  
.26,FC,5A,26,F1,9C,76,25,E9,3  
9,B6
- 64 DATA 5,18,4C,B7,5,18,86,20,BE  
.3F,19,30,88,20,A7,84,39
- 65 DATA4,175,128,174,3,172,128,4  
.175,128,175,172,172,175,128.  
4,175,8,128,128
- 66 DATA175,128,128,175,128,171,3  
.163,128,128,165,170,128,128,  
175,163,163,175,128,175,128.1  
28,175,8,128,128
- 67 DATA4,175,4,128,165,128,128.1  
65,170,128,128,175,128,175,12  
8,128,175,128,128,175,8,128.1  
28
- 68 DATA175,128,128,175,128,3,163  
.167,128,128,165,170,128,128,  
175,128,175,175,128,4,175,999
- 69 DATA3,175,171,128,4,175,128,3  
.175,171,128,4,175,128,4,175,  
8,128,128
- 70 DATA175,128,128,175,128,175,1  
28,128,175,128,175,128,128,17  
5,128,175,4,128,175,163,163,9  
.128
- 71 DATA175,128,128,175,128,175,1  
28,128,175,128,175,128,128,17  
5,128,175,128,172,175,128,175  
.172,172,128,8,128,128
- 72 DATA3,175,174,128,4,175,128,3  
.175,174,128,4,175,128,4,175,  
999
- 73 DATA" welcome to"," astro  
dodge"." ","you are about to  
"."fly your ship","through ma  
ny","dangerous","asteroid fie  
lds"." ","do not let your","s  
hip hit an","asteroid"," ","e  
ach asteroid"."you pass is"."  
worth 5 points"
- 74 DATA" ","the field"."becomes  
thicker","the longer you","fl  
y"." ","each 1000 point","inc  
rement you","must cross the".  
"forboding","galactic barrier  
" " "
- 75 DATA"hit the totally","blue @  
asteroids","to get bonus","sh  
ips"." ","may you fly well",  
\*  
\*  
\*

# ML Programming

by

John Galus

Part 16

## *A Journey Through Rom*

If we were to look at a memory map for the Color Computer, like the one in the Radio Shack manual, we would see that the Extended Color Basic ROM is located at \$8000 to \$9FFF, the normal Color Basic is from \$A000 to \$BFFF and the Disk Basic ROM is from \$C000 to \$DFFF. What these areas really contain is the Color Computers Basic interpreter written by Microsoft in 6809 machine language. Interspersed with the machine instructions are ASCII data representing error messages, prompts and the Basic keywords themselves. The Basic keywords are the commands that this interpreter understands. If we try to give the computer a command that is not in its vocabulary we will get the all to familiar SN or syntax error. If we were to peek out areas of ROM we should be able to find all sorts of interesting things but, instead of having you look through the entire ROM I will tell you where you can find the starting address of the Basic commands so that you can examine them and see how they operate.

All of the addresses of these ROM routines will be for the Color Computer II 1.1 version of Extended and Disk Basic. If you own a different version, especially Disk version 1.0 or a COCO III these addresses may be different. First a little information on this thing we call an interpreter. As the word

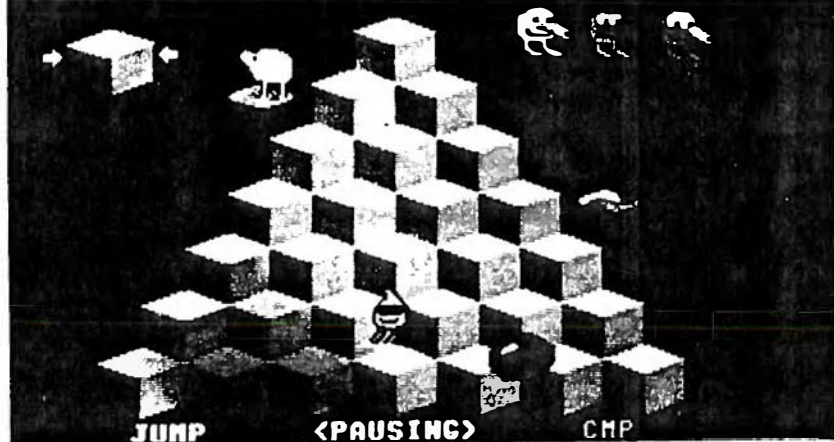
suggests the role of an interpreter is to accept a Basic program or statement as input, analyze this code and attempt to perform the instruction. Actually, to the interpreter your Basic program is seen as nothing more than a data file. For the interpreter to act on any of your commands naturally it must understand them and act accordingly. It does this by means of subroutine calls located in the ROM, which first, get the parameters for a particular command if required and perform the functions. To find the correct subroutine to call for a Basic command, the interpreter uses a "lookup table" where it finds the right address and transfers control to that subroutine. It then performs the task and returns to the interpreter's monitor to fetch another command.

If we look at \$AA66 in Color Basic, \$8183 and \$821E in Extended Color Basic, and \$C192 and \$C219 in Disk Basic 1.1 version we find the Basic Keywords in ASCII. Following each of these tables we find a two byte address for the location of the beginning of the Basic keyword in order. These two byte addresses start at \$AB67 for Color Basic and at \$81F0 for Extended Basic for one half of the keywords and at \$8257 for the other half.

Disk Basic's tables are located at \$C238 and \$C24E. Basic knows where these routines are located by looking at a zero page memory area starting at \$120. Here you can find the

HI: 00900  
SCORE: 000250

LEVEL: 1  
ROUND: 1



Introduction

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number of keywords followed by a two byte address for the ASCII basic keywords followed by a two byte address that points to the beginning of the lookup table for those keywords. Here is an example of what this looks like starting at \$120.

```
$137 35 NUMBER OF KEYWORDS
$138-39 $AA29 ASCII KEYWORDS
$140-41 $AB67 LOOKUP TABLE
```

When the number of keywords in these tables is zero then we have reached the end of the tables. If you own a Disk system some of the addresses listed above will point to an area in the Disk section of ROM. The system is setup on initialization for the type of Color Computer you have. You can use this information to examine the Basic ROM's and find the addresses for the commands on your machine.

Below is a list of all the ROM subroutine addresses but, unfortunately there is a slight problem with this list due to the fact that these addresses are where the Basic interpreter enters the subroutine. If you wish to use some of these routines in your Assembly language programming then you must find a direct entry address to that instruction. If you own a Disassembler, such as EDTASM+, you could disassemble the code for a command and find out where the parameters for a Basic instruction are placed. This is usually in a zero page memory area.

For example, on examination of the SOUND command we find that \$8C contains the frequency of the sound and \$8E contains the duration of the sound. After a little work at \$A956 we find a direct entry location for the Sound command. Now if we wish to use the Basic SOUND command in Assembly, all we need to do is place the required duration and frequency into the correct memory areas and then call the subroutine at \$A956 as follows:

```
SOUND 10,10
```

```
SOUND LDA #10 ;FREQUENCY
      STA $8C
      LDA #10 ;DURATION
      STA $8E
      JSR $A956
      SWI
      END
```

#### EXTENDED BASIC ROM SUBROUTINES

| BASIC<br>KEYWORD | ADDRESS |
|------------------|---------|
| DEL              | \$8970  |
| EDIT             | \$8533  |
| TRON             | \$86A7  |
| TROFF            | \$86A8  |
| DEF              | \$8871  |
| LET              | \$AF89  |
| LINE             | \$93BB  |
| PCLS             | \$9532  |
| PSET             | \$9361  |
| PRESET           | \$9365  |
| SCREEN           | \$9670  |
| PCLEAR           | \$968B  |
| COLOR            | \$9546  |
| CIRCLE           | \$9E9D  |
| PAINT            | \$98EC  |
| GET              | \$9755  |
| PUT              | \$9758  |
| DRAW             | \$9CB6  |
| PCOPY            | \$9723  |
| PMODE            | \$9621  |
| PLAY             | \$9A22  |
| DLOAD            | \$8C18  |
| RENUM            | \$8A09  |
| ATN              | \$83B0  |
| COS              | \$8378  |
| TAN              | \$8381  |
| EXP              | \$84F2  |
| FIX              | \$8524  |
| LOG              | \$8446  |
| POS              | \$86AC  |
| SQR              | \$8480  |
| HEX\$            | \$8BDD  |
| VARPTR           | \$86BE  |
| INSTR            | \$877E  |
| TIMER            | \$8968  |
| PPOINT           | \$9339  |
| STRING\$         | \$874E  |

#### COLOR BASIC SUBROUTINES

|     |        |
|-----|--------|
| SGN | \$BC7A |
| INT | \$BCEE |
| ABS | \$BC93 |
| USR | \$112  |

|         |        |       |        |
|---------|--------|-------|--------|
| RND     | \$BF1F | CLOSE | \$A416 |
| SIN     | \$BF78 | LLIST | \$B75E |
| PEEK    | \$B750 | SET   | \$A880 |
| LEN     | \$B681 | RESET | \$A8B1 |
| STR\$   | \$B4FD | CLS   | \$A910 |
| VAL     | \$B716 | MOTOR | \$A78D |
| ASC     | \$B6A0 | SOUND | \$A94B |
| CHR\$   | \$B68C | AUDIO | \$A990 |
| EOF     | \$A5CE | EXEC  | \$A59E |
| JOYSTK  | \$A9C6 | SKIPF | \$A5EC |
| LEFT\$  | \$B6AB |       |        |
| RIGHT\$ | \$B6CB |       |        |
| MID\$   | \$B6CF |       |        |
| POINT   | \$ABF8 |       |        |
| INKEY\$ | \$A564 |       |        |
| MEM     | \$B4EE |       |        |
| FOR     | \$AD47 |       |        |
| GO      | \$AE86 |       |        |
| REM     | \$AEE3 |       |        |
| IF      | \$AF14 |       |        |
| DATA    | \$AEE0 |       |        |
| PRINT   | \$B8F7 |       |        |
| ON      | \$AF42 |       |        |
| INPUT   | \$AFF5 |       |        |
| END     | \$AE02 |       |        |
| NEXT    | \$BOF8 |       |        |
| DIM     | \$B34E |       |        |
| READ    | \$B046 |       |        |
| RUN     | \$AE75 |       |        |
| RESTORE | \$ADE4 |       |        |
| RETURN  | \$AECO |       |        |
| STOP    | \$AE09 |       |        |
| POKE    | \$B757 |       |        |
| CONT    | \$AE30 |       |        |
| LIST    | \$B764 |       |        |
| CLEAR   | \$AE41 |       |        |
| NEW     | \$AD17 |       |        |
| CLOAD   | \$A498 |       |        |
| CSAVE   | \$A44C |       |        |
| OPEN    | \$A5F6 |       |        |

DISK BASIC COMMANDS 1.1 VERSION

|        |        |
|--------|--------|
| DIR    | \$CCA9 |
| DRIVE  | \$CEC5 |
| FIELD  | \$DOBC |
| FILES  | \$D15C |
| KILL   | \$C6EF |
| LOAD   | \$CA48 |
| LSET   | \$D102 |
| MERGE  | \$CA39 |
| RENAME | \$D01B |
| RSET   | \$D101 |
| SAVE   | \$C9E0 |
| WRITE  | \$D066 |
| VERIFY | \$D74E |
| UNLOAD | \$D233 |
| DSKINI | \$D599 |
| BACKUP | \$D262 |
| COPY   | \$D3B9 |
| DSKI\$ | \$D4ED |
| DSKO\$ | \$D562 |
| DOS    | \$D6EC |
| CVN    | \$CDF4 |
| FREE   | \$CE9C |
| LOC    | \$CE10 |
| LOF    | \$CE37 |
| MKN\$  | \$CE02 |
| AS     | \$B277 |

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## REFORMATTING DATA

There are numerous applications where data must be changed from one form to another. In communications many different codes are used. We are familiar with ASCII because it is the code computers use for sending serial data. Early teletype machines used the Baudot code. This is a 5 bit code which will allow 32 characters to be sent. A shift code is sent to set (1) or clear (0) a bit effectively allowing a 6 bit code. This allows over 60 characters to be sent. To get computer data to print on a Baudot machine, the ASCII has to be changed to Baudot information and the shift character sent as needed.

Some data can be converted by using lookup tables. For the ASCII-BAUDOT conversions we can look up the equivalent codes for converting from one to the other. This can easily be done by using arrays in basic. Arrays can be established in memory by starting at a given location and counting from the start of the data. Suppose we want our ASCII-BAUDOT data to reside in memory starting at 32000. An ASCII "A" is 65, so at 32065 we can put the equivalent BAUDOT value. The following is an example program for obtaining this data.

```
10 INPUT X$:X=ASC(X$) 'ASCII
   VALUE
20 B=PEEK(32000+X) 'BAUDOT
   EQUIVALENT
```

Looking up equivalent values in a table or array is not very difficult or time consuming. Suppose each byte has to be broken down into bits and recombined to form new bytes. This is more involved and is the subject on which we want to concentrate.

Let's consider computer graphics. Suppose it is desirable to design a graphics print program. It will not take long to discover that the graphics data in color computers does not have the same format as graphics for a printer.

For now we want to look at techniques for reformatting data with the objective of developing a graphics screen dump print program. Everything can be done using basic. However basic can be very slow especially for printing a graphics picture if it has to reformat the data. To obtain speed, machine language subroutines can be called from basic. We will show how to reformat the bytes for a screen print routine. With this knowledge special screen print formats can be designed such as double size and double strike or blown up pictures.

### GRAPHICS FORMAT

```
PMODE 4 Graphics data is
stored in memory with 8 pixels
being contained within a byte.
A total of 32 bytes are needed
```

to represent one line. Multiplying 32 by 8 gives 256 pixels for one line. Each byte is placed in a horizontal position with the first position being the most significant bit and the eighth position the least significant bit.

### GRAPHICS PRINTER FORMAT

Graphics printers print in a vertical position. Most graphics printers have 8 pins that print up to 8 vertical dots for each byte. The printer itself is a computer. For normal text, it sends several commands to the print pins for each character. For near letter quality print, many dots are formed for each character received. The printer's microprocessor is able to handle this task.

### REFORMATTING PMODE 4 GRAPHICS

The computer must reformat the data from a horizontal position to a vertical position for a graphics printer to print it. To get the first printer byte we have to pull the bits from 8 memory locations as follows:

|       |     |    |    |    |    |    |    |    |
|-------|-----|----|----|----|----|----|----|----|
| BITS  | 7   | 6  | 5  | 4  | 3  | 2  | 1  | 0  |
| VAL   | 128 | 64 | 32 | 16 | 8  | 4  | 2  | 1  |
| M     | A7  | A6 | A5 | A4 | A3 | A2 | A1 | A0 |
| M+32  | B7  | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| M+64  | C7  | C6 | C5 | C4 | C3 | C2 | C1 | C0 |
| M+96  | D7  | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| M+128 | E7  | E6 | E5 | E4 | E3 | E2 | E1 | E0 |
| M+160 | F7  | F6 | F5 | F4 | F3 | F2 | F1 | F0 |
| M+192 | G7  | G6 | G5 | G4 | G3 | G2 | G1 | G0 |
| M+224 | H7  | H6 | H5 | H4 | H3 | H2 | H1 | H0 |

FIGURE 1

From the preceding chart the bits of the byte for the indicated memory are displayed horizontally. The printer byte will be formed by combining the corresponding bits from 8 different memory locations as shown in the columns of the following chart:



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## PRINTER BYTES

|      |    |    |    |    |    |    |    |    |  |
|------|----|----|----|----|----|----|----|----|--|
| BIT  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |  |
| BYTE |    |    |    |    |    |    |    |    |  |
| 1    | A7 | B7 | C7 | D7 | E7 | F7 | G7 | H7 |  |
| 2    | A6 | B6 | C6 | D6 | E6 | F6 | G6 | H6 |  |
| 3    | A5 | B5 | C5 | D5 | E5 | F5 | G5 | H5 |  |
| 4    | A4 | B4 | C4 | D4 | E4 | F4 | G4 | H4 |  |
| 5    | A3 | B3 | C3 | D3 | E3 | F3 | G3 | H3 |  |
| 6    | A2 | B2 | C2 | D2 | E2 | F2 | G2 | H2 |  |
| 7    | A1 | B1 | C1 | D1 | E1 | F1 | G1 | H1 |  |
| 8    | A0 | B0 | C0 | D0 | E0 | F0 | H0 | H0 |  |

**FIGURE 2**

Notice that we have an array of 64 elements which was formed from 8 bytes of memory. We recombine the bits to form a new byte for the printer. The printer bits are printed horizontally across the page with the most significant first. Notice that for the first byte we combined the most significant bit with a weight of 128 of each of the 8 graphics bytes. The second printer byte is formed by combining each corresponding bit with a weight of 64.

One method of performing the combination would be to set up an array as we have done and break the bytes into bits. The bits could then be recombined to form the new byte.

### STRIPPING BITS FROM A BYTE

The basic AND command can be used to remove a bit from a byte. Since bits have values of 1, 2, 4, 8, 16, etc., we can AND the byte with the bit we want to remove. If the result is 0 then the bit is 0. If not the bit is a 1. The following program

segment will remove the bits from a byte and place them into an array:

```

10 INPUT "ENTER THE BYTE"; X
20 M=30000
30 F=1:FOR J=0 TO 7
40 A(J)= F AND X 'AND BYTE
50 IF A(J)>0 THEN A(J)=1'REMOVE
   MULTIPLIER
60 F=F * 2 'UPGRADE MULTIPLIER
70 POKE M+J,F 'STORE BIT IN
   MEMORY
80 NEXT J

```

The program removes the bits from a byte and stores them at memory from 30000 to 30007 with the least significant bit at 30000 and the most significant bit at 30007. It also places them into an array A(J).

To recombine the bits to form a byte we could do the following:

```

10 F=1: B=0 'B IS THE SUM OF
   BITS, F IS MULTIPLIER
20 FOR J=0 TO 7
30 A= PEEK( 30000+J)
40 B =B+F*A 'THIS IS THE SUM
50 F=2*F 'NEW MULTIPLIER
60 NEXT J
70 ?"VALUE OF BYTE IS "B

```

The preceding are examples of using basic statements to reduce a byte to bits and then recombine bits to form a byte. Next month we will continue and give more detail on how these bits can be recombined to form a byte for a graphics printer. Also we will show techniques for printing double strike and double size.

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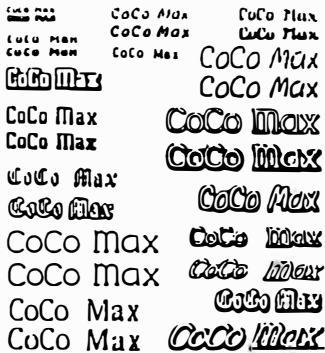
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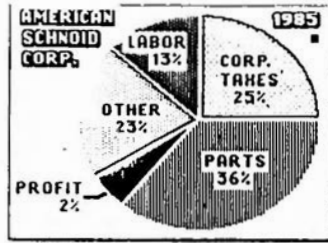
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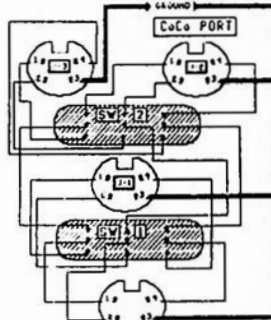
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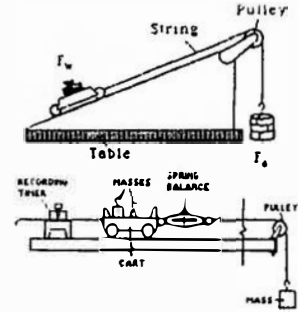
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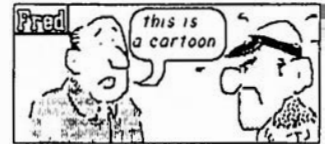
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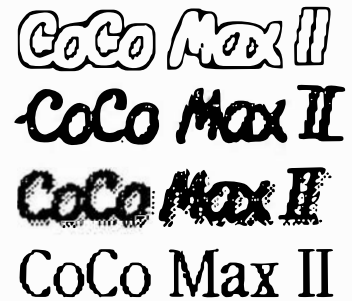
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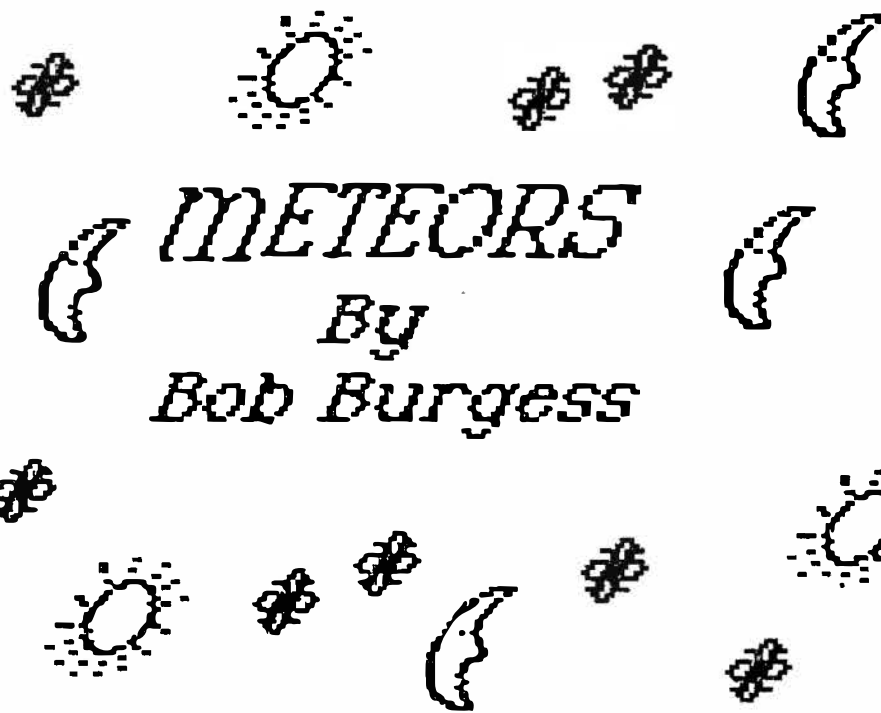
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Meteors is a short basic game which I wrote. The object of this game is to maneuver your way through a meteor shower using the arrow keys. After traveling past 200 meteors the mother ship will appear and you must attempt to dock with it by aiming for its center. If you succeed you will receive 500 bonus points. If you fail the mother ship will fly right by. In either case, the second round will begin with twice as many meteors. The game ends when the front of your ship is hit by a meteor.

Meteors is a fairly simple program. The machine code subroutines which it uses shift the screen down to move the meteors down the screen. These subroutines are much like reverse scrolling. I will not go into their actual code here, however.

Lines 30 through 60 build the game characters and set the initial game conditions. Lines 80 to 160 are the main game loop. The program listing explains this fairly well. Line 150 creates the random pattern of meteors at the top of the screen.

Lines 165 to 230 are the main docking loop. It is entered by

line 120 (this occurs after enough meteors have been passed). If a successful dock occurs lines 235 to 260 are executed. These lines produce an upward scrolling situation that takes the mother ship back to the top of the screen.

Lines 270 and 280 are the machine code data. Lines 290 to 300 are invoked after a game has ended and simply prompt the user for another game.

```

1 REM METEORS
2 REM BY BOB BURGESS
3 REM 10-86
6 REM COPYRIGHT (c) 1987
7 REM DYNAMIC eLECTRONICS INC
10 CLS(0):PRINT@200,"*** METEORS
   ***";:PRINT@296,"BY BOB BURG
   ESS";:PLAY"V31":FORX=1TO30:PL
   AY"V-T202L100ACGDG":NEXT
15 ' POKE IN MACHINE CODE
   SUBROUTINES
20 CLEAR200,16000:FORX=16000TO16
   025:READA:POKEX,A:NEXT:FORX=1
   6228TO16253:READA:POKEX,A:NEX
   T:FORX=16100TO16125:READA:POK
   EX,A:NEXT
30 DEFUSR0=16000:DEFUSR1=16228:D
   EFUSR2=16100
35 ' BUILD GAME CHARACTERS
40 U$=CHR$(143):B$=CHR$(128):G$=
   CHR$(141)+U$+U$+B$+U$+U$+CHR$
   (142):H$=CHR$(135)+U$+"*"+U$+
```

```

CHR$(139):FORX=1TO32:D$=D$+
B$:NEXT:S$=CHR$(167)+CHR$(162
)
50 F$=CHR$(131)+CHR$(131)+CHR$(1
31):O$=CHR$(141)+U$+U$+U$+U$+
U$+CHR$(142)
55 ' INITIALIZE GAME VARIABLES
    S=SCORE, J=COUNTER,
    R=ROUND, K=SHIP POSI
TION
60 Z=RND(TIMER):S=-15:J=0:R=1:K=
495
70 CLS(0)
75 ' CHECK FOR SHIP CRASH
80 A$=INKEY$:IFPEEK(992+K)=15THE
N290
85 ' SHIP MOVMENT (RIGHT AND
LEFT)
90 IFPEEK(343)=247ANDK>481THENK=
K-1ELSEIFPEEK(344)=247ANDK<50
9THENK=K+1
100 IFK=509THENPRINT@481,"RTB":
105 ' INCREMENT SCORE AND SHIFT
SCREEN DOWN
110 S=S+1:J=J+1:IFRND(2)=1ANDJ<5
00THENA=USR(0)ELSEA=USR1(0)
115 ' PRINT SHIP AND CHECK FOR
DOCKING TIME
120 PRINT@K,S$,:IFJ>200THENPRINT
@0,D$,:GOTO170
130 PLAY"L25502V5T2C"
140 PRINT@1,D$:
145 ' PRINT METEORS
150 PRINT@RND(31),"o"::IFPEEK(99
2+K)<>128THEN290ELSEIFR>1THEN
PRINT@RND(31),"o":
160 GOTO80
165 ' DOCKING PHASE
170 IFJ>232THEN180ELSE190
175 ' PRINT MOTHER SHIP
180 IFJ=233THENPRINT@84,G$,:PRIN
T@51,H$,:PRINT@22,F$:
190 IFJ<235THENA=USR(0):PRINT@0,
D$:
195 PLAY"L25502V5T2C"
200 IFJ>232THENPLAY"O3L200T2V20A
CGDG"
205 ' CHECK FOR A SUCCESSFUL
DOCK
210 IFPEEK(992+K)=106THEN240
220 IFJ>255THEN260
230 GOTO80
235 ' SUCCESSFUL DOCK SEQUENCE
240 PRINT@K-65,F$,:PRINT@K-36,H$
,:PRINT@K-3,O$,:PLAY"T3":FORX
=1TO16:A=USR2(0):PRINT@K-3,B$
+B$+B$+B$+B$+B$+B$+B$,:PLAY"V
15T+O3L20ACGDG":NEXT:S=S+100
250 CLS(0):PLAY"O3T2L50V15ACGDGE
DDCCL5A"

```

```

260 CLS:PRINT"SCORE="S:PLAY"P1P1
":CLS(0):J=0:R=R+1:GOTO80
265 ' MACHINE CODE DATA
270 DATA142,6,36,0,0,191,62,131,
166,159,62,131,48,136,32,167,
132,48,136,223,140,4,0,46,236
,57
280 DATA142,6,36,0,0,191,63,103,
166,159,63,103,48,136,31,167,
132,48,136,224,140,4,0,46,236
,57,142,4,0,0,0,191,62,231,16
6,159,62,231,48,136,224,167,1
32,48,136,33,140,6,0,35,236,5
7
290 CLS:PRINT"GAME OVER":PRINT:P
RINT"SCORE="S:PRINT:PRINT"ANO
THER GAME? (Y/N)"
300 A$=INKEY$:IFAS="Y"ORAS="N"TH
EN310ELSE300
310 IFAS="Y"THEN60
320 END

```

## OPERATING HINT

You can disable the cartridge port with POKE 65314,54. Enable it with POKE 65315,52.

**CC-THERM**  
**(NEW)**

CC-THERM is a digital thermometer for Radio Shack Color Computers. It consists of a thermistor wired to the end of a flat cable. The other end of the cable is wired to a joystick plug. The thermistor can be mounted on a wall, inside equipment, or outside for temperature measurements. It can be used to monitor the temperature inside a computer or other equipment where a remote temperature measurement is desired. The computer could be used to control a relay to turn on a heater or air conditioner for regulating temperature. A dual version is available for measuring temperature in two locations or for measuring both inside and outside temperatures. The outside temperature can be read from your screen for Ham Radio use. Basic software on tape or disk continuously prints the temperature in both Fahrenheit and Centigrade. The software could be merged with other programs to expand its usefulness.

CC-THERM \$12.95, CC-THERM 2 \$19.95  
Specify tape or disk. Add \$3 shipping.

**DYNAMIC ELECTRONICS**  
**Box 896 (205) 773-2758**  
**Hartselle, AL 35640**



RAM

MONITOR

DISK DRIVE

MEGA

SOFTWARE

# Computer Terminology

BYTE

PRINTER

By  
Bill Chapple

KILO

PARALLEL

SERIAL

HARD DISK

This article is for those who are not familiar with computers. All of us have heard of computers and have heard of an application using a computer. Suppose you just purchased a new car. Did you know that there are computers in the car's electronics? Suppose you or a member of your family want to purchase a computer. What type should you purchase and with what options? There are many possibilities and a general knowledge of computer terms will help in making a purchase.

## What a Computer Can Do

One thing nice about a computer is that it can be programmed to do any task within its capability. For the new comer, games are very impressive. We are familiar with the arcade games. Computers are used in these games and most computers can give very good animation for games. Hangman, Flight Simulator, Chess, Checkers, and Football are good examples of computer games. These can be very entertaining and provide many hours of enjoyment.

## Business Programs

Perhaps the computer is best known for its calculating ability. Back in the early days of the space program, computers gained recognition for their ability to calculate orbits and other space related parameters.

For business applications computers can be used for letter writing, address files, book keeping, inventory control, payroll, taxes, plus many other tasks. Information can be kept in files and modified for future use. For example to write a letter, access the letter writing file and change the date. Then complete the letter and print it on a printer. The letter can be saved and recalled later if needed. Secretaries now need training in computers because they will probably be exposed to one on their job.

## Students

Every college student should have a computer. Most subjects require writing. Computers are excellent for handling text. A word processor will allow words to be added, deleted, inserted, or moved from one place to another. Liberal arts courses such as History, English, and Journalism require a large amount of report writing which can be quickly and easily done on a computer. Students in technical areas such as science or engineering can use the computer for computation as well as for writing laboratory reports. Portable computers can be taken to class and used for taking notes.

## Industrial Controllers

Computers are indispensible in plants for production control. Inputs to the computer

allow it to control various functions. For example suppose the temperature in an oven is to be maintained at 525F. A temperature sensor with proper input /output (I/O) electronic circuitry can be connected to the computer. If the temperature drops too low, the computer sends a command to turn on the heater. When the temperature reaches the upper limit, the computer sends a signal to turn off the heater. There are many other applications where computers are used for industrial controllers.

### Computer Terms

The purpose of this article is to define computer terms. It is necessary to think of the total computer system. A computer by itself is not very useful. We could compare this to an automobile engine without the rest of the pieces that make up an automobile. It would be useless without the rest of the components. The computer itself may be the cheapest item in a computer system. For example it is not hard to find a computer for under \$200. Now the price of a monitor, disk drive, and printer must be added. These items may drive the cost up to \$800.

### The Computer

There are many options for purchasing computers. Some computer packages are complete with disk drives and monitors. A disk drive is used to save the programs, data, and files. A monitor is used to display the data from the computer. For some computers a television can be used as a monitor providing a reduction in cost.

One of the main factors to consider in purchasing the computer is the amount of memory it has. Generally the more memory the better. There are two types of memory. Permanent memory is used to initialize the computer when it is turned on and when it is reset. This is contained in

electronic chips called read only memories (ROM).

The second kind of memory is called random access memory (RAM). The basic memory unit is the byte. Computer memory is designated in terms of thousands of bytes or Kilobytes. Terms like 64K, 128K, 256K, and 640k mean 64 thousand, 128 thousand, 256 thousand and 640 thousand bytes. To get a feel for the size of a byte, each time a key is pressed on the keyboard, a value representing that key could be contained within one byte. If 500K of memory were available for text, then 500,000 characters could be stored in this memory. This would be from 20 to 25 pages of text.

Most computers can be expanded by adding additional memory later. However it may be advantageous to purchase one with the required memory because something may be damaged if the extra memory is not properly installed. If you are not technically oriented and have to pay an installation fee, this should be considered when the computer is purchased.

### Saving Programs

Devices for saving programs are tape, disk drives, and hard disks. Tape is the slowest mode and the cheapest. Inexpensive audio recorders can be used to save programs which can later be reloaded into the computer. The tape method is very good and can give excellent service if good tapes are used. Much misery will result if the 3/\$1.00 type C-60 tapes are used. Get good quality C-10 or C-20 computer quality tapes. Besides speed, another disadvantage of using tapes is that programs have to be located on the tape. The operator can locate the programs by listening to the tones or using a different tape for each program or keeping track of the numbers on the tape counter. This is a good inexpensive way to start.

## Disk Drives

Disk drives are the most popular method of saving programs. Disk drives use disks similar to a phono record in a square case. It is inserted into a compartment inside the disk drive. A great advantage of disk drives over tape recorders is that the computer does the searching for programs. All the operator has to do is instruct the computer to load or save a program and the rest is automatic.

If the computer has two disk drives then disks can be duplicated by placing the original disk in one drive and a formatted disk in the other drive. They can be duplicated with one disk but several disk swaps are required unless a ramdisk is used. A ramdisk is a section of memory that is configured to act like a disk drive. This is a very valuable feature for several reasons. First it is much faster than a disk drive because there are no mechanical parts. It takes time to remove and add information because data is taken from different parts of the disk as it rotates. The disk spins and a stationary head recovers information at the proper time. For a ramdisk the information is quickly obtained with a minimum time delay. For a one disk drive computer with a ramdisk, a disk can be copied into the ramdisk and then the ramdisk information can be copied onto a blank disk. No disk swapping is required. A 512K or larger computer with 2 disk drives makes a very good combination.

## Hard Disks

A hard disk acts like a disk drive but retains its information when power is removed. It is usually mounted inside the computer and is configured to act as one of the disk drives. Hard disks store millions of bytes of data. Notation like 10

M, 20 M, 30 M, and 80 M is used to designate hard disks of 10 Megabytes, 20 Megabytes, etc. Hard disks require a controller and cost from \$250 up.

## Monitors

Monitors are the best for displaying the computer's information. There are two types of monitors which are composite and RGB. A composite monitor is one that would display television video from a VCR. All of the signals are mixed into one signal. A composite monitor will have a video input and an audio input. Cheaper monitors do not have the audio input. Monitors without color are called monochrome monitors. Monitors with color are called color monitors.

RGB stands for Red, Green, & Blue. These are the 3 basic colors from which the other colors can be derived. An RGB monitor is generally considered to be better for color use. In purchasing a monitor, one should determine if color is important and worth the extra cost which can be \$200 or more. For business use or applications involving programming or word processing, color is not required.

## Printers

There have been many advances in printer technology in the past few years. Now dot matrix printers can produce near letter quality print which could only be obtained by a daisy wheel printer a few years ago. Dot matrix printers can do a super job and I use them for all of my printing. Also dot matrix printers can print graphics. This allows all of the information on the screen to be printed plus charts, pictures, and fancy titles for articles. Printer costs vary from about \$150 up depending upon the features. At the top of the line is laser printers. These are similar to copy machines and can print

several copies a minute. They are expensive and are in the \$1500 up cost range. A good printer can be obtained for around \$200 - \$250 that will satisfy most printing requirements.

Interfacing a printer is a very important consideration. There are two major types of interfaces which are serial and parallel. Some computers such as Commodore and Atarri require special interfaces for using standard printers. IBM computers and clones require a printer with a parallel input. Radio Shack Color Computers require a serial input. If a parallel printer is used with a computer that has a serial port then an interface is required.

#### Software

A computer will not do anything unless it receives instructions. Software is the term given to computer instructions. It is not unusual for a business to pay as much or more for the software than for the computer. Software is available for most computers for games, business, educational, and many other areas. Before purchasing software find out exactly what it can do. Have a sales person demonstrate the software or if possible read reviews of the software from computer magazines.

### **BACK ISSUES**

Back issues of Dynamic Color News are available for \$1.95 each, 3 for \$5 or 12 for \$15 pp.

Foreigners other than Canada add \$2 for Air Mail postage.

A good source of software is called public domain software. This is software which anyone can use and can be obtained at a reasonable rate from many sources. There are generally no instructions with this software so it may be time consuming to learn to use it. Some public domain software has instructions on disk that can be printed on a printer. There are many subjects available in public domain software.

#### Summary

This has been an overview of what is required for a computer system. A computer system consists of the computer, monitor, storage device, and printer. There are other accessories that could be added such as a modems, expansion boxes, and joysticks. As stated earlier a computer can be whatever you want it to be. It can be a source of entertainment, record keeper, calculator, music composer, and word processor. It can be a language translator, can control devices and even talk with the proper interfaces. Its like a dream come true. What do you want the computer to do for you? I bet there is a program or hardware package that will do your task.

### **OPERATING HINT**

Checking Tape Programs - You can check the programs on a cassette tape by using the SKIPF command. Load the tape and rewind it. Then type SKIPF"X where X is a file that is not on the tape. The name of each file will be displayed on the screen as they are found on the tape. If there is an error the computer will give an error message and stop the recorder. All files or programs before the recorder stopped are good. If the recorder goes to the end of the tape without indicating an error then all of the files are good. Press the rear reset button to reset the computer.

# RELAY INTERFACE

## HARDWARE PROJECT

In our series on Interfacing Computers we have shown how to interface various devices with a Color Computer. We showed how to interface the ASCII port with other ASCII device and how to make various devices using the joystick port. This month we want to show how an expensive relay can be used to control a light or a larger relay using the MOTOR ON and MOTOR OFF commands.

The motor commands are designed to turn on the cassette motor relay for tape use. The relay has an uncommitted set of contacts which could be used to control a device except for one problem. A cassette recorder usually requires 3 volts for the motor. In order to protect the computer, two back to back zener diodes are placed across these contacts. This limits the maximum voltage to a few volts.

For controlling a 110 volt line, we need a relay without these diodes. Also if the relay were external, the computer would be protected from excessive voltages. Our procedure will be to use two plugs to obtain the voltages we need to operate the relay. The relay requires 5 volts and is Radio Shack part number 275-232. This is a reed relay and requires a very small coil current. Its contact is rated at 1 ampere, 125 VAC.

Now how do we wire the relay? Pin 5 of a joystick plug is connected to 5 volts through a 100 ohm resistor. This will connect to one side of the relay coil. Next it will be necessary to connect the other side of the coil to ground for the relay to turn on. This can be accom-

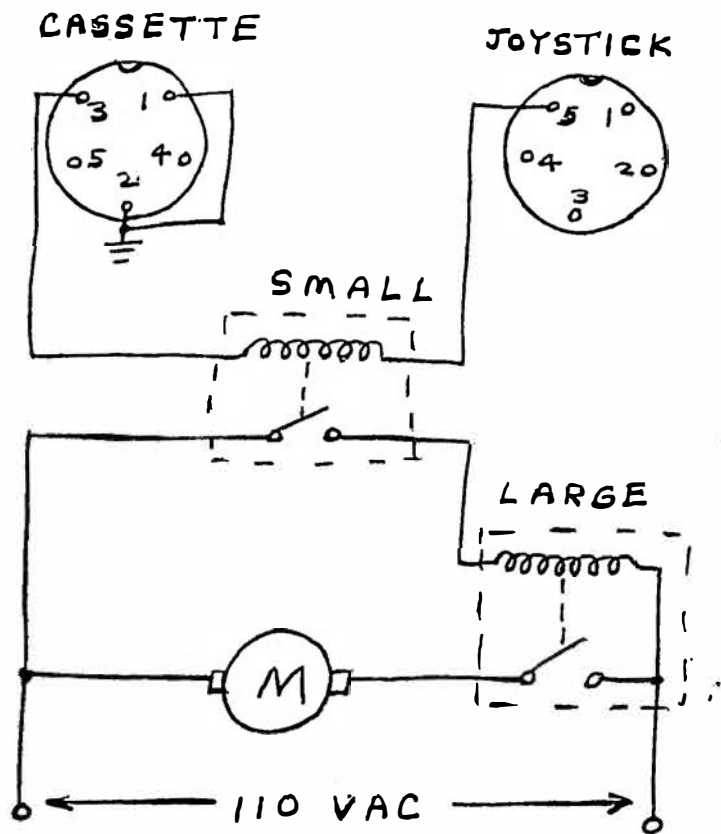


Figure 1

plished by using the cassette port. The cassette motor contacts are on pins 1 and 3 while ground is on pin 2. Connect pin 1 to pin 2. Then connect the unconnected end of the coil to pin 3. Figure 1 is a wiring diagram showing the connections for the small relay and an optional large relay. This relay could drive a motor, lights, or air conditioner. In selecting the large relay make sure its coil does not require over an ampere. Also make sure its contacts will handle the voltage and current of the device.

For example suppose you want to control an air conditioner that requires 110 VAC at 12

## HAM RADIO

amperes. A relay rated at 8 amperes should not be used. However a 15 ampere relay would handle the job properly.

The small relay can control a device that does not draw over an ampere. To calculate the current with the wattage given the following formula can be used:

$I=P/E$  where

I is the current in amperes  
P is the power rating in watts  
E is the voltage in volts

To turn on a 75 watt light then we would have  $75/110$  which is less than one ampere and within the limits of the relay contact. Rearranging the equation to determine the maximum power for the 1 ampere of current, we find that  $P=E*I =110*1$  or 110 watts. So the small relay can control a 100 watt light bulb.

## AIR CONDITIONER & HEATER CONTROLLER

The large relay could be used to control an air conditioner when used with a temperature sensor. We showed how to make such a sensor and gave software in our May edition. The software could be modified as follows assuming we want the motor on if the temperature is greater than 80F and off if it reaches 76F:

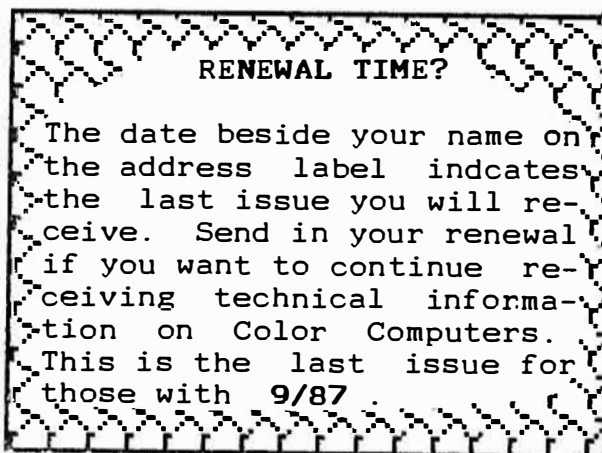
```
1000 IF T>80 THEN MOTOR ON
1010 IF T<76 THEN MOTOR OFF
1020 RETURN
```

The subroutine could be added to the temperature sensor to have a complete controller. Most air conditioners and heaters do not have very good controllers. By using a computer, the controller could be tailored to the individual's desires. Also it could be turned off at specified times by including a timer in the software.

The small relay could key a ham transmitter. This might be usable on the old tube type transmitters with large keying voltages.

## SUMMARY

The small relay will handle 1 ampere at 125 VAC. This will drive lights and small appliances. Use the small relay to control a larger relay for higher power requirements. The MOTOR ON and MOTOR OFF commands will energize or turn on the small relay. The cassette relay is also energized since its contacts control the small external relay. This is an inexpensive project requiring the reed relay and plugs for the cassette and joystick ports.



## OPERATING HINT

Patch around bad sectors: If you have a file in a bad sector on your disk and wish to save another copy of the file, then save it under a different name. This will force the file to be placed in a different sector. Rename the file in the bad sector and then you can use its name to rename the new file. The good file will then be loaded whenever it is called.

# 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.

## COCO III SECRETS REVEALED

This is a 35 page collection of notes and information on the color computer 3. It explains the differences in the CC3 and the earlier computers.

Chapter 1 explains the MMU and Palette registers. In chapter 2 the new commands are explained. A program is given to convert old programs.

Chapter 3 is devoted to experimenting with the palettes. Example programs are given. Also memory pokes are given for enhancements for the 32x16 screen such as true lower case characters and reversed video.

Chapter 4 is titled Smooth Scrolling, Peeks and Pokes, and other Tidbits. Example programs are given for scrolling the graphics screen. A program is also included for saving a high resolution graphics picture to a disk.

Chapter 5 covers the memory map. It also gives details of the I/O registers starting at FF00. A video resolution section is included which gives the number of pixels, colors, and bytes across for various graphics selections.

Chapter 6 gives a summary and suggests some applications for using the extra memory. The information presented is very good. For more information contact Spectrum Projects, P. O. Box 264, Howard Beach, NY 11414.

## WORD PROCESSOR 2

This is a simple easy to use word processor. It allows text to be composed in memory, saved to a disk or tape, and printed to a printer. To use the program load it and then type RUN. A menu appears from which a file can be added, displayed to the screen, edited, loaded, printed to a printer, or saved. Other options select printer parameters, a new file, or quit the program.

In the edit mode characters can be entered from the keyboard. They are displayed on the 32 character screen. These are normal characters and are easy to read. Most lines are more than 32 characters long and the program will adjust the lines for the proper length when the text is printed. To end the edit mode, press the shift and up arrow keys. This will cause the program to return to the command mode and COMMAND: will be displayed. To continue enter a letter for the desired function. A help file is included and an H can be entered if help is desired. A file can be edited by inserting or deleting characters.

A file can be saved by selecting S from the menu. The computer will then ask for a name and will save the file to a cassette or disk. It is saved as a binary file. A file can be loaded from a cassette or disk by entering L from the menu. Information that was in the computer is lost as a new file is loaded.

Printer codes can be embedded while in the edit mode. This allows for setting up different types of print. The text can be printed on a printer. First set up the printer parameters. It provides a variable left margin but does not right justify.

We found the word process to perform as advertised. It will

do a good job of writing reports or letters. The cost is only \$6 including shipping. Drayon Software, P. O. Box 2516, Renton, WA 98056.

### VIDEO DRAW POKER

Video draw poker was written to simulate some of the casino video draw poker slot machines. The program is available for tape or disk. After the program is run the artifact color for the heart can be adjusted. If the heart is not red then press the reset button and run the program again. Machine language subroutines are then loaded. A menu appears giving the option of testing strategy or playing.

To play enter the number of quarters. This can be any number and 25 is a good start. Then enter a number from 1 to 5 for the number to bet. If 5 is selected the cards are automatically dealt. For numbers less than 5 press "D" to deal the cards. The cards are drawn on the screen with very good resolution.

Five cards are dealt. Any card can be held or discarded by pressing the number of the card. An "H" appears above the card that is selected to be held. If a mistake is made or you change your mind then the number can again be pressed and the "H" is removed. To deal the second time press "D" and new cards will be dealt for those not held. The amount bet and the balance is displayed. If you have a winning hand the total is added to the credits. Continue playing until there are no credits or the "Q" key is pressed.

There is an option for strategy testing. With this option the player selects the original cards and decides whether to hold them or discard. Then the computer plays the hands.

We found the game to be very exciting. It is not difficult to learn to play and can provide good entertainment for one or more players. It works on all

color computers. The cost is \$15 including shipping on tape or disk. Prometheus Software, 14684 Joshua Tree Ave., Moreno Valley, CA 92388

These are collections of programs from Dynamic Color News.

#### DCN-1

- 1.\* 64K all RAM
- 2.\* 2- bank address file
3. Alarm Clock
4. Loan Interest
5. Character Generator
- 6.\* Bank Switching  
\* Won't work on CC-3  
CC-2 Memory managers

#### DCN-2

1. Check Book Program.
2. Ball Team Sort Program.
3. Card Shuffling
4. Student Study Program
5. Address File

#### DCN-3

1. Restore-Recover program lost after NEW command.
2. Fast Food
3. Bar Graph
4. Memory Peek & Poke
5. Graphics draw

#### DCN-4

1. Address File with Sort
2. Morse Code Generator
3. Star Constellations
4. Dueling Cannons

#### DCN-5

##### COLOR COMPUTER 3 PROGRAMS

1. CC-3 Memory Manager
2. CC-3 Error Trapping
3. CC-3 Graphics
4. CC-3 Graphics Save

#### DCN-6

1. Accounts Payable
2. Dog Race
3. Compound Interest
4. Address File Disk Sort
5. Invoice Program

Programs are \$5.95 each tape or disk. Add \$1 shipping. Checks, VISA & MC.



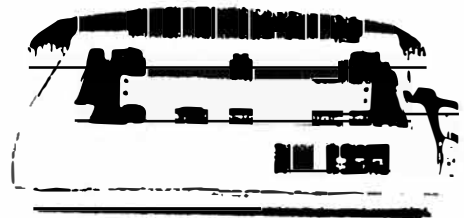
# SEIKOSHA PRINTERS

For some time we have been looking for a printer for color computers that does not require an interface and has excellent features like an Epson. We found a double bargain in the Seikosha SP-1000AS. Not only does it have the features we desire in a printer, it is available from us for only \$229.95 + \$5 shipping complete with a cable to plug into your color computer. No longer do you have to wait for the printer to print your text. A 2.6K buffer will free your computer while the printer finishes its assignment. The printer accepts data at the 9600 baud rate. This means that you can quickly send a page or more of text to the printer and then start a different task with the computer. There are many programs that are Epson compatible. This ad is done on a SP-1000AS with our Epson codes in our word processor and COCO MAX.

With the SP-1000A your computer can print 40, 48, 68, or 136 characters per line. It can print 35 separate character styles including 13 double width and 3 reversed styles. You get Pica, Elite, Condensed and Italics plus true superscripts and subscripts. All this can be done automatically through commands right from your keyboard. You will hardly know the printer is working because it is one of the quietest printers that we have seen.

## FEATURES

- \* Impact dot matrix method of printing.
- \* 100 (Draft mode), 20 cps (Near Letter Quality) print speed
- \* Functions include Underline, Bold Print & Double Striking.
- \* Many print character sets including Pica, Elite, Elongated, Proportional, Condensed, Italics, Super/Subscript and Italic Super/Subscripts.
- \* Adjustable tractor and friction feed.
- \* Automatic paper loading function.
- \* Paper empty detector.
- \* Right, left margin set function.
- \* Self-test and Automatic printing.
- \* 2 year warranty.



As a special we are including our DYPRINT package at no extra charge. This will allow you to print banners or blown up graphics pictures.

Order SP-1000AS for COCO & specify tape or disk software for DYPRINT. Give street address for UPS. Cost \$229.95 +\$5 shipping.

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# HAM RADIO & COMPUTERS

by

Bill Chapple W4GQC

In this series we have been looking at methods of interfacing color computers with ham radio equipment. I have presented software programs and have shown how to build an interface using the serial port. This month I want us to consider interfacing with the cassette port.

To save programs on a cassette the computer generates and decodes audio tones. Our serial ASCII interface decoded audio using an integrated circuit. First let's look at receiving data. Suppose we want to decode radio teletype (RTTY) signals. We tune in a RTTY station and hear audio tones coming out of the speaker. The tones vary in frequency. In fact there are two frequencies called mark and space. Data saved on a cassette is also saved as two frequencies. This differs from RTTY audio signals because each cycle represents a 0 or a 1. One cycle at a frequency of 2400 hertz is sent for each "1" and one cycle of 1200 hertz is sent for each "0". This gives a baud rate of around 1500 which is too fast for ham use except on VHF and higher frequencies.

For RTTY on the high frequency (HF) bands, a frequency shift of the carrier frequency is used to indicate a change.

This shift can be up to 1000 hertz but is usually 170 hertz for HF operation. The carrier frequency represents a mark or "1" and the shifted frequency represents a space or "0". When listening to a RTTY signal on a single sideband receiver, two audio tones are heard. These are different from the COCO cassette tones in that several cycles of audio can occur for each mark or space depending upon the baud rate of the RTTY signal. Also the frequency shift is much less. If you are confused about how serial data is sent using ASCII, I suggest reviewing our editorials in issues 3-2 through 3-11.

Earlier teletype machines used the Baudot code. This code is different from ASCII but the principles are the same. Baudot is a five bit code allowing only 32 possible characters. To get the other characters a shift command has to be sent and the receiving device remembers the state of this command. This allows an additional 32 characters to be sent. Remember that ASCII can be 7 or 8 bits per character while Baudot is 5. With ASCII a complete character can be sent without any prior history being required.

Now let's look at the tones. The signal to the speaker of a single sideband receiver is

audio. Now if we can connect a sample of this audio to the cassette port we can use the computer to decode the audio. All we will need is a tee and maybe a resistor divider to reduce the level of the signal depending upon its amplitude. It should be obvious that software will be needed. As I have stated the main need for ham radio applications is software.

What is needed for transmitting? Again let's assume we have a good single sideband transceiver. If we can generate audio tones that have the proper frequencies and connect these tones to the microphone circuits then we can frequency modulate the transmitter. When a tone is applied to the microphone of a SSB transmitter a radio frequency is generated which is equal to the transmitter's carrier frequency plus or minus the frequency of the audio. For upper sideband the frequencies would add and for lower sideband they would subtract. To keep from generating harmonics of the audio a sine wave should be used to generate the tones. If the signal contains harmonics then more than one frequency will be transmitted.

The audio cassette interface will give us many possibilities. Besides RTTY, we could operate on slow scan television (SSTV), Morse Code, AMTOR, and PACKET. Also we could develop software for decoding tones for computer control of a telephone for repeater or other uses.

I have a Yaesu FT-757 transceiver. It is possible to interface it with a computer to control most of the functions. I plan to do this soon and will show how this can be done. There are many possibilities with computers and we will be looking at more applications.

Next month I plan on details of the simple cassette interface. So until then 73's -Bill.

## ***Ham Radio Programs***

**MORSE** - This program allows a key to be pressed and then sounds the Morse equivalent. It also will send random characters. This is an excellent tool for developing code speed for the the Novice, Technician, or General class licenses.

**DX** - Consists of two parts. The first part allows notes to be typed onto the screen. The second part allows the countries for a letter or number prefix to be displayed.

**ANTENNA** - An antenna design program that calculates the dimensions for a wide spaced Yagi antenna of up to 4 elements.

Order HR-1 (3 programs) \$11.95

## ***Morse Terminal***

When used with an interface this converts your color computer into a Morse Terminal. To transmit just type the Morse characters and the computer keys your transmitter. In the receive mode the computer decodes and displays the Morse characters on the screen. Instructions are included for building an interface with off the shelf parts. HR-2 \$12.95

## ***Station Log***

Keep a record of your contacts. Just enter the information as it is requested. Items that are the same such as date, frequency, and type of emission need only be entered once and changed as needed. Save and load records to tape or disk. Add to the log and quickly find stations. HR-3 \$9.95

## ***Thermometer***

Now your computer can give you the temperature in both Fahrenheit and Centigrade. Assembly plugs into a joystick port and consists of a thermistor on a 10' cable for the single unit and a second thermistor on a 20' flat cable for the dual unit. The dual unit can be used to measure inside and outside temperature. CC-THERM \$12.95, CC-THERM 2 \$19.95.

## ***Memory Saver 2***

A battery backup for all color computers. Leave programs in your computer and the Memory Saver will preserve them in case of a power failure. A real time saver for cassette systems. \$39.95

## ***Memory Manager***

Allows using the second 32K memory bank for 64K color computer 2 and earlier computers. Configure the second bank for a ramdisk and quickly load and run programs. Not for the COCO 3 \$19.95

All programs are color computer 3 compatible unless indicated and are on tape or disk. Please specify tape or disk software. Checks, VISA or MC, Add \$3 ship.

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disks had to be formatted differently. Next there was an update and then another. Then we found out that we could purchase Basic -09 which would be compatible with OS-9. All of this would cost about \$200 which is outrageous. It looks like Radio Shack introduced OS-9 too soon.

MSDOS for the IBM computer is compatible with basic. The disks are formatted and basic is called from the system. This is the way an operating system is supposed to work. It's purpose is to make things easier not more complicated.

We use COCO MAX II for our titles. Thanks for the comments.

Yes we are looking for articles. If you have something send it in and we will make you an offer if we can use it.

+ + +

Dear Sirs,

2 months ago I subscribed to Spectrogram magazine. They took my Visa \$18.00. Then went bankrupt without no compensation to me. Please don't follow suit.

Paul

We can appreciate your concern. There have been many Color Computer magazines that have died. We were very disappointed when we heard that Spectrogram had to file for bankruptcy. They were very cooperative and we enjoyed working with them. We are in our fourth year and are having a good year. Thanks for your subscription and we are sure you will get your money's worth from Dynamic Color News.

+ + +

Dean

I really do enjoy the magazine and look forward to each months issue.

I'm scheduled to have another back surgery so will be bed ridden for a couple of months, and

the above back issues will provide education, fun, and help to make the hours go by. I plan on eventually obtaining all of the issues.

Also I have a couple of questions. Is the ME-12 simply a set of chips for 128K or EPROMS? Re: April '87 EPROM article on pages 7-10 you list a 27128 and/or 27256. The Jameco Catalog lists 27128-20 128K (21.v) 200ns  
27128-25 128K (21.v) 250ns  
27128A-25 128K (12.5v) 250ns and similiar for the 27256. Which is the preferred chip?

What is a part number and source of a thermistor as discussed in April and May for the Temperature sensor circuit? I'd like to put together a setup for my 1300 that would by remote display the temperature of the ocean, engine, transmission, and outside. I'd need quite a few of the thermistors, so need a supplier.

Sincerely,

John Holtz

John the numbers in parentheses indicates the programming voltage and the number at the end is the speed. Anything less than 250ns will be fast enough. If you have a 21 volt programmer then select the chips with (21.v) and if you have a 12.5 volt programmer select those with (12.5v).

We can supply you with thermistors for \$2 each. This looks like an interesting project. We hope you quickly recovered from your operation. Thanks for your letter.

+ + +

Dear Sir,

I noticed your advertisement in the July 1987 issue of QST magazine. I have a Radio Shack Color Computer (grey) and am currently attempting to interface it with my Heathkit Transciever by use of an MFJ 1224 Computer Interface. My problem is that I have no RTTY program to

## ***Color Computer 3***

### ***256K MEMORY***

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Add another 128K of memory to your color computer 3. It's like having two computers in one package. ME-31 \$49.95.

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run on the computer. Can you help me? I am also interested in any other hardware or software you have available for Ham use for the Color Computer.

Thanks.

Scott

We will be presenting a RTTY program in a couple of months that uses the cassette port. See our ham radio article in this issue. The MFJ unit may not be usable on RTTY.

+ + +

Dear Bill,

I went to our local Radio Shack yesterday to pick up more parts for the Tone Decoder for CW. I had quite a surprise when I was told that at least two parts that you have listed have not been sold by Radio Shack for over a year and are not available. They are MC 1488 (276-2650) and the Power Supply (277-1022). I asked for the possible identification of the part so that I could get them at some other electronics outlet but they could not even give me that. I thought I should write to let you know what is happening. I noticed in your last publication that you have the program advertised. You might have some unhappy customers who have purchased a terrific program with no way to use it. I did not check all the parts. There may be more outdated. Now what?

Sincerely,

Bill Crowley Morrill, Neb.

Bill the MC 1488 is listed in the new 1988 Radio Shack catalog on page 141. The power supply was listed in one of their previous sales flyers. They may be sold out. Check some other

## CLASSIFIED ADS

stores as they may still have some. We just purchased two of them and there seems to be plenty in our area. We are looking into building the interface. If you can not find a power supply we can let you have one of ours for the RS price plus shipping. Any power supply that will give the required voltages can be substituted.

Most of the people that run the Radio Shack stores are not knowledgeable about electronics or about their products. They will give you wrong information rather than tell you that they don't know. Its a shame that when they have a product listed in their new catalog that they tell you it has not been sold in Radio Shack Stores for over a year. How were we able to buy the parts if they were not sold? As a rule do not ask them for advice.

Their computer stores are more depressing. Occasionally a salesperson knows something about their computers but this is an exception. A few years ago a lady told us you could not do business programs on a color computer. We would really be in a mess if we did not have ours.

### 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.

Dealers we need your new product listings for this section. We do not have any listings for this month.

### OPERATING HINT

High speen COCO 3: For high speed operation (1.788 MHz) POKE 65497,0. To return to slow speed (0.894 MHz) POKE 65496,0.

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# EDITOR'S COMMENTS

August is usually one of the worst months for those in the computer business. I want to thank each of you for your support as we had a good month in August. Also I want to thank each of you who have written a letter. We use these to determine future subjects and of course answer your questions in our questions and answers section. It is easy to forget that everybody is not a computer programmer. So we want to tailor our editorials to meet our reader's needs.

This month I wrote an editorial about computer terms. We have some new comers and want to present material that will benefit them. Next month we will continue and again show how to write basic programs. If you missed out on our programming series then you can start with this new series. It is not hard to learn to program but takes practice.

Also this month we have a hardware article. This will allow an external relay to be controlled by the computer. A larger relay can be used for controlling heaters, air conditioners, or motors. Computers can be more than toys or calculators. They can also perform physical tasks.

There is plenty of interest in our ham radio section. Last year when I started it I was wondering if it were the right thing to do. The response we have had indicates that it was. The only problem is that some hams seem a little impatient and want the programs and informa-

tion quicker than I can produce it. However I have been well pleased with their attitude. I have covered quite a bit on this subject and there is much more coming.

John Galus is continuing the ML programming series. His editorials are very good and we appreciate his support. While on this subject we can use more programs and editorials. If you will notice in this issue and last month's we had a program by a new writer. We do pay for articles based upon their value to us. Programs should be supported by text explaining what the program does. This can be a word processor file or write the comments in a basic program using remarks.

Last week Dean and I went to the Smoky Mountains in Tennessee. While on our way back we passed a small river with lots of people in the water with rafts and canoes riding the rapids. I want to return and join them this weekend. The weather has been in the 95 range for the past few days and this will probably be our last chance this year.





# CONVERT

This program will do all of those conversions required when mixing English and Metric quantities. For example how many meters are in a 100 yard football field. Or how many Kilograms will a 210 pound man weigh? What is the temperature in Fahrenheit for 26 degrees Centigrade? These are examples of conversions that can be made with the program. The program is easy to use. Just type "RUN" and select the options from the menu.

```
5 'PUBLIC DOMAIN
10 CLS
20 PRINT"WHICH CONVERSION DO YOU
  WANT?"
30 PRINT"(1) LENGTH"
40 PRINT"(2) AREA"
50 PRINT"(3) VOLUME"
60 PRINT"(4) WEIGHT"
70 PRINT"(5) TEMPERATURE"
80 INPUT"(PRESS 1,2,3,4,5)";A
81 IF A>5 GOTO 80
85 ON A GOSUB 1000,2000,3000,400
  0,5000
90 GOTO 10
1000 CLS
1005 PRINT"WHICH DO YOU WANT?"
1011 PRINT"(1) INCHES TO CENTIME
  TERS"
1012 PRINT"(2) CENTIMETERS TO IN
  CHES"
1013 PRINT"(3) FEET TO METERS"
1014 PRINT"(4) METERS TO FEET"
1015 PRINT"(5) YARDS TO METERS"
1016 PRINT"(6) METERS TO YARDS"
1017 PRINT"(7) MILES TO KILOMETE
  RS"
1018 PRINT"(8) KILOMETERS TO MIL
  ES"
1019 PRINT"(9) NONE"
1020 INPUT"PRESS 1,2,3,4,5,6,7,8
  ,9";B
1021 IF B>9 GOTO 1020
1022 CLS
1025 ON B GOSUB 1100,1200,1300,1
  400,1500,1600,1700,1800,1900
1030 GOTO 1000
1100 INPUT"HOW MANY INCHES:";C
1110 PRINT C;"INCHES=";C*2.54;"
  CENTIMETERS"
1120 INPUT"PRESS <ENTER> TO CONT
  INUE.";A$
1130 RETURN
1200 INPUT "HOW MANY CENTIMETERS
  ";D
1210 PRINT D;"CENTIMETERS=";D*.3
  94;"INCHES"
1220 INPUT"PRESS <ENTER> TO CONT
  INUE.";A$
1230 RETURN
1300 INPUT"HOW MANY FEET:";E
1310 PRINT E;"FEET=";E*.305;"MET
  ERS"
1320 INPUT"PRESS <ENTER> TO CONT
  INUE.";A$
1330 RETURN
1400 INPUT"HOW MANY METERS:";F
1410 PRINTF;"METERS=";F*3.281;"F
  EET"
1420 INPUT"PRESS <ENTER> TO CONT
  INUE.";A$
1430 RETURN
1500 INPUT"HOW MANY YARDS:";G
1510 PRINT G;"YARDS=";G*.914;"ME
  TERS"
1520 INPUT"PRESS <ENTER> TO CONT
  INUE.";A$
1530 RETURN
1600 INPUT"HOW MANY METERS:";H
1610 PRINT H;"METERS=";H*1.094;"
  YARDS"
1620 INPUT"PRESS <ENTER> TO CONTI
  NUE.";A$
1630 RETURN
1700 INPUT"HOW MANY MILES:";I
1710 PRINT I;"MILES=";I*1.609;"K
  ILOMETERS"
1720 INPUT"PRESS <ENTER> TO CONT
  INUE.";A$
```

```

1730 RETURN
1800 INPUT"HOW MANY KILOMETERS:"
    ;J
1810 PRINT J;"KILOMETERS=";J*.62
    1;"MILES"
1820 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
1830 RETURN
1900 GOTO 90
2000 CLS
2005 PRINT"WHICH DO YOU WANT?"
2011 PRINT"(1) SQ IN TO SQ CM"
2012 PRINT"(2) SQ CM TO SQ IN"
2013 PRINT"(3) SQ FT TO SQ M"
2014 PRINT"(4) SQ M TO SQ FT"
2015 PRINT"(5) SQ YD TO SQ M"
2016 PRINT"(6) SQ M TO SQ YD"
2017 PRINT"(7) ACRES TO HECTARES
    "
2018 PRINT"(8) HECTARES TO ACRES
    "
2019 PRINT"(9) NONE
2020 INPUT"PRESS 1,2,3,4,5,6,7,8
    ,9";K
2021 CLS
2025 ON K GOSUB 2100,2200,2300,2
    400,2500,2600,2700,2800,2900
2030 GOTO 2000
2100 INPUT"HOW MANY SQ IN:";L
2110 PRINT L;"SQ IN=";L*6.452;"S
    Q CM"
2120 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
2130 RETURN
2200 INPUT "HOW MANY SQ CM:";M
2210 PRINT M;"SQ CM=";M*.155;"SQ
    IN"
2220 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
2230 RETURN
2300 INPUT"HOW MANY SQ FT:";N
2310 PRINT N;"SQ FT=";N*.093;"SQ
    M"
2320 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
2330 RETURN
2400 INPUT"HOW MANY SQ M:";O
2410 PRINT O;"SQ M=";O*10.764;"S
    Q FT"
2420 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
2430 RETURN
2500 INPUT"HOW MANY SQ YD:";P
2510 PRINT P;"SQ YD=";P*.836;"SQ
    M"
2520 INPUT "PRESS <ENTER> TO CON
    TINUE.";A$

```

```

2530 RETURN
2600 INPUT"HOW MANY SQ M:";Q
2610 PRINT Q;"SQ M=";Q*1.196;"SQ
    YD"
2620 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
2630 RETURN
2700 INPUT "HOW MANY ACRES:";R
2710 PRINT R;"ACRES=";R*.405;"HE
    CTARES"
2720 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
2730 RETURN
2800 INPUT"HOW MANY HECTARES:";S
2810 PRINT S;"HECTARES=";S*2.471
    ;"ACRES"
2820 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
2830 RETURN
2900 GOTO 90
3000 CLS
3005 PRINT"WHICH DO YOU WANT?"
3011 PRINT"(1) GALLONS TO LITRES
3012 PRINT"(2) LITRES TO GALLONS
3013 PRINT"(3) QUARTS TO LITRES"
3014 PRINT"(4) LITRES TO QUARTS"
3015 PRINT"(5) CU FT TO CU M"
3016 PRINT"(6) CU M TO CU FT"
3017 PRINT"(7) CU IN TO CU CM"
3018 PRINT"(8) CU CM TO CU IN"
3019 PRINT"(9) NONE"
3020 INPUT"PRESS 1,2,3,4,5,6,7,8
    ,9.";U
3021 IF U>9 GOTO3020
3022 CLS
3025 ON U GOSUB 3100,3200,3300,3
    400,3500,3600,3700,3800,3900
3030 GOTO 3000
3100 INPUT"HOW MANY GALLONS:";V
3110 PRINT V;"GALLONS=";V*3.785;
    "LITRES"
3120 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
3130 RETURN
3200 INPUT"HOW MANY LITRES:";W
3210 PRINT W;"LITRES=";W*.264;"G
    ALLONS"
3220 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
3230 RETURN
3300 INPUT"HOW MANY QUARTS:";X
3310 PRINT X;"QUARTS=";X*.946;"L
    ITRES"
3320 INPUT"PRESS <ENTER> TO CONT
    INUE.";A$
3330 RETURN
3400 INPUT"HOW MANY LITRES:";Y

```

```

3410 PRINT Y;"LITRES=";Y*1.057;"
QUARTS"
3420 INPUT"PRESS <ENTER> TO CONT
INUE.";A$
3430 RETURN
3500 INPUT"HOW MANY CU FT:";Z
3510 PRINT Z;"CU FT=";Z*.028;"CU
M"
3520 INPUT"PRESS <ENTER> TO CONT
INUE.";A$
3530 RETURN
3600 INPUT"HOW MANY CU M:";T
3610 PRINT T;"CU M=";T*35.315;"C
U FT"
3620 INPUT"PRESS <ENTER> TO CONT
INUE.";A$
3630 RETURN
3700 INPUT"HOW MANY CU IN:";AC
3710 PRINT AC;"CU IN=";AC*16.387
;"CU CM"
3720 INPUT"PRESS <ENTER> TO CONT
INUE.";A$
3730 RETURN
3800 INPUT"HOW MANY CU CM:";AD
3810 PRINT AD;"CU CM=";AD*.061;"
CU IN"
3820 INPUT"PRESS <ENTER> TO CONT
INUE.";A$
3830 RETURN
3900 GOTO 90
4000 CLS
4005 PRINT"WHICH DO YOU WANT?"
4011 PRINT"(1) LB TO KG"
4012 PRINT"(2) KG TO LB"
4013 PRINT"(3) TONNES TO BUSHEL"
4014 PRINT"(4) NONE"
4020 INPUT"PRESS 1,2,3,4";AE
4021 CLS
4025 ON AE GOSUB 4100,4200,4300,
4400
4030 GOTO 4000
4100 INPUT"HOW MANY LB:";AF
4110 PRINT AF;"LB=";AF*.454;"KG"
4120 INPUT"PRESS <ENTER> TO CONT
INUE.";A$
4130 RETURN
4200 INPUT"HOW MANY KG:";AG
4220 PRINT AG;"KG=";AG*2.205;"LB
"
4230 INPUT"PRESS <ENTER> TO CONT
INUE.";A$
4240 RETURN
4300 PRINT"WHICH GRAIN?"
4301 PRINT"(1) WHEAT"
4302 PRINT"(2) BARLEY"
4303 PRINT"(3) OATS"
4304 PRINT"(4) RYE"
4307 PRINT"(5) NONE"
4310 INPUT "PRESS 1,2,3,4,5";AH
4311 CLS

```

```

4312 ON AH GOSUB 4320,4330,4340,
4350,4400
4315 GOTO 4300
4320 INPUT"TONNES OF WHEAT:";TW
4321 PRINT"=";(TW*2204.6)/60;"BU
SHEL"
4322 RETURN
4330 INPUT"TONNES OF BARLEY:";TB
4331 PRINT"=";(TB*2204.6)/48;"BU
SHEL"
4332 RETURN
4340 INPUT"TONNES OF OATS:";TT
4341 PRINT"=";(TT*2204.6)/32;"BU
SHEL"
4342 RETURN
4350 INPUT"TONNES OF RYE:";TR
4351 PRINT"=";(TR*2204.6)/56;"BU
SHEL"
4352 RETURN
4400 GOTO 90
5000 CLS
5005 PRINT"WHICH DO YOU WANT?"
5011 PRINT"(1) C TO F"
5012 PRINT"(2) F TO C"
5013 PRINT"(3) NONE"
5020 INPUT"PRESS 1,2,3";AL
5021 IF AL>3 GOTO 5020
5022 CLS
5025 ON AL GOSUB 5100,5200,5300
5030 GOTO 5000
5100 INPUT"WHAT DEGREE C:";AM
5110 PRINTAM;"CELCIUS=";(AM*9/5)
+32;"F"
5120 INPUT"PRESS <ENTER> TO CONT
INUE.";A$
5130 RETURN
5200 INPUT"WHAT DEGREE F:";AN
5210 PRINT AN;"F=";(AN-32)*5/9;"
C"
5220 INPUT "PRESS <ENTER> TO CON
TINUE.";A$
5230 RETURN
5300 GOTO 90

```

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**DYTERM** -Allows a Color Com-  
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