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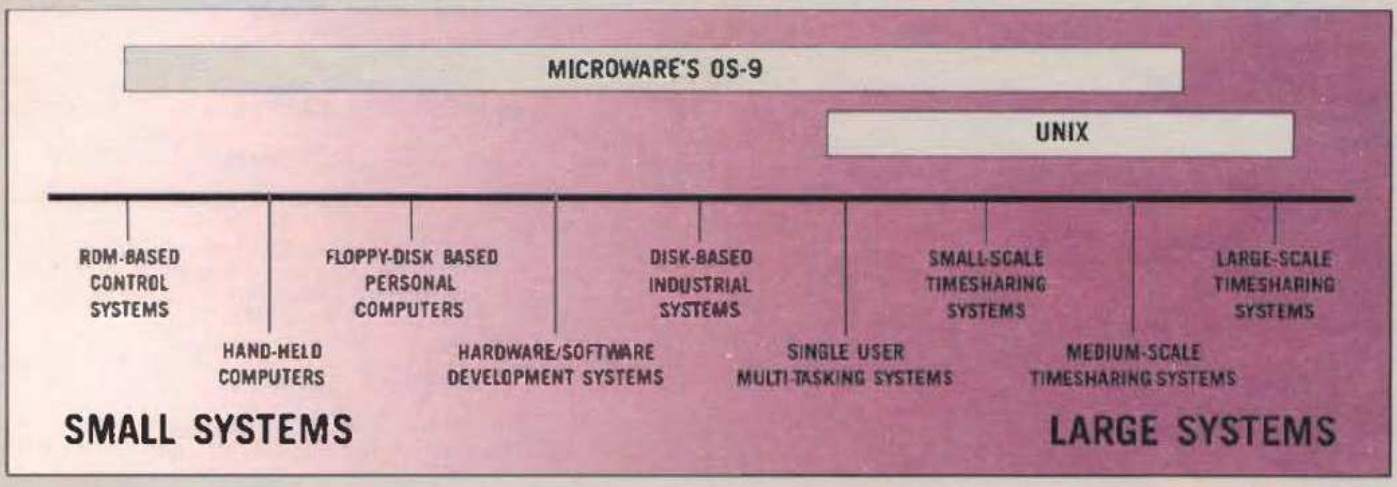

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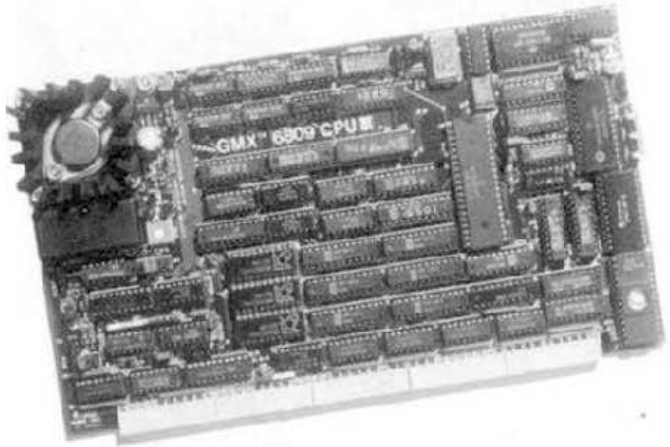

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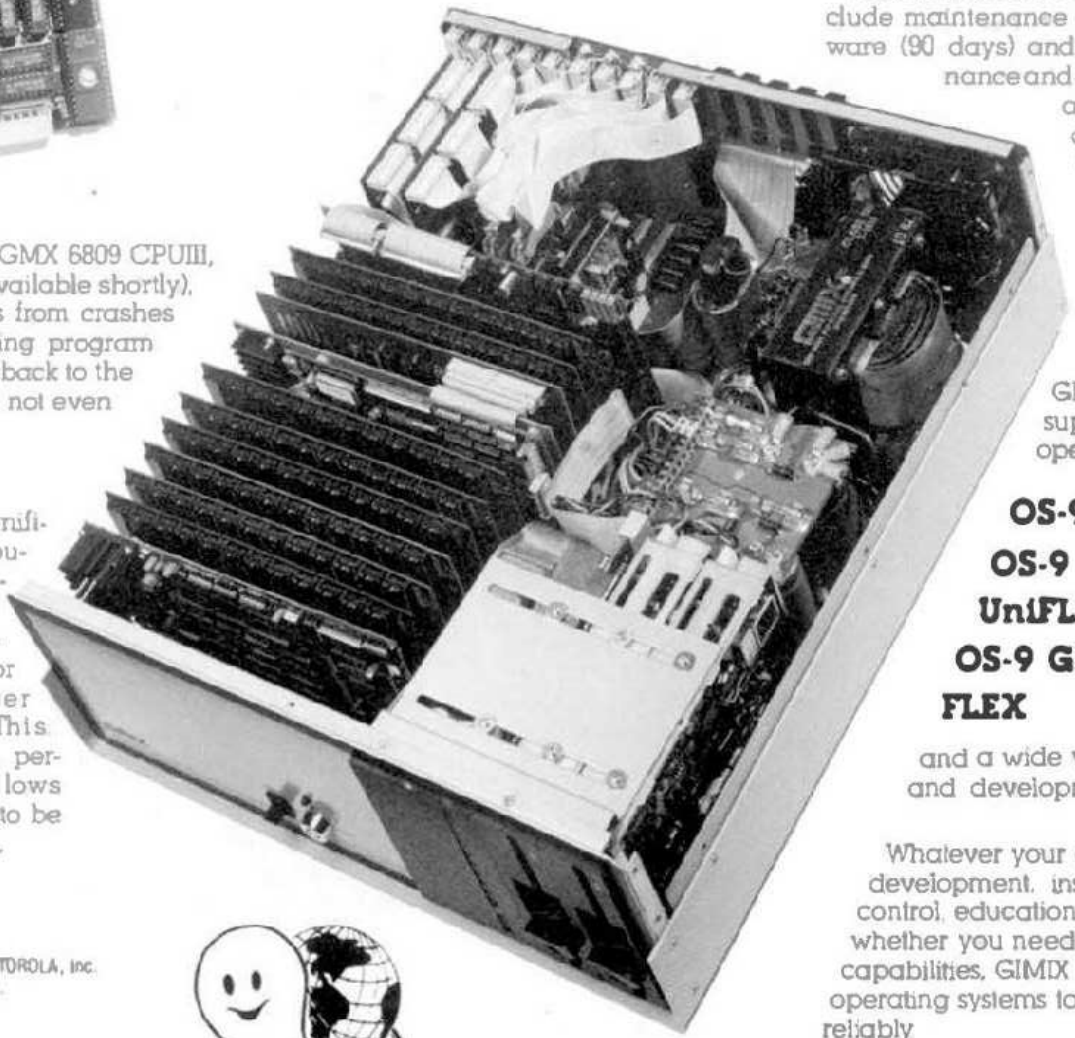

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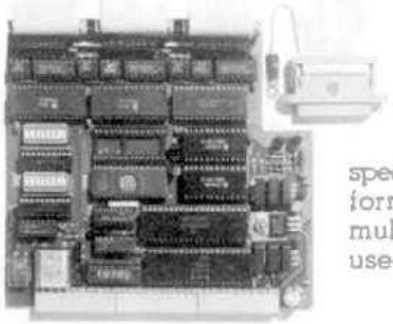

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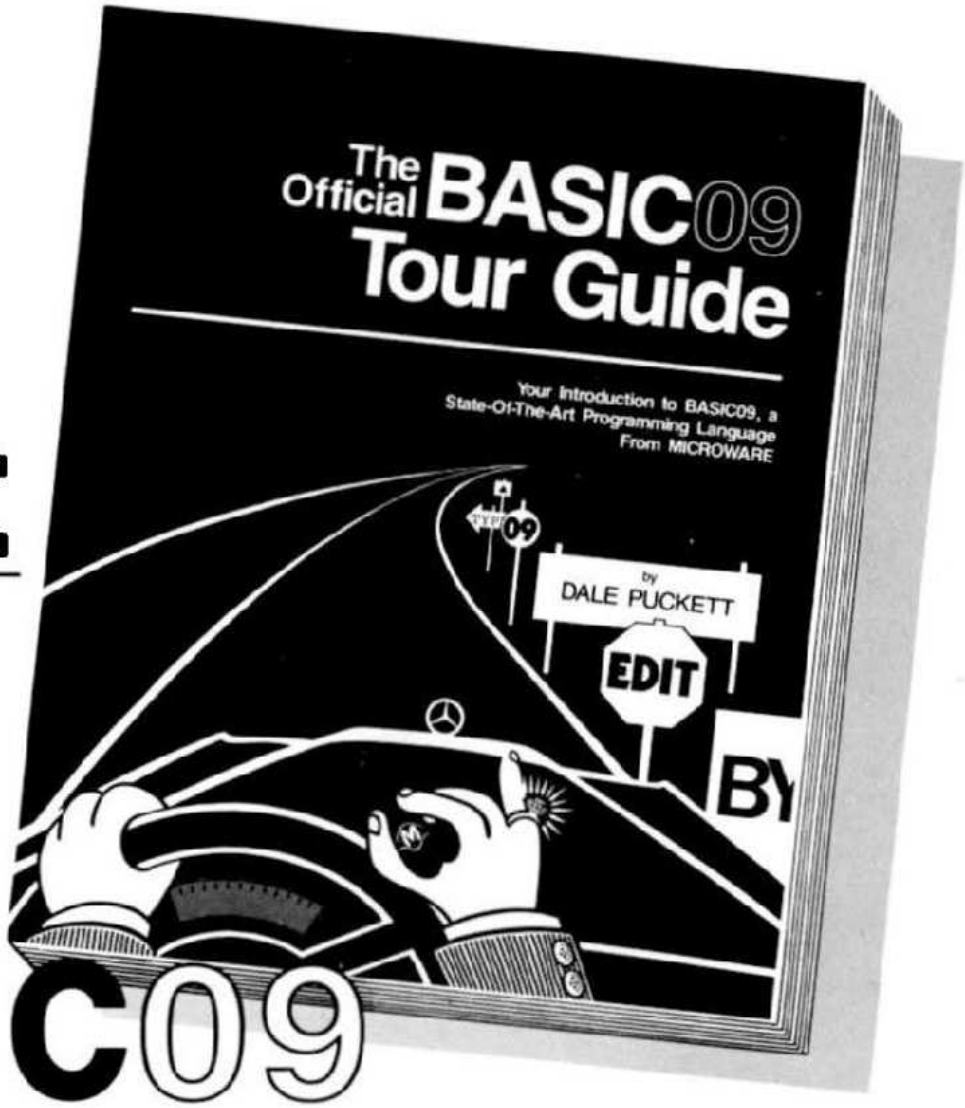

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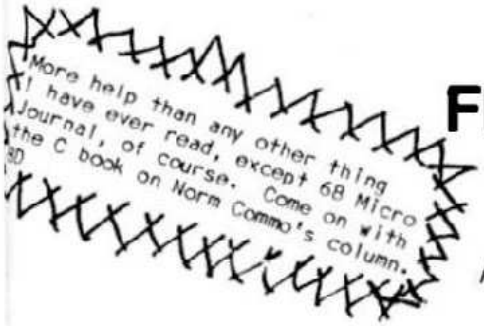

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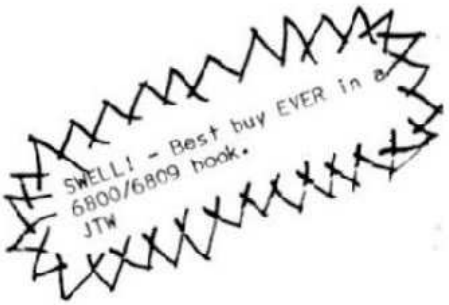
By: Ronald W. Anderson
As published in 68 MICRO JOURNAL™



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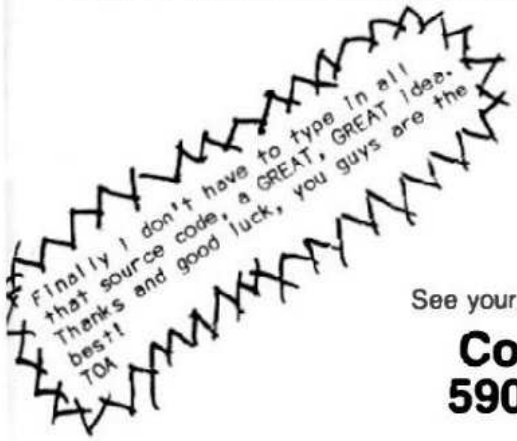

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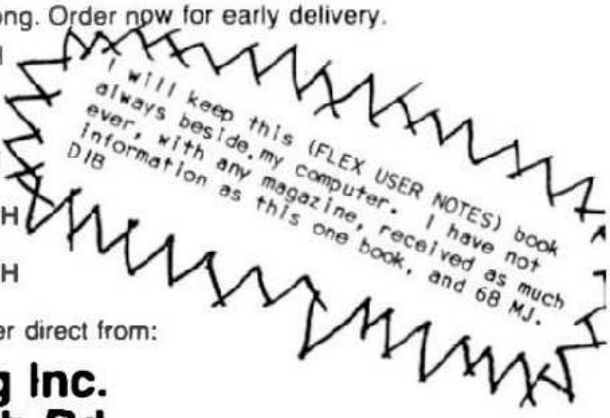

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Flex User Notes

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An Editorial of Sorts

You know, I've been giving a lot of thought lately to the subject of progress. Just what is the most effective hardware to do an industrial control or instrumentation job. We all know that new things cost a great deal at first. Therefore it is reasonable that if I don't need the extra capabilities of new processors, I would be foolish to pay for them. On the other hand, it is possible to argue that "I have a working design. Why change it?" to the point of becoming very obsolescent. For example, there are still 6800 processors being built into instruments. If they have all the capabilities, and the software is done once and for all, that is all just fine. Why not keep building the instrument or whatever just as it is now.

Now here is where I think the fallacy lies. If the product requires a great deal of software support, perhaps a different program for each customer, maybe the designers are just in a rut. Think for a moment about the superior instruction set of the 6809 as compared to the 6800. Any reasonably good assembler programmer can generate the same program for the 6809 with 15% to 30% fewer lines of instructions. I believe that the difficulty of debugging any program increases faster than the number of lines of code. Perhaps a good estimate would be that the debug time is about proportional to the square of the size of the program. By that estimate, a program 30% smaller will take half as long to debug. Also, it will take less time to write and to list. Another factor to be considered is that the 6800 and 6809 are very similar and minimal circuit changes are required to make the conversion. Hardly any other component changes need be made, so that the cost of switching is minimal, and the cost per unit is also increased very nominally. I therefore argue that anyone who has a 6800 based product that requires program adaptation or rewriting should seriously consider switching.

When it comes to the use of the 68000 however, (again my argument is limited to machine control and instrumentation applications), the situation is somewhat different. The 68000 costs several times as much as the 6809, and it requires more and faster hardware to support it. Bus speeds are higher, making noise immunity lower in industrial environments. In general the premium paid for using "the latest" is not small. I've been saying for a couple of years now, that as soon as I had an application the 6809 couldn't handle, I would use a 68000. I'm still waiting for that application, and I still have plenty of room to improve my 6809 handling of applications. Presently, my designs are still running the 6809 at 1 MHz. I can do everything twice as fast by plugging in a 68B09, an 8 MHz crystal, and the B version of the serial and parallel interface chips. Memory is already capable of 2 MHz.

I'm not saying that tomorrow won't bring me a problem that requires the extra speed of an optimized 68000 assembler code solution, just that such a problem has not yet come forth. I think many designers don't try very hard to squeeze some extra performance out of their present hardware. I can relate tales of improving performance (execution time) by using better software, by a factor of about 200, and that on a 6800 system. I think the early 6809 software that just echoed the 6800 code didn't take advantage of the 6809. In the past few years, improvements of a couple orders of magnitude have taken place in the performance of the object code generated by 6809 compilers. (Language is irrelevant to this discussion). The newest of the compiler implementations are still showing single digit percentage gains in performance, but the gigantic improvements have pretty much taken place.

Benchmarks run on the 68000 early on, were very disappointing. It usually turned out that a 2 MHz 6809 could match or exceed the performance of the 68000 on the same benchmark. However, I think the same thing has happened with the 68000 as happened early with the 6809. Programmers did not immediately learn to take full advantage of the 68000 instruction set. More recent results indicate that the 68000 can do things a good deal faster than the 6809 if its resources are used wisely, (such as the use of registers to hold variables). Yes, the 68000 is coming of age.

Now before several hundred of you start writing me letters about my stupidity, let me repeat in no uncertain terms that I AM NOT TALKING ABOUT ALL APPLICATIONS HERE. I don't know how to shout my point in writing, but if I did, I would. No, I am NOT talking about trying to misapply a 6809 to a 12 user super office computer, a CAD system, the control of a complex robot or a multi-axis CNC machine tool application. I am ONLY talking about applications in reasonably simple controls and instrumentation. I am talking about "canned software" in a Stand Alone system with very limited or no user programmability beyond the input of "set up" parameters. I'm talking about what I call a "dedicated computer" application. In such applications, there is generally NO mass storage device. There MAY be some battery backed up RAM to allow the system to remember certain constants and limits while power is off. Generally the program is in ROM.

I hope this will have sufficiently narrowed down the applications about which I am speaking. I think most of the differences of opinions that have been aired in this column come about because we each tend to see something entirely different when someone says "Computer". We see a computer in the configuration in which we use it ourselves. Many of us are not even aware of all the applications that have become feasible both technically and economically because of the existence of the microprocessor and the ever tumbling prices for its peripheral devices. This difference in perception of what a computer is, is after all partly because a computer is a VERY general purpose tool. My little development system is nothing at all without software. At the moment it is a very nice text editor - processor. In a little while, it will be a software development system as I translate some of the software modules that I use frequently into a new language that I am studying. At other times it is a design tool that lets me explore alternate ways of solving a problem, at times through simulation techniques. Sometimes it is a tool to do a plodding search of several thousand possibilities to find the best solution to a specific problem. I have several friends who own computers, and for them, the word brings forth entirely different visions of what the computer is. For one, it is a data collector for experiments in Chemistry. For another it is a data management system for student grades, a word processor for the preparation of class notes and quizes, writing of technical papers, books, letters, etc. Your concept of what a computer is, may not agree with any of those I've mentioned here. Perhaps for you, computer means a system to handle you company's payroll and accounting records. If you work for an airline, your idea of a computer is that it can store and instantly recall vast amounts of information about flights, passengers, seating arrangements, prices, timetables, etc. I think the point is made, so I will stop here.

We Engineers have to consider several factors in designing a system. One of the major factors is cost. The latest, best, and newest technology, the "state of the art" things are always very expensive at first. Once the bugs in the production of these new items are worked out, and the design costs more or less paid for, the price nearly always takes a large drop. Somewhere along the way, the price begins to level off, and that is usually the point where it becomes economically feasible to use the new technology. Suppose I am using an EPROM that stores 4K bytes. It costs $4 in some quantity. A new device stores 16K bytes. It costs $64 in somewhat smaller quantity.

First of all, if my requirements for storage are around 4K or 8K, the new part may never become more economical. On the other hand, if I need 16K or 32K, the new part will become economically feasible before the price per K of storage is the same as the old device. I need only 1/4 as many of these devices. Handling is reduced. Programming time is reduced because I don't have to handle four devices, just one. Printed circuit board space is reduced, resulting in savings. The board only needs one socket, probably with a few more pins than the original device for which I need four sockets to get the same storage.

I've tried always, to work down at that point where the price of new devices starts to level off after the initial high price phase. I think that maximizes the value of the design. Of course, with the rapid changes in technology over the past decade or so, today's maximum value design is not tomorrow's. A designer must keep up with the latest items constantly, and a design can't stay static for very many years in most cases. If it does, you can be sure that the competitors will soon have something that does more, is simpler, and costs less. Enough said on this subject.

Computer Bargains

A few words for you out there with the limited budgets (that certainly includes most or all of us). Recently, I've acquired a couple of used SS-50 systems for very reasonable prices. I was fortunate to find a couple of sellers who realize that an original SWTPc 4K memory board is not worth anything. (You would need 14 of them to have 56K of memory). An 8K board is not useless, but is certainly of limited value. Old 6800 processor boards such as the MP-A and later MP-A2 are certainly of little value to most of us who want 6809 systems. And lastly, a pair of old 35 track single sided disk drives with a disk controller that won't run double density, no matter how little they have been used, and how reliable they are, are not worth a great deal, since now anyone who reads the ads in the magazines can pick up a double sided double density 40 track drive for less than $150. One of these will hold just about 370K bytes of data. Though the old 35 track drives cost nearly $1000 for a pair in a box with a power supply, you can now, with a little ingenuity put two drives and a power supply together for around $400, and have 700K of storage. How much is the 35 track single sided drive worth that holds 92K of data? It can't be worth more than $50 or $75.

My point is that these facts are not all bad. If you want to get into computing at minimal cost, find someone with an old SWTPc box containing a 6800 or 6809 processor board, 32K or more of memory, and a few I/O ports, a disk interface and a pair of drives, and you can be in business for a very small investment. You simply have to realize and accept the fact that you don't have the latest, fastest, largest system. Most sellers of these old SWTPc systems are selling because they are going into a more modern computer such as a Macintosh or an IBM PC for the simple reason that there is a great deal of software for these systems. Such sellers usually are willing to sell their original software at bargain prices too. I recently picked up two spreadsheet programs and a database program for the 6809 as part of a purchase.

As I've said before, the beauty of a "component system" or a bus system if you like, is that it can be upgraded a step at a time. You can replace those 4K memory boards with used 8K boards one at a time until you have 56K installed. You can now buy 64K boards new for around $200, and reduce the memory board count to one. If you become affluent later, you can buy a 256K board that takes less power than some of the old 8K and 16K boards. You can upgrade disk controllers and drives one at a time until you have a very capable system. Meanwhile you can be learning about computing and software as your system grows, and you never have to throw away anything of great value to go to the "next step up" in your computer.

You say "yes but I can't afford a terminal!" Just look around and be patient. I've lately seen a couple of perfectly good and serviceable terminals for $250 each. Find someone else who is upgrading from an old terminal to something more up to date, and take advantage of his upgrade to get yourself a terminal. Is there a junior college nearby? Schools sometimes upgrade the systems installed for student use. Perhaps they have a dozen terminals for sale and you can be an early customer and get the pick of the lot for the same price as the worst.

"Gee" you say, that still adds up to lots of money compared to a Commodore 64 or something like that. Of course you are right. The point is that you don't have to spend all that money at one time, or even in one year. I suppose I could look at the system I have right here and conclude that it is the most expensive electric typewriter that I could buy.

In my case, I have made enough on consulting fees over the years, and on articles that I have written for magazines in the past, to pay for my system a couple times over. What I have learned through what started out as a hobby interest has brought about a job for me in a highly paid position doing work that I thoroughly enjoy. If I look at my computing equipment as an educational investment, I've spent far less than it would cost to go to college for a couple of years at today's prices. The fact that you are reading this indicates that you have more than a passing interest in computers. You didn't buy a Color Computer and stop at playing games on it. It is not gathering dust as a doorstop somewhere in your house. If you find computing to be exciting, you have some success in writing programs and/or designing and building computer hardware, consider a computer an investment in your future, and work toward the goal of a career in some area of computing.

Cobol

I recently reviewed Crunch Cobol in this publication. I'm really glad that I took the approach that I did, and that I didn't claim to have written an elegant program in Cobol as the example.

I've just read the reply from Compusense that illustrates a couple of better ways to write that program in Cobol. As I said in the little review, I had expected someone to show me that I had done the program the hard way, and I appreciated the kind words in that reply. (They didn't even call me stupid!!)

Of course, the good solution to the problem involves using the REDEFINES feature of Cobol. The folks at Compusense wrote a letter to '68' Micro Journal (see Ed's Notes), and I think Don will publish their lesson on Cobol that shows how to redefine a character in working storage as an integer, perform the operation of converting it and then recover it as a character to go into the output string. I won't go into trying to describe their program since they do a fine job of that in their reply. I also received a letter from Mike Martin of Weatherford, TX, also a Cobol programmer who indicates that the Compusense implementation "is a good deal for a hundred bucks". He also sent me a solution to the case conversion program that uses the REDEFINES feature of Cobol. Thanks to both Compusense and Mike for setting us all straight on one of the most useful features of Cobol. Mike also indicates that a very good book on Cobol is "A Guide to Structured COBOL With Efficiency Techniques and Special Algorithms" by Pacifico A. Lim (Van Nostrand Reinhold Company). Mike goes on to say that most books on Cobol lean toward the IBM version, and that a number of features of Cobol discussed in these books are not supported by Crunch Cobol. Since Don will probably print Mike's letter and program in its entirety, I won't dwell on this any further. Thanks to both of you for setting the record straight.

Long time readers might remember a similar occurrence when I first started writing a few programs in "C". I had done a memory dump in Ascii and HEX program in a couple languages and tried a "C" version. Norm Commo was quick to show me a better way to write that program in "C", and I appreciated the lesson. I can say the same for the lesson on Cobol from Compusense. While I am too

much a Pascal and "C" programmer to agree that having only "static" or "global" variables to work with is better, I do see a clarity in Cobol. I can readily understand how a good Cobol programmer would have little trouble maintaining someone else's code, and I appreciate the lesson, though I still don't see that "ADD A TO B GIVING C" is clearer than C := A+B;.

- - -

Ed's Notes: Gotcha, Ron. Beatcha to the draw. See January 1985 68 Micro Journal, BIT BUCKET section.

DMW

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OS9 USER NOTES

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Automated Updates

This month's column will be relatively short. I have a program I want to include that's longer than the usual, but I think it's worth sacrificing some text for.

I keep mentioning that I've turned into a full-time graduate student. The effects are finally beginning to show (bleary eyes from no sleep and lots of staring at books and terminals). I've spent a lot of time using UNIX. Two program development tools seem especially useful and much needed in OS-9. I wish I could write a debugger like DBX and include it in this column, but that's beyond me. Make, however, is a program I can fake.

Make is a UNIX program that looks at first like a version of the shell with a few special features that make it especially suited to running sequences of programs that make something. In the simplest case it is like packaging a long cc ... command line in a command file to save yourself from having to retype it every time you compile the program. Once I bothered to look into it I discovered that Make is much more that a special shell. The most important part of Make is its ability to understand dependencies.

A complicated program is composed of many pieces. There are a number of separately compiled modules with each module requiring one or more source files. If any of the sources have been changed since their modules were last compiled, they need to be recompiled. If any of the modules have been updated since the program was last linked, the module needs to be relinked. If you construct systems of programs, a modification to one of the programs may result in regeneration of some composite files -- maybe you'll want to print a new manual.

Make automates all this. You build a file that details the dependencies (prerequisites) for each file that is generated as part of the construction of the program. It also contains the command line that generates each file. Make checks the last-modified date and time on the file it's generating and each of the files that it depends on. If any of the dependencies are more recent than the file it's making, Make runs the command to build a new file. The program is arranged so it checks each dependency to see if it should be updated before it uses it to decide whether to update the final result.

An example would probably make this much clearer. Say you have a terminal simulator. It is divided into four modules: Setup, Run, Transfer, and Print. This would be stated (to my version of Make) as:

```
/h0/cmds/terminal: Setup.o Run.o Transfer.o Print.o
=cc2 Setup.o Run.o Transfer.o Print.o -f=terminal
```

That is: if any of Setup.o, Run.o, Transfer.o or Print.o have been updated since /h0/cmds/terminal, run the command line starting with cc2.

Make also understands that the .o files may need to be updated. The descriptions for them might be something like:

```
Setup.o: Setup.a ACIA.Codes.h /h0/defs/OS9defs
Menu.fcbs CursorControl.a
=cc2 Setup.a -o

Run.o: Run.c ../localdefs/terminal.h
/h0/defs/stdio.h
=cc2 Run.c -o
Transfer.o: Transfer
=rma transfer -o=Transfer.o

Print.o: Print.c /h0/defs/stdio.h
=cc2 Print.c -o
```

When you run make against this file, it will first check Setup.o. If any of the dependencies for Setup.o (there are five of them) have been modified since Setup.a was last assembled Make will reassemble it. Then it will check run.o, transfer.o, and print.o in the same way. Finally make will come to /h0/cmds/terminal. If any of its dependencies have been modified since terminal was last modified, it will be relinked. This applies even if the dependency was updated by an earlier step in this make.

Often the depth of nesting goes beyond two. You'll be working on a system that includes files that depend on files that depend on other files and so forth. Make can deal with any degree of complexity. The only limitations are artificial. I set the constant DEPENDENCIES. You may reset it to a larger number if you need to. The C compiler generates the other limitation by chosing a default memory allocation. If you want to nest dependencies very deeply, it would be good to give make some extra memory. The procedure, resolve, allocates extra stack space for each level of nesting.

Documentation

The version of Make with this column was written in Microware C. I don't think I used any strange features so it should be easy to convert to other versions of C.

Make isn't any good without a "makefile." You'll have to write one up for every program (or system) you want to use Make with. The convention is to put all the files associated with a program in a directory by themselves and call the makefile for that program "makefile". If you just run Make, it will look for a file called makefile in the current data directory.

If you don't want to call your makefile "makefile," or you want to keep several in a directory, you can tell Make to use a different name

for the makefile by putting the name on the command line:

OS9:make prog.d

would use a file called prog.d as the makefile.

The first line(s) of the makefile must contain the dependencies of the highest level file -- the end result of the make -- with the command that generates the top-level file next. From then on the files can be specified in any order. First a dependency line denoted by the name of the file it's referring to, followed by a colon and the list of dependencies; then an equal sign and the command line for that file.

The command lines are restricted to 80 characters, but the dependency lines can be any length or be several lines long.

As usual for programs in this column there is a lot that needs improving in this program. It is good enough to be very useful, but there's plenty of room for bells and whistles. If I still feel interested in it next month, I may cook up a fancy version over Christmas break and see if I can get Don to sell it for me.

I Spoke Too Soon

Just before the Microware Seminar I heard from Gimix that they had stopped work on their 68000 board. I was very unhappy about it, but hoped they might change their mind. Last month I gave up and groaned about it a little in this column. Just a few weeks after I sent the column in, I heard that Gimix was working on the board again. Now, it's true that the board is being designed to work with UniFlex, not OS-9, but at least there is hope. Remembering the number of Gimix CPUs in Microware's lab I think there is good reason to hope for OS-9 support sometime next year. I don't know much about the board, but from what I do know combined with my experience with UNIX, I'm looking forward to showing my Computer Science friends my micro running about as fast as their minicomputers.

- - -

```
#include <stdio.h>
#include <direct.h>
#include <ctype.h>
#define TRUE 1
#define FALSE 0
#define DEPENDENCIES 20
static char *Makefile = 'makefile';
FILE *f;
static struct
{
    char *Name;
    char ModTime[5];
    char *Dependency[DEPENDENCIES];
    int DCtr;
    char *Constructor;
} Graph[DEPENDENCIES];

static char ITime[5] = {0,0,0,0,0};

static int GraphSize;

char *scan();

main (argc, argv)
 int argc;
char **argv;
{

    argc--; /* skip program name */
    argv++;

    if(argc > 0)
       Makefile = *argv;
    BuildGraph();
    resolve(0);
}

BuildGraph()
{
    register int i=0;
    char *s;

    if((f = fopen(Makefile, "r")) == NULL)
       {
          fprintf(stderr, "I don't know how to make %s.\nError #%d\n",
                Makefile, errno);
          exit(1);
       }
    if((s = scan()) == NULL)
       {
          fprintf(stderr, "There are no directions in %s\n", Makefile);
          exit(1);
       }
    for(GraphSize=0;i<DEPENDENCIES && (s != NULL); GraphSize++)
       {
          strcpy(Graph[GraphSize].ModTime,"",5);
          SetName(s, GraphSize);
          SetDep(GraphSize);
          SetCmd(GraphSize);
          s = scan();
       }
}

resolve(n)
int n;
{
    char date[5];
    register i, x, flag;

    if(strncmp(Graph[n].ModTime, ITime,5) == 0)
       getdate(Graph[n].Name, Graph[n].ModTime);
    for (i=0, flag=FALSE; i< Graph[n].DCtr; i++)
       {
          if ((x = FindName(Graph[n].Dependency[i])) >= 0)
             {
                resolve(x);
                if(!flag)
                   {
                      getdate(Graph[x].Name, Graph[x].ModTime);
                      if(strncmp(Graph[n].ModTime,Graph[x].ModTime,5) < 0)

                         flag++;
                   }
             }
          else if('flag)
             {
                getdate(Graph[n].Dependency[i], date);
                if(strncmp(Graph[n].ModTime, date, 5) < 0)
                   flag++;
             }
       }
    if(flag)
       {
          if((n = system(Graph[n].Constructor)) != 0)
             {
                fprintf(stderr, "Return Id from:\n%s\n", x,
                                Graph[n].Constructor);
                exit(x);
             }
       }
    return;
}

findName(s)
char *s;
{
    register int i;
    char ts[127];

    strcpy(ts,s);
```

```
110     fixname(ts);
111     for (i=0;i<GraphSize;i++)
112        if(strcmp(ts,Graph[i].Name) == 0)
113           return(i);
114     return(-1);
115  }
116
117
118  SetName(s,i)
119   char *s;
120   int i;
121   {
122     Graph[i].Name = malloc(strlen(s) + 1);
123     strcpy(Graph[i].Name, s);
124     if((s = scan()) == NULL || (*s != ':'))
125        {
126           fprintf(stderr, "Colon required after %s\n", Graph[i].Name);
127           exit(1);
128        }
129     return;
130  }
131
132  SetDep(i)
133   int i;
134   {
135     char *s;
136     register int j=0;
137
138     s = scan();
139     Graph[i].DCtr = 0;
140     while((s != NULL) && (*s != ';') && (j < DEPENDENCIES))
141        {
142           Graph[i].Dependency[j] = malloc(strlen(s));
143           strcpy(Graph[i].Dependency[j++], s);
144           Graph[i].DCtr++;
145           s = scan();
146        }
147     return;
148  }
149
150  SetCmd(i)
151   int i;
152   {
153     char s[80];
154
155     if(fgets(s, 80, f) == NULL)
156        {
157           fprintf(stderr, "No command line for %s\n", Graph[i].Name);
158           exit(1);
159        }
160     Graph[i].Constructor = malloc(strlen(s));
161     strcpy(Graph[i].Constructor, s);
162     return;
163  }
164
165  static char token[81];
166
167  char *scan()
168  {
169     char *ptr, *limit;
170
171     ptr = token;
172     limit = ptr+80;          /* High bound on token string */
173     skipblanks();
174     if((*ptr = getc(f)) == EOF)
175        return NULL;
176
177     /* = and : are special tokens.  They are returned as single character

178        tokens even if they have non-blanks on either side.
179     */
180     if((*ptr == '=') || (*ptr == ':'))
181        ptr++;
182     else                     /* Accumulate characters until a delimiter
*/
183        for(ptr++; (ptr != limit) && !delim(*ptr = getc(f)); ptr++);
184     *ptr = '\0';             /* seal off the string */
185     return token;
186  }
187  /* Delim returns TRUE if c is a delimiter character. FALSE

188     otherwise.
189  */
190  delim(c)
191   char c;
192   {
193      switch (c)
194        {
195           case '\n':
196           case ' ':
197           case ',':
198           case '\0':
199           case '\t':
200              return(TRUE);
201              break;
202           case '=':
203           case ':':
204              ungetc(c,f);
205              return(TRUE);
206              break;
207           default:
208              return(FALSE);
209        } /* end case */
210     return(FALSE);   /* Never executed */
211  }
212
213  skipblanks()   /* Read from file 'f' until just before a non-
214                    delimiter. */
215   {
216     register char c;
217
218     while(isspace(c = getc(f)) || (c == ','));
219     ungetc(c,f);
220     return;
221  }

222
223
224  getdate(filen, date)    /* put the last-modified date of filen in date */

225   char *filen;            /* file name */
226   char date[5];           /* last-modified date and time */
227   {
228     char *dir, *nm, *find_dir(), *find_nm();
229     char diskname[33];            /* Name of disk containing filen */
230     FILE *DirFile, *DiskFile;
231     struct dirent Entry;          /* Directory entry format */
232     int found=FALSE;
233     long LSN;                     /* Logical sector number */
234     struct fildes Descriptor;     /* File descriptor format */
235
236     find_disk(filen,diskname);    /* Extract disk name from
237                                      qualified filename */
238     nm = find_nm(filen);          /* Extract filename from
239                                      qualified file name */
240     fixname(nm);                  /* change nm to all caps, C-format stri
ng */
241     dir = find_dir(filen);        /* Extract directory name from qualifie
d
242                                      file name */
243
244     if((DirFile = fopen(dir, "d")) == NULL)
245        {
246           fprintf(stderr, "Can't open directory %s\n", dir);
247           exit(1);
248        }
249
250     /*
251      Search through the directory for filename nm.
252     */
253     fixname(nm);
254     while(fread(&Entry, sizeof Entry, 1, DirFile) == 1)
255        {
256           if(Entry.dir_name != '\0')
257              {
258                 if(strcmp(nm, Entry.dir_name) == 0)
259                    {
260                       found++;
261                       break;
262                    }
263              }
264        }
```

```
265     if(!found)
266        {
267           fprintf(stderr, "%s can't be found in %s\n", nm, dir);
268           exit(1);
269        }
270
271     /*
272        Close the directory and open the disk.
273     */
274
275     fclose(DirFile);
276     if((DiskFile = fopen(diskname, "r")) == NULL)
277        {
278           fprintf(stderr, "Error %d in open for %s\n", errno, diskname);
279           exit(1);
280        }
281
282     LItol(&LSN, &entry.dir_addr,1);
283     fseek(DiskFile, LSN*256, 0);  /* Seek to file descriptor on disk */
284     if(fread(&Descriptor, sizeof Descriptor, 1, DiskFile) == NULL)
285        {
286           fprintf(stderr, "Error %d in disk read for %s\n", ferror(DiskFil
e),
287            diskname);
288           exit(1);
289        }
290
291     fclose(DiskFile);
292     _strass(date, Descriptor.fd_date, 5);
293     return;
294  }
295
296 fixname(s)   /* Switch s from OS-9 string to C-string and convert it to ca
ps */
297  char *s;
298  {
299     register char *ptr;
300
301     for(ptr = s; *ptr < 127 && *ptr > 0; ptr++)
302        *ptr = toupper(*ptr & 127);
303     *ptr = toupper(*ptr & 127);
304     ptr++;
305     *ptr = '\0';
306     return;
307  }
308
309 char *find_name(s) /* must be called before find_dir */
310  char *s;
311  {
312     register char *loc;
313
314     if((loc = rindex(s,'/')) == NULL)
315        return s;
316     else
317        return loc+1;
318  }
319
320 char *find_dir(s)  /* return a directory name or "." if non can be
321                       found in s. */
322  char *s;
323  {
324     register char *loc;
325
326     if((loc = rindex(s, '/')) == NULL)
327        return ".";
328
329     *loc = '\0';
330     return s;
331  }
332
333 find_disk(s,dist) /* determine the disk file s is on given its file name.
334                      If no device name is in the file name, assume
335                      the disk with the data directory on it.
336                      Return the 0-qualified file name for the device. */
337  char *s, *disk;
338  {
339     register char *ptr;
340
341     ptr = disk;
342     if(*s == '/')
343        do
344           *ptr++ = *s++;
345        while(*s != '/' && *s != '\0');
346
347     *ptr++ = '@';
348     *ptr = '\0';
349     return;
350  }
351
352
353 static char ts2[127];
354
355 cstrcmp(s1, s2) /* compare change s2 to C-format, all caps and compare to
s1 */
356     char *s1, *s2;
357     {
358        strcpy(ts2, s2);
359        fixname(ts2);
360        return(strcmp(s1,ts2));
361     }
362
```

"C" User Notes

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INTRODUCTION

This month's column continues the definition of the string-handling library started in the previous column. It provides the text of many of the shorter functions, along with explanations of how they work.

STRING-HANDLING IN C

The "b" family of string-handling functions allows arbitrary contents of strings, as the processing is controlled entirely by the specified length. Note that the C compiler handles only null-terminated strings properly, in terms of string constant definition, string input, string output, etc. Thus length-terminated strings must be handled carefully, or their contents may be either prematurely terminated by a single 0x00 character or operations on them may not terminate properly because of the lack of a terminating 0x00 character.

bcmp(s1, s2, len) returns the number of bytes remaining in the strings after any equal bytes at the beginning of the strings have been skipped. The function counts down the length while it performs the comparisons.

```
int bcmp(s1, s2, len)
char *s1, *s2;
int len;
{
    while (--len >= 0 && *s1++ == *s2++);
    return len+1;
}
```

bcopy(src, dst, len) copies "len" bytes from the source "src" to the destination "dst".

```
bcopy(src, dst, len)
char *src, *dst;
int len;
{
    while (--len >= 0) *dst++ = *src++;
}
```

bfill(dst, len, fill) copies "len" fill characters to "dst".

```
bfill(dst, len, fill)
char *dst;
int len;
char fill;
{
    while (--len >= 0) *dst++ = fill;
}
```

bmove(dst, src, len) copies "len" bytes from the source "src" to the destination "dst". It differs from "bcopy" in the order of its source and destination arguments.

```
bmove(dst, src, len)
char *dst, *src;
int len;
{
    while (--len >= 0) *dst++ = *src++;
}
```

bzero(dst, len) copies "len" 0x00 bytes to "dst".

```
bzero(dst, len)
char *dst;
int len;
{
    while (--len >= 0) *dst++ = '\0';
}
```

The "mem" family of string-handling functions allows arbitrary contents of strings, as the processing is controlled entirely by the specified length. Although the functions in the family are similar to the functions in the "b" family, although they have different argument orders, return different values, perform slightly different operations, etc.

memccpy(dst, src, chr, len) copies bytes from "src" to "dst" until either "len" bytes have been moved or a byte equal to "chr" has been moved. It returns either NULL or a pointer one beyond the location in the destination string with "chr".

```
char *memccpy(dst, src, chr, len)
char *dst, *src, chr;
int len;
{
    while (--len >= 0)
        if ((*dst++ = *src++) == chr)
            return dst;
    return NULL;
}
```

memchr(src, chr, len) searches the memory area pointed to by "src" extending for "len" bytes, looking for an occurrence of the byte "chr". It starts at the beginning of the string and stops when it encounters the first match.

```
char *memchr(src, chr, len)
char *src, chr;
int len;
{
    while (--len >= 0)
        if (*src++ == chr)
            return src-1;
    return NULL;
}
```

memcmp(lhs, rhs, len) compares the two memory areas "lhs[0..len-1]" and "rhs[0..len-1]". It returns a value < 0, == 0, or > 0, depending upon whether "lhs" < "rhs", "lhs" == "rhs", or "lhs" > "rhs". It skips the equal prefixes and uses the values of the first unequal characters to determine the comparison value.

```
int memcmp(lhs, rhs, len)
char *lhs, *rhs;
int len;
{
    while (--len >= 0)
        if (*lhs++ != *rhs++)
            return lhs[-1]-rhs[-1];
    return 0;
}
```

memcpy(dst, src, len) copies "len" bytes from "src" to "dst" and returns a pointer to "dst".

```
char *memcpy(dst, src, len)
char *dst, *src;
int len;
{
    char *d = dst;
    while (--len >= 0) *dst++ = *src++;
    return d;
}
```

memmov(dst, src, len) copies "len" bytes from "src" to "dst" and returns "dst"+"len".

```
char *memmov(dst, src, len)
char *dst, *src;
int len;
{
    while (--len >= 0) *dst++ = *src++;
    return dst;
}
```

memrchr(src, chr, len) searches the memory area pointed to by "src" extending for "len" bytes, looking for the last occurrence of the byte "chr". It starts at the beginning of the string, but scans the entire string, rather than stopping with the first match.

```
char *memrchr(src, chr, len)
char *src, chr;
int len;
{
    char *ans;
    for (ans = NULL; --len >= 0; src++)
        if (*src == chr)
            ans = src;
    return ans;
}
```

memrev(dst, src, len) copies "len" bytes from "src" to "dst", in reverse order. It will work with completely overlapping, but not partially overlapping, source and destination strings. On each iteration, it swaps successive characters from the next positions from the front and end of each string.

```
memrev(dst, src, len)
char *dst, *src;
int len;
{
    char *dste = dst+len, *srce = src+len, t;
    while (srce > src)
    {
        t = *--srcz;
        *--dste = *src++;
        *dst++ = t;
    }
}
```

memset(dst, chr, len) fills the memory area "dst[0..len-1]" with "len" bytes all equal to "chr", and returns a pointer to "dst".

```
char *memset(dst, chr, len)
char *dst, chr;
int len;
{
    char *d = dst;
    while (--len >= 0) *dst++ = chr;
    return d;
}
```

The "str" family of string-handling functions does not allow arbitrary contents of strings, as the processing is controlled by the terminating nulls in each string. This is consistent with the manner in which C compilers handle constant strings and the standard C functions handle character strings.

strcat(s, t) concatenates "t" on the end of "s" and returns a pointer to "s". First it finds the end of "s"; then it copies "t" to the end of "s".

```
char *strcat(s, t)
char *s, *t;
{
    char *save = s;
    while (*s++);
    for (--s; *s++ = *t++; );
    return save;
}
```

strchr(s, c) returns a pointer to the first place in "s" where "c" occurs, or NULL if "c" does not occur in "s".

```
char *strchr(s, c)
char *s, c;
{
    for (;;)
    {
        if (*s == c) return s;
        if (!*s++) return NULL;
    }
}
```

strcmp(s, t) returns a value > 0, = 0, or < 0 when "s" > "t", "s" = "t", or "s" < "t", according to the ASCII sequence of characters. It skips the equal prefixes and uses the values of the first unequal characters to determine the comparison value.

```
int strcmp(s, t)
char *s, *t;
{
    while (*s == *t++)
        if (!*s++) return 0;
    return *s-t[-1];
}
```

strcpy(dst, src) copies the characters starting with "src" to the area starting with "dst" until a null character is found, and returns a pointer to "dst".

```
char *strcpy(dst, src)
char *dst, *src;
{
    char *save = dst;
    while (*dst++ = *src++);
    return save;
}
```

strend(s) returns a character pointer to the null which ends "s".

```
char *strend(s)
char *s;
{
    while (*s++);
    return s-1;
}
```

strlen(s) returns the number of characters in "s".

```
int strlen(s)
char *s;
{
    int l = 0;
    while (*s++) ++l;
    return l;
}
```

strmov(dst, src) copies the null-delimited string pointed to by "src" into "dst", and returns a pointer to the terminating null in "dst".

```
char *strmov(dst, src)
char *dst, *src;
{
    while (*dst++ = *src++);
    return dst-1;
}
```

strrchr(s, c) returns a pointer to the last occurrence of "c" in "s", or NULL if "c" is not found in "s".

```
char *strrchr(s, c)
char *s, c;
{
    char *ans;
    for (ans = NULL; *src; src++)
        if (*src == cbr)
            ans = src;
    return ans;
}
```

strrev(dst, src) copies characters from "src" to "dst", in reverse order. It will work with completely overlapping, but not partially overlapping, source and destination strings. On each iteration, it swaps successive characters from the next positions from the front and end of each string.

```
strrev(dst, src)
char *dst, *src;
{
    char *dstx, *srcx = src, t;
    while (*srcx++);
    srcx--;
    dstx = dst + (srcx - src);
    while (srcx > src)
    {
        t = *--srcx;
        *--dstx = *src++;
        *dst++ = t;
    }
}
```

strrpt(dst, src, k) repeats string "src" into "dst" "k" times. It returns the number of characters moved.

```
int strrpt (dst, src, k)
char *dst, *src;
int k;
{
    char *save = dst, *p;
    for ( ; --k >= 0; --dst)
        for (p = src; *dst++ = *p; );
    return dst-save;
}
```

straub(dst, src, off, len) copies up to "len" bytes from "src"+"off" to "dst". The value returned is a pointer to the terminating null of the resulting string.

```
char *substr(dst, src, off, len)
char *dst, *src;
int off, len;
{
    while (--off >= 0)
        if (!*src++)
        {
            *dst = '\0'
            return dst;
        }
    while (--len >= 0)
        if (!(*dst++ = *src++))
            return dst-1;
    *dst = '\0';
    return dst;
}
```

Next month's column will continue the expansion of O'Keefe's string-processing functions. The ultimate goal is the definition of several families of functions which will provide the programmer with a flexible library which will increase productivity, readability, ease of use, and enhance the structuring of C programs.

C PROBLEM

The problem with the following definition:

```
#define tolower(x) (isupper(x) ? (x)|32 : (x))
```

is in its side-effects with certain arguments. Consider the effect of the following usage of the definition:

```
c = tolower(*p++);
```

which, when expanded, becomes the following:

```
c = (isupper(*p++) ? (*p++)|32 : (*p++));
```

Note that the character which is tested for case is not the same character which may be converted to lower case. There are at least two possible solutions to the problem. One is to make "islower" a function, taking advantage of the call-by-value of arguments to C functions, as follows:

```
char islower(x)
char x;
{
    return (isupper(x) ? (x)|32 : (x));
}
```

which works only for arguments of type char and int. Another possible solution involves the introduction of an intermediate variable to circumvent the double expansion of the argument of the definition. The revised definition and variable declaration are as follows:

```
#define tolower(x) (isupper(_c=(x)) ? _c|32 : _c)
char _c;
```

which works for arguments of any low-level type,. but is slightly less efficient in code and time than the original definition.

What does the following program output?:

```
#include "stdio.h"
#define sp(x) if ((x) == '\t') printf(" ")
main()
{
```

```
        char c[] = "abc\tdef";
        char *p;
        for (p = c; *p; p++)
        {
            if (*p != 'c')
                exp(*p);
            else
                printf("%c",*p);
        }
    }
```

What guideline for C programs does it illustrate?

EXAMPLE C PROGRAM

Following is this month's example C function; it is from Phil Gunsul, and provides a "rename" function for the Introl version of C for FLEX.

```
/*  Rename will rename a file on the disk.  The string s1 must
    point to the old file name and extention, with an optional
    drive number followed by a period.  For example, s1 may
    point at a string "2.junk.txt".  If a number is not
    specified, such as "junk.txt" the working drive number will
    be used.  S2 should point at the desired new name, such as
    "junk.bak".  No number is allowed to prefix s2 , and it must
    have an extention prefixed by a '.'.  If the file maneger is
    unable to change names (disk is write protected, a file by
    that name already exist, etc.), a -1 will be returned.
*/


#include <stdio.h>
#include <flex.h>

rename(old_name_ext, new_name_ext)
char    *old_name_ext, *new_name_ext;
{


        char    c;
        struct fcb wrk_fcb;

        wrk_fcb.function = RENAME;
        if (isdigit(c = *old_name_ext)) {
                wrk_fcb.drive = *old_name_ext++ - '0';
                old_name_ext++;
        } else
                wrk_fcb.drive = FLEX_DATA.work_drive;

        transfer(&wrk_fcb.filename, old_name_ext);
        transfer(&wrk_fcb.s.new_name, new_name_ext);

        return(_fms(&wrk_fcb, c));
}


transfer(fcb_pnt, string)
char    *fcb_pnt, *string;
{

        int     j, i;
        char    c;

        for (i = 10; i > 0; i--)
                fcb_pnt[i] = 0;

        while ((c = string[i]) != '.' && i < 8)
                fcb_pnt[i++] = c;

        j = ++i;
        i = 8;

        while ((c = string[j++]) != 0 && i < 11)
                fcb_pnt[i++] = c;
}
```

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Portability

In one of my previous articles, I mentioned that I was now commonly writing utility programs in C, and using them without change on both the 6809 and the 68000. This has proved to be more and more important. For instance, I am working on several different large programs at the moment, with an eye towards selling them, and it makes sense to be able to sell them in both 6809 and 68000 markets with minimal changes to the programs. As I write these programs, though, it is becoming obvious that simply using a high level language is no guarantee of portability. Writing a truly portable program turns out to require a little care and thought, as well as some good programming habits.

Syntax

There are some obstacles to program portability which are beyond a programmer's ability to control. The compilers used to implement a given high level language in two different environments may actually accept two slightly different languages, syntactically. For instance, with Pascal, there is no universally established method for declaring a default action whenever the expression in a **case** statement fails to match any of the **case** values. Since it is very useful to be able to specify a default, as in the C language **switch/case/default** construct, individual compiler authors have extended Pascal, each using their own peculiar syntax.

C also has some problems in this regard. While C compilers tend not to implement unique extensions to the language, probably because the standard language as defined in K & R (Kernighan & Ritchie, The C programming Language) is quite powerful and complete, various compilers fail to implement some features. This is commonly found in the so called 'Small C' compilers. Typically, these compilers do not accept C language features like floating point operations, structures, or initializers. Further, even few 'full' C compilers implement bit fields, which are described in K & R, or such newer features as passing of structures as parameters, added to C since the publishing of K & R.

Point one in writing portable programs, then, is to use the minimal language syntax which can be expected to be widespread among compilers. For C, this mostly means staying away from bit fields. Unless a Small C compiler is all you have available, go ahead and use structures, initializers, and the like, since full C compilers are now quite common, and structures, in particular, are indispensible in combatting other portability problems.

The Library

Much of the power of C is derived from the routines which make up the subroutine library which is supplied with the compiler. Unfortunately, different compilers come with different libraries. There does exist a standard of sorts, the library found with the Unix version of C. This became a standard mainly through it's inclusion in K & R, and is known the 'standard I/O', or **stdio** package. Just because a compiler claims to be Unix-compatible, or include the stdio package, though, is no promise of immediate portability as far as the library goes.

Generally, the presence of the stdio package means that certain file routines, known as the buffered I/O subroutines, are available. These include such functions as **fopen, fread, getch, putch,** and **printf,** which work by buffering data into blocks, which are then read or written as a whole. The buffered I/O routines are usually externally identical, so that they can safely be used in portable programs.

There is another set of I/O routines which supply more direct calls on the operating system. These routines include **read, write, open,** and **creat.** While direct I/O routines may in fact have these names in a C package, they may not be used in the same manner as the like routines in another package. For instance, **open** takes a parameter giving the file's access mode, such as read, write, or update. The actual numeric values of the code,

though, may depend on the particular operating system. Thus, the access mode parameter used in the Microware C package is different from the same parameter in Unix C. While direct I/O may be required or preferred, for reasons of efficiency, portability may force a programmer to use the buffered routines instead. As an alternative, there are techniques using the C pre-processor which may assist in making direct I/O calls portable. These will be discussed later.

One constant source of headaches in writing portable C programs is the memory allocation routines. These routines are used to request more memory from the operating system, or to return memory which is no longer required. Generally, such routines as calloc, malloc, free, and brk are available. Depending on the c iler, there may be several variations of brk, such as Microware's sbrk, lbrk, and ebrk (in the OS-9/68000 version only). As with file I/O, these routines may be thought of as buffered and direct routines. The buffered routines, calloc, malloc, and free, request memory from the operating system in chunks, and then parcel it out in pieces as higher level requests are made. The brk routine, on the other hand, performs direct calls to the operating system. As such, it is more likely to change from compiler to compiler. Certainly check beforehand, but if it all possible, use the buffered routines for portability, as they are more likely to remain compatible among separate compilers.

Point two in writing portable programs: stick to whatever standard exists, as far as the run-time library of support routines goes. This standard, usually, will be the buffered routines found in the Unix C library. Use carefully, or preferably avoid, the direct I/O routines which exist with the same names but different forms in various compilers. Finally, avoid if at all possible those routines which are unique to a certain operating system or compiler, unless you do not plan on porting a program to another OS. For instance, OS-9 C compilers generally have an os9 subroutine, which is used to issue direct requests to the kernel. The subroutine may have a different name, though, and if you wish to port a program to CP/M, for example, where a subroutine called bios exists for the same purpose, the calls will be totally incompatible.

The Pre-processor

Sometimes, a program may be portable to another operating system with only some changes in various parameters such as buffer sizes. Here is where the pre-processor comes in handy. The C pre-processor does not actually understand the C language. Instead, its job is to read the C source text, searching for special lines hich are commands to the pre-processor, and modifying the text according to these commands before passing it on to the actual compiler. By proper use of pre-processor commands, different versions of a program can be selected by the modification of a single line in the source.

The main idea, as far as taking care of numbers and strings which may change between compilers and operating systems, is to create what are known as manifest constants. A manifest constant is a constant, or fixed value, which is given a name. In each place where the constant is required, the name is used instead. If the line equating the name with the constant is placed where it is highly visible, at the start of the source file, then modification of the program does not require digging into the text for obscure references. Instead, just the definitions are changed. As an example, suppose a program requires a buffer of a fixed size of 8K. Instead of numerous incomprehensible references to the number 8192, a single line

```
#define BUFFER_SIZE     8192
```

can be present at the start of the program, with the name BUFFER_SIZE being used in the body of the program. Changing the size of the buffer, for a new operating system, for instance, is as simple as changing the single #define.

Still more can be done. It is rather inconvenient to have to physically change many definition lines in order to use a program on a new operating system. An alternative is to supply all of the constants, for each of the various operating systems. This is done with conditional compilation, using the #if/#else/#endif pre-processor commands. As an example, consider the BUFFER_SIZE definition:

```
#ifdef OS9
#define BUFFER_SIZE     8192
#else
#ifdef UNIX
#define BUFFER_SIZE     32768
#else
#define BUFFER_SIZE     4096
#endif
#endif
```

The #ifdef pre-processor command checks if a given manifest constant has been defined before. A previous definition will usually be done using an #define statement, though some compilers allow a name to be defined from the command line. The lines above pre-suppose the definition of a manifest constant giving the name of the operating system being used. Thus, if OS-9 is used, a line such as '#define OS9 1' must exist. If running under Unix, the name UNIX is defined instead. If the constant OS9 has been defined, then the name BUFFER_SIZE will be equated with the number 8192. If not, then the name UNIX is checked. If it exists, BUFFER_SIZE will be 32768. If both OS9 and UNIX are undefined, a default definition of 4096 will be triggered.

The Microware C compilers automatically define names for the particular operating system. The 6809 C compiler predefines a name of **OS9**, while the 68000 version predefines a name of OSK. Thus, when working on a dual 6809/68000 machine, as I am, these names may be used in a program without definition, greatly enhancing the ability to compile a program under the two operating systems with no changes whatsoever to the source text.

The conditional pre-processor commands do not have to surround other pre-processor commands only. Normal C language may also be conditionally selected. For instance, in a program I have written, I need to use chain, which transfers execution to another program. There was a bug in the 68000 version of chain, though, and I was forced to drop back on the equivalent routines os9fork followed by wait. This is inefficient, though, and since the 6809 is tight on address space, I preferred to stick with the chain if possible. The resulting code went something like this:

```
#ifdef OSK
        os9fork(name,psize,...);
        wait(&status);
#else           /* OS-9 default */
        chain(name,psize,...);
#endif
```

If there are a large number of definitions that change between versions of a program running under different operating systems, it may be easier to prepare a separate text file, consisting only of the definition lines for a particular operating system, and use the #include pre-processor command to read the separate file. For instance, #include "defs.h" will cause the lines in the file defs.h to be included as part of a C program. If the source for a number of operating systems is kept as a single file on a machine, such as on a dual 6809/68000, #ifdef statements may be used as above to include different files based on the operating system. If the source is transported to a different machine, then the same definitions file name can be used, assuming the file name meets the requirements of the new operating system. If not, then the #include line will have to be changed.

Point three when writing portable C programs: use the pre-processor, especially as regards manifest constants. Don't tell yourself that of course some number will stay the same between operating systems. If there is any chance it might change, give it a name, and comment the definition of the name so you know to change it later.

Data Types

As long as programs were being ported among 8 bit computers, little attention needed to be paid to such matters as the size of ints and other data types. When moving bet een 8 and 16 bit systems, though, the matter can become quite important, causing bugs which are very difficult to find.

On the 6809, ints, short integers, and pointers are 16 bits wide, chars are 8 bits, and long integers are 32 bits. On the 68000, char, short, and long integers remain the same size, but types int and pointer are now 32 bits wide (at least under Microware C). Because of this, code which assumes 2 bytes per integer or pointer will fail. While a program will occasionally need to know the size of an int, it should never use a fixed constant. Instead, the sizeof operator should be used. This

returns the size of a data type in units of the size of chars, which is 1 byte for practically all microcomputers. Thus, to increment a pointer of type char * past an integer, the line used should be

```
p += sizeof(int);
```

not

```
p += 2;
```

There are other places to look out for the data size problem. A program I once wrote created a temporary file which included pointers to symbol table references in memory. The program assumed a 2 byte pointer, and used calls to a routine outword() to perform the output to the file and inword() to read the pointer back. When the program was moved to a 16 bit processor, I had to slowly search through the entire program, looking for all inword()/outword() references to pointers. Each of these then had to be changed to 4 byte read/writes, using new routines inptr()/outptr(). It would have been far better if I had had the foresight to use separate routines for the pointers from the start. The moral: don't ever assume anything about the size of a data type. It might change.

With ints and longs being the same size in the 68000, it is tempting to ignore longs altogether. This can cause problems if you try to port back to the 6809. If a variable will fit in an integer in both the 6809 and the 68000, use an integer. If it needs a long with the 6809, use a long for both processors. Be especially careful when using **printf**, since it requires long parameters to be explicitly declared long in the output format string (e.g. "%ld" instead of "%d"). If you are forced to convert an int to a long s a 68000 program can be moved to the 6809, look carefully for these printfs.

Another problem with differences in data types has to do with sign extension and the type char. K & R specifically state that a character value may be converted to either a signed integer or an unsigned integer, and no assumptions should be made as to which actually occurs. The Microware C compilers, for both the 6809 and 68000, perform sign extensions, for instance, while CP/M C compilers I have used perform unsigned extension. To prevent problems, programs should perform an AND operation (c & 0xff) whenever sign extension might be a proble . Having said that, though, I have to acknowledge that it can be devilishly difficult to find all such occurrences.

More importantly for 6809/68000 portability, the same problem appears when dealing with type **short**. One program of mine created a symbol table which I wanted to keep as small as possible, so short integers were used where possible. This caused no problem on the 6809, since short and int are the same thing there. n the 68000, though, shorts ere sign extended to ints. The results were quite confusing, until I printed out some values using debug printfs, only to discover that some values were being printed, in hex, as 0xffffabcd, instead of the expected 0xabcd. The answer, as before, is careful use of AND statements (val & xffff).

Sign extension can also be handled by specifically declaring affected variables as **unsigned** char or **unsigned short**. This will only work if your compiler understands such declarations, which is by no means assured, since K & R seems to specify that such declarations are illegal (I think - the book is rather hard to read, there). Despite K & R, several compilers, including the latest versions of the 68000 Microware compiler, do accept these types, probably because the Unix compiler does so.

The final point (this month) in working towards portability: watch the assumptions ab ut data types. An integer is not necessarily the same everywhere you look.

Where Did My Space Go?

I seem to have gotten too talkative again. There is still more to be covered, particularly the use of #defines to take advantage of features available only with particular microprocessors or operating systems. In addition, I am beginning to see information appear on the new 68020, and should have something to say about it next month.

\- - -

SOFTWARE TOOLS IN PASCAL

SOFTWARE TOOLS IN PASCAL

Brian W. Kernigan and P.J.Plauger have written an excellent book that teaches good programming techniques. The programs and algorithms that they present in the book are useful, and they work. Many authors in the past using other programming languages have typically presented programs that are incomplete and barely work at best. This author was very pleasantly surprised at the quality of the programs that Kernigan and Plauger have presented in their book. This book is a treasure trove of useful and valuable Pascal programs.

Chapter one, titled "Getting Started", deals with the methods and styles that Kernigan and Plauger use throughout the rest of the book. Within this chapter the various lower level "primitives" are discussed in detail. These functions and procedures are used as the basic tools or building blocks for the rest of the book. Besides basic file copying methods, various character and word counting programs are illustrated.

Chapter two continues with various groups of programs that are called FILTERS. Filters are used to make changes to data that is being passed through them. Programs that fall into this category include TAB removal and replacement within text files. ther programs are designed to replace backspaces or perform text compression or decompression on files.

Chapter three discusses in detail various methods for handling data within files. This chapter includes e file comparison program. Also since some Pascal compliers do not include a "5nclude" function, a program is presented that performs this task. Other programs include file concatenation, dynamic file creation, and archiving.

Sorting is discussed in chapter four. Several methods are explained including the bubble sort, shell sort and quick sort algorithms. All three techniques are shown along with programs that demonstrate the algorithms. Besides in-memory sorting programs the chapter also illustrates the methods by which one can develop a variable record length sorting program that can sort files larger than those that can be sorted in memory.

Chapter five discusses the methods of text pattern checking and matching. A program named FIND illustretes the methods by which one can implement this useful function. Another program is explained which also changes text besides just finding it.

A very interesting and novel text editor is presented in chapter six. This particular editor is a line editor, and it is very well documented. Thus one should not have too much difficulty implementing it on any specific computer system. The editor sports all the neccesary functions including line insertion, deletion, and search and replace procedures.

Chapter seven discusses text formatting. The text formatter that is presented contains all the needed functions that one would normally require in formatting a text file. Some of the functions include left and right margin justification, paging, page numbering, line centering, and indenting. The text formatter works very well as this article was originally formatted using it.

Chapter eight covers macro processing. Macros are used to extend a programming language such as assembly language. Macros can also be used to expand upon the text editor that is presented in the book. Also one could use macros to replace text in a file with more complex forms of text.

In the appendix, the last section of the book, various example procedures and functions are provided to help aid one in being able to utilize these programs. Such low level procedures and functions include opening and closing files, and the reading and writing of characters. Some implementations include examples for the University of California at Berkeley (UCB), Whitesmiths Limited, University of California at San Diego (UCSD) Pascal systems. These various implementations also include UNIX compatibility, so users with microcomputer systems using TSC's UNIFLEX or Microware's OS-9 should have little difficulty getting the programs up and running.

"Software Tools in Pascal" was preceded by an earlier work titled "Software Tools". The earlier book presented it's programs in RATFOR, which is a language based on FORTRAN. The newer book goes much farther in redesigning the programs and considerably improving upon the original FORTRAN implementations. "Software Tools in Pascal" is published by the Addison-Wesley Publishing Company.

In closing, the author has added the following Pascal programs named DPAGE, NDPAGE, TPAGE, and NTPAGE to those in the book. DPAGE and NDPAGE perform the function of setting up formatted text into double column pages. TPAGE and NTPAGE set up the formatted text into triple column pages. All four Pascal programs were compiled using Microware's Pascal compiler and language package. All of these programs as presented in the book and the additional ones can be compiled all the way into Native Code using Microware's Pascal compiler. NDPAGE and NTPAGE also demonstrate the use of entering information into a program via the command line with the language extension SYSPARAM.

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```
WHILE cmd[1]='f' DO
  BEGIN
    random(rnd,s,ra);
    f:=150+rnd*10;
    random(rnd,s,ra);
    v:=rnd*10-100;
    random(rnd,s,ra);
    d:=400+rnd*10;
    random(rnd,s,ra);
    g:=l+rnd;
    IF g>9 THEN g:=9;
    landed:=false;
    WHILE not landed DO
     BEGIN
       movles(d);
       status(f,v,d);
       IF f>0 THEN
         burnrate(b)
       ELSE
         b:=0;
       IF b>f THEN
         b:=f;

       f:=f-b;
       v:=b-g;
       d:=trunc(d+v+v/2);
       v:=v+v;

       IF d<=0 THEN
         landed:=true;
     END; (of inner while loop)

    writeln;
    writeln;
    writeln('LEM is on the surface of the moon');
    writeln;

    IF v<-5 then
     BEGIN
       writeln('Excessive speed on landing!');
       writeln;
       crashed(rnd,s,v,f,d,ra)
     END
    ELSE
     ADR(v,f);

    writeln;
    write(' Another game (Y/N): '); prompt;
    i:=1;
    WHILE (not eoln) and (i<6) DO
      BEGIN
        read(cmd[i]);
        i:=succ(i);
      END;
    writeln;
    IF cmd[1]='y' THEN cmd[1]:='Y';
  END; { of outer while loop }
END.

        writeln(f:6,' units of fuel remaining.');
        random(rnd,s,ra);
        d:=rnd+3;
        writeln('Produced an explosion covering ',d:0,' sq miles');
        writeln(' of lunar surface!!');
        writeln;
      END;
    writeln('L E M  D E S T R O Y E D ! ! !');
    writeln;
    writeln('***** YOU BLEW IT! *****');
    writeln;
    writeln;
  END;

  PROCEDURE ADR(VAR v,f: INTEGER);
  BEGIN
    writeln;
    writeln(' C O N G R A T U L A T I O N S ! ! !');
    writeln;
    writeln('A perfect landing!');
    writeln;
    writeln('Touchdown velocity: ',v:0);
    writeln('Fuel remaining: ',f:0);
    writeln;
  END;

  PROCEDURE MOVELER(d: INTEGER);
  { used to make the LEM appear to move down the screen }
  VAR
    s: INTEGER;
  BEGIN
    s:=trunc(12-d/40);
    WHILE s>0 DO
```

```
    BEGIN
      writeln;
      s:=pred(s);
    END;
END;

{ The main program }

BEGIN
 s:=128;

 random(rnd,s,rn);
 i:=rnd[1];
 WHILE i>0 DO
  BEGIN
    random(rnd,s,rn);
    i:=pred(i);
  END;

writeln;
writeln;
writeln('      LUNAR LANDER GAME SIMULATION');
writeln;
writeln;
writeln('     Try to land the LEM on the surface of the moon by entering');
writeln(' the fuel burn rates when requested.');
writeln;
writeln('     GOOD LUCK!');
writeln;
writeln;
cons[1]:='Y';


PROGRAM LUNARLANDER;
{ LunarLander is another implementation of the classical game }
{ in which you have to land a space vehicle on the moon.      }
{ This particular version could not have been implemented at  }
{ all if it wasn't for T.R.Elbert and his series of articles  }
{ in "68 Micro Journal" issues Nov.81, Dec.81, Jan.82, Feb.82 }
{ titled "Simulation, Games, and Random Variables.            }
{                                                             }
{ By E.N.Bollinger on May, 15 1982.                           }


VAR
  b,c,d,f,q,i,rnd,v,s: INTEGER;
  rn: REAL;
  cons: ARRAY[1..5] of CHAR;
  landed: BOOLEAN;

PROCEDURE RANDOM(VAR rnd,s: INTEGER; rn: REAL);
VAR
  j: INTEGER;
{ used to generate random integers between 0 and 9 }

BEGIN
  mathabort(false);
  s:=1014*s;
  IF s<0 THEN s:=s+32767+1;
  rn:=s/32767.0;
  mathabort(true);
  j:=mathresult; {used to clear any error codes out}

  rnd:=trunc(s/1000);
  IF rnd>9 THEN rnd:=rnd mod 10;
END;

PROCEDURE STATUS(VAR f,v,d: INTEGER);
BEGIN
  writeln(' D          FUEL: ',f:0);
  writeln('(0)         SPEED: ',v:0);
  writeln('/-\         HEIGHT: ',d:0);
  writeln;
END;

PROCEDURE BURNRATE(VAR b: INTEGER);
BEGIN
  write('BURN: '); prompt;
  readln(b);
END;

PROCEDURE CRASHED(VAR rnd,s,v,f,d: INTEGER; rn: REAL);
BEGIN
  writeln;
  writeln('CRASH     CRASH     CRASH');
  writeln('*****     *****     *****');
  writeln;
  writeln;
  writeln('Impact velocity: ',v:0);
  writeln('LEM buried: ',d:0,' feet.');
  writeln;
  IF f>0 THEN
    BEGIN


1     08  0 PROGRAM NTPAGE;
2     00  0 { NTPAGE-- outputs a three column format page of text }
3     00  0 { from the file as inputted. The file should be set   }
4     00  0 { up with columns less than 40 wide and 66 lines to a }
5     08  0 { page.                                               }
6     00  0 { This version prints page numbers, starting with the }
7     00  0 { page number as entered by the user. It also prints  }
8     00  0 { only the leftmost top of page header line, and      }
9     08  0 { strips all the rest of the header and footer lines. }
10    00  0 { NTPAGE is inspired be Kernigan and Plauger's book   }
11    00  0 { titled 'Software Tools in Pascal'.                  }
12    00  0 {                                                     }
13    08  0 { Typical command lines:                             }
14    00  0 {   OS9: Pascals <source >destination NTPAGE ;pagenum }
15    08  0 {   OS9: Pascals <source >destination NTPAGE slab     }
16    00  0 {     If compiled into object code:                   }
17    08  0 {   OS9: NTPAGE <source >destination ;page_number     }
18    00  0 {                                                     }
19    08  0 { BY E.N.BOLLINGER on October 12, 1982               }
20    00  0
21    08  0
22    00  0 CONST
23    08  0   PAGELEN = 66;
24    00  0   MAILINE = 41;
25    08  0   MAISTR  = 132;
26    00  0
27    08  0 TYPE
28    00  0   string = array[1..MAISTR] of char;
29    08  0   page = array[1..PAGELEN,1..MAILINE] of char;
30    00  0
31    08  0 VAR
32    00  0   NEWLINE,NULL : char;
33   -28  0   lpage,mpage,rpage : page;
34 -01200  0   pn : integer;
35 -01220  0   done : boolean;
36 -01230  0
37 -01230  0 FUNCTION GETC(var c: char): boolean;
38    00  1 { GETC -- gets a character from standard input }
39    00  1 Begin
40     0  2   if eof then
41     8  3     c:=NULL
42     9  3   else if eoln then
43    22  4     begin
44    22  4       readln;
45    25  4       c:=NEWLINE
46    26  4     end
47    30  4   else
48    33  4     read(c);
49    37  2   if c=NULL then
50    48  3     getc:=true
51    48  3   else
52    55  3     getc:=false;
53    5e  2 end; { of getc }
54     0  1
55     0  1 FUNCTION GETLINE(var s: string; maxsize: integer): boolean;
56     0  1 { getline -- gets a line of text from the standard input }
57     0  1 { var
58    00  1   i: integer;
59   -20  1   ch: char;
60   -38  1 Begin
61     0  2   i:=1;
62     4  2   while (not(getc(ch))) and (i<maxsize) and (ch<>NEWLINE) do
63    25  3     begin
64    25  3       s[i]:=ch;
65    37  3       i:=succ(i)
66    39  3     end;
67    43  2   if (ch=NULL) and (i>1) then  { back up one, gone too far }
```

```
 68   56  3      i:=pred(i);
 69   59  2    s[i]:=NEWLINE;
 70   72  2    getline:=(ch<>NULL);
 71   81  2  End; { of getline }
 72    0  1
 73    0  1  PROCEDURE GETPAGENUMBER(var pn: integer);
 74    0  1  { getpagenumber -- gets the starting page number from the }
 75    0  1  { parameter passed to it in the command line.             }
 76    0  1  VAR
 77    0  1    i: integer;
 78   -2B  1    RETURN: char;
 79   -3D  1  Begin
 80    0  2    RETURN:=NEWLINE;
 81    7  2    i:=0;
 82    9  2    WHILE (sysparam[i]<>' ') and (i<79) DO
 83   33  3          i:=succ(i);
 84   39  2    sysparam[i]:=RETURN;
 85   52  2    i:=1;
 86   54  2    IF sysparam[0]<>RETURN THEN
 87   68  3       i:=trunc(cnvtreal(sysparam));
 88   78  2    pn:=i;
 89   81  2  End; { of getpagenumber }
 90    0  1
 91    0  1
 92    0  1  PROCEDURE GETPAGE(var pg:page; var done: boolean);
 93    0  1  { getpage -- gets an entire page of text from standard input }
 94    0  1  var
 95    0D  1    i,n: integer;
 96   -4D  1    s: string;
 97  -136  1  Begin
 98    0  2    For i:=1 to PAGELEN Do
 99   17  3      Begin
100   17  3        IF (not(done)) and (getline(s,MAILINE)) Then
101   35  4          begin
102   35  4            n:=1;
103   37  4            IF (s[n]<>NEWLINE) and (s[n]<>NULL) Then
104   77  5              begin
105   77  5                REPEAT
106   77  5                  pg[i,n]:=s[n];
107  111  6                  n:=succ(n)
108  113  6                UNTIL (s[n]=NEWLINE) or (s[n]=NULL) or (n=MAILINE);
109  159  5              end;
110  159  4            IF n<MAILINE Then
111  166  5               pg[i,n]:=NEWLINE;
112  189  4          end
113  189  4        ELSE
114  192  4          Begin

115  192  4            pg[i,1]:=NEWLINE;
116  210  4            pg[i,2]:=NULL;
117  228  4            done:=true
118  229  4          End;
119  232  3      End; { of for next loop }
120  246  2  End; { of getpage }
121    0  1
122    0  1  PROCEDURE OUTPUTTRIPLEPAGE;
123    0  1  { It simply takes three pages of previously formatted text }
124    0  1  { and outputs them all onto one page.                      }
125    0  1  var
126   00  1    i,n,s,mid: integer;
127   -8  1  Begin
128    0  2    mid:=trunc(MAXSTR/2-4);
129   14  2    i:=1;
130   16  2    WHILE i<=PAGELEN DO
131   23  3      Begin
132   23  3        IF i=64 THEN
133   30  4          Begin
134   30  4            write(' ');
135   38  4            FOR s:=1 to mid DO
136   48  5                write(' ');
137   66  4            write('PAGE ',pn:4);
138   81  4            pn:=succ(pn)
139   85  4          End
140   88  4        ELSE
141   91  4          Begin
142   91  4            IF (lpage[i,1]=NEWLINE) and
143  114  4               (mpage[i,1]<>NEWLINE) and
144  138  4               (rpage[i,1]=NEWLINE) THEN
145  165  5              begin
146  165  5                 (do nothing for this part)
147  165  5              end
148  165  5            ELSE
149  168  5             Begin
150  168  5               write(' ');
151  176  5               n:=1;
152  178  5               WHILE (lpage[i,n]<>NEWLINE) and (n<MAILINE) DO
153  214  6                 Begin
154  214  6                   write(lpage[i,n]);
155  242  6                   n:=succ(n)
156  244  6                 end;
157  248  5               IF n<MAILINE Then
158  255  6                 begin
159  255  6                   FOR s:=n to MAILINE DO
160  267  7                     write(' ');
161  285  6                 end;
162  285  5
163  285  5               IF i<>3 THEN   (strip extra two headers)
164  291  6                Begin
165  293  6                  write('   ');
166  299  6
167  299  6                  n:=1;
168  301  6                  WHILE (mpage[i,n]<>NEWLINE) and (n<MAILINE) DO
169  337  7                    begin
170  337  7                      write(mpage[i,n]);
171  365  7                      n:=succ(n)

172  367  7                    end;
173  371  6                  IF n<MAILINE then
174  378  7                    begin
175  378  7                      FOR s:=n to MAILINE DO
176  389  8                          write(' ');
177  407  7                    end;
178  407  6
179  407  6                  write('   ');
180  415  6
181  415  6                  n:=1;
182  417  6                  WHILE (rpage[i,n]<>NEWLINE) and (n<MAILINE) DO
183  453  7                    Begin
184  453  7                      write(rpage[i,n]);
185  481  7                      n:=succ(n)
186  483  7                    end;
187  487  6                End;
188  487  5             End;
189  487  4          End;
190  487  3        writeln;
191  490  3        i:=succ(i);
192  493  3      End;
193  496  2  End; { of outputtriplepage }
194    0  1
195    0  1  { MAIN PROGRAM }
196    0  1  Begin
197    0  1    NEWLINE:=chr(13);
198    7  1    NULL:=chr(0);
199   12  1    done:=false;
200   17  1    pn:=1;
201   21  1
202   21  1    getpagenumber(pn);
203   27  1
204   27  1    WHILE not(done) DO
205   34  2     begin
206   34  2       getpage(lpage,done);
207   43  2       getpage(mpage,done);
208   52  2       getpage(rpage,done);
209   61  2       outputtriplepage;
210   64  2     end;
211   67  1  End. { of tpage }
```

PROC	NAME	PSEC	PSIZE	LOCAL	STACK	CSEC	CSIZE	DEBUG
0	MTPAGE	0	69	8123	9	9	0	0
1	GETC	1	60	0	15	2	0	0
2	GETLINE	2	83	3	10	3	0	0
3	GETPAGEN	3	82	3	16	4	0	0
4	GETPAGE	4	248	138	13	5	0	0
5	OUTPUTTR	5	497	10	17	7	20	0
			1039	8277	80		20	

211 Lines of source code compiled with no errors found

```
1    00  0 PROGRAM TPAGE;
2    00  0 { TPAGE -- outputs a three column format page of text }
3    08  0 { from the file as inputted. The file should be set   }
4    00  0 { up with columns less than 80 wide and 66 lines to a }
```

```
 5    08  0 { page.                                                    }
 6    00  0 { TPAGE was inspired by Kernigan and Plauger's book       }
 7    0D  0 { titled 'Software Tools in Pascal'.                      }
 8    00  0 {                                                         }
 9    0D  0 { Typical command input line:                             }
10    00  0 {  Pascal& <source >destination tpage                     }
11    0E  0 { or if compiled into object code:                        }
12    0B  0 {  tpage <source >destination                             }
13    0D  0 {                                                         }
14    00  0 { By E.W.BOLLINGER on October 1, 1982                     }
15    0D  0
16    00  0
17    0D  0 CONST
18    00  0   PAGELEN = 66;
19    0D  0   MAILINE = 61;
20    0D  0   MAXSTR  = 132;
21    0D  0
22    0D  0 TYPE
23    0B  0   string = array[1..MAXSTR] of char;
24    60  0   page = array[1..PAGELEN,1..MAILINE] of char;
25    0D  0
26    0D  0 VAR
27    0D  0   NEWLINE,NULL : char;
28   -2D  0   lpage,epage,rpage : page;
29 -B120D  0   done : boolean;
30 -B121D  0
31 -B128D  0 FUNCTION GETC(var c: char): boolean;
32    0D  1 { GETC -- gets a character from standard input }
33    0D  1 Begin
34     0  2   if eof then
35     8  3     c:=NULL
36     9  3   else if eoln then
37    22  4     begin
38    22  4       readln;
39    25  4       c:=NEWLINE
40    26  4     end
41    30  4   else
42    33  4     read(c);
43    37  2   if c=NULL then
44    48  3     getc:=true
45    48  3   else
46    55  3     getc:=false;
47    59  2 end; { of getc }
48     0  1
49     0  1 FUNCTION GETLINE(var s: string; maxsize: integer): boolean;
50     0  1 { getline -- gets a line of text from the standard input }
51     0  1 var
52    0D  1   i: integer;
53   -2D  1   ch: char;
54   -3D  1 Begin
55     0  2   i:=1;
56     4  2   while (not(getc(ch))) and (i<maxsize) and (ch<>NEWLINE) do
57    25  3     begin

58    25  3       s[i]:=ch;
59    37  3       i:=succ(i)
60    39  3     end;
61    43  2   if (ch=NULL) and (i>1) then  { back up one, gone too far }
62    56  3     i:=pred(i);
63    59  2   s[i]:=NEWLINE;
64    72  2   getline:=(ch<>NULL);
65    81  2 End; { of getline }
66     0  1
67     0  1 PROCEDURE GETPAGE(var pg:page; var done: boolean);
68     0  1 { getpage -- gets an entire page of text from standard input }
69     0  1 var
70    0D  1   i,n: integer;
71   -48  1   s: string;
72 -13AD  1 Begin
73     8  2   For i:=1 to PAGELEN Do
74    17  3     Begin
75    17  3       IF (not(done)) and (getline(s,MAILINE)) Then
76    35  4         begin
77    35  4           n:=1;
78    37  4           IF (s[n]<>NEWLINE) and (s[n]<>NULL) Then
79    77  5             begin
80    77  5               REPEAT
81    77  5                 pg[i,n]:=s[n];
82   111  6                 n:=succ(n)
83   113  6               UNTIL (s[n]=NEWLINE) or (s[n]=NULL) or (n=MAILINE);
84   159  5             end;
85   159  4           IF n<MAILINE Then
86   166  5             pg[i,n]:=NEWLINE;
87   189  4         end
88   189  4       ELSE
89   192  4         Begin
90   192  4           pg[i,1]:=NEWLINE;
91   210  4           pg[i,2]:=NULL;
92   228  4           done:=true
93   229  4         End;
94   232  3     End; { of for next loop }
95   246  2 End; { of getpage }
96     0  1
97     0  1 PROCEDURE OUTPUTTRIPLEPAGE;
98     0  1 { It simply takes three pages of previously formatted text }
99     0  1 { and outputs them all onto one page.                      }
100    0  1 var
101   0D  1   i,n,x: integer;
102  -6D  1 Begin
103    0  2   i:=1;
104    4  2   WHILE i<=PAGELEN DO
105   11  3     begin
106   11  3       IF (lpage[i,1]=NEWLINE) and (epage[i,1]=NEWLINE) and (rpage[i,1]
 =NEWLINE) THEN

107   85  4         {do nothing for this part}
108   85  4       ELSE
109   89  4         Begin
110   88  4           write(' ');
111   96  4           n:=1;
112   98  4           WHILE (lpage[i,n]<>NEWLINE) and (n<MAILINE) DO
113  134  5             begin
114  134  5               write(lpage[i,n]);

115  162  5               n:=succ(n)
116  164  5             end;
117  168  4           IF n<MAILINE Then
118  175  5             begin
119  175  5               FOR x:=n to MAILINE DO
120  186  6                 write(' ');
121  204  5             end;
122  204  4
123  204  4           write('   ');
124  212  4
125  212  4           n:=1;
126  214  4           WHILE (epage[i,n]<>NEWLINE) and (n<MAILINE) DO
127  250  5             begin
128  250  5               write(epage[i,n]);
129  280  5               n:=succ(n)
130  282  5             end;
131  286  4           IF n<MAILINE then
132  293  5             begin
133  293  5               FOR x:=n to MAILINE DO
134  304  6                   write(' ');
135  322  5             end;
136  322  4
137  322  4           write('   ');
138  330  4
139  330  4           n:=1;
140  332  4           WHILE (rpage[i,n]<>NEWLINE) and (n<MAILINE) DO
141  368  5             begin
142  368  5               write(rpage[i,n]);
143  396  5               n:=succ(n)
144  398  5             end;
145  402  4         End;
146  402  3
147  402  3       writeln;
148  405  3       i:=succ(i);
149  408  3     End;
150  411  2 End; { of outputtriplepage }
151    0  1
152    0  1 { MAIN PROGRAM }
153    0  1 Begin
154    0  1   NEWLINE:=chr(13);
155    7  1   NULL:=chr(0);
156   12  1   done:=false;
157   17  1
158   17  1   WHILE not(done) DO
159   24  2     Begin
160   24  2       getpage(lpage,done);
```

```
161   33  2      getpage(mpage,done);
162   42  2      getpage(rpage,done);
163   51  2      outputtriplepage;
164   54  2    end;
165   57  1  End. { of tpage }
```

PROC	NAME	PSEC	PSIZE	LOCAL	STACK	CSEC	CSIZE	DEBUG
0	TPAGE	7	59	8121	11	8	0	0
1	GETC	1	60	0	15	2	0	0
2	GETLINE	2	83	3	10	3	0	0
3	GETPAGE	3	248	138	13	4	0	0
4	OUTPUTTR	4	412	8	15	6	11	0
			862	8270	64		11	

165 Lines of source code compiled with no errors found

```
1     08  0 Program NDPAGE;
2     0D  0 {NDPAGE is inspired by Kernigan and Plauger's book titled}
3     0D  0 {  'Software Tools in Pascal'.                           }
4     0D  0 { It simply takes a previously formatted file of text    }
5     0D  0 { and builds a new file of dual column text pages.       }
6     0D  0 { This particular program expects to read a file of text }
7     0D  0 { formatted with 54 columns per line at up to 66 lines   }
8     0D  0 { per page. This version outputs page numbers, starting  }
9     0D  0 { with the number as entered. It also strips the footer  }
10    0D  0 { lines from the text, if there are any.                 }
11    0D  0 { Page numbers are inserted on the 63rd line of each page}
12    0D  0 {                                                        }
13    0D  0 { Typical command line:                                  }
14    0D  0 { DS9:Pascal5 (source )destination NDPAGE :page_number   }
15    0D  0 {     If compiled into object code:                      }
16    0D  0 { DS9:NDPAGE (source )destination :page_number           }
17    0D  0 {                                                        }
18    0D  0 { By E.W.Bollinger on September 15, 1982.                }
19    0D  0
20    0D  0
21    0D  0 CONST
22    0D  0  ENDFILE = -1; { end of file marker }
23    0D  0  NEWLINE = 13; { carraige return }
24    0D  0  ENDSTR  =  0; { null }
25    0D  0
26    0D  0  MAXSTR = 132; { maximum string length }
27    0D  0  MAXLINE = 56; { maximum text line length }
28    0D  0  PAGELEN = 66; { maximum text page length in lines }
29    0D  0
30    0D  0 TYPE
31    0D  0  character = -1..127; { ASCII plus ENDFILE }
32    0D  0  string = array[1..MAXSTR] of character;
33    0D  0  page = array[1..PAGELEN,1..MAXLINE] of character;
34    0D  0
35    0D  0 VAR
36    0D  0  lpage,rpage: page; { left and right text page arrays }
37-14784D 0  done: boolean;
38-14785D 0  pn: integer; { number of pages counter }
39-14787D 0
40-14787D 0 FUNCTION GETC(var c: character): character;
41    0D  1 { getc -- get one character from standard input }
42    0D  1 VAR
43    0D  1  ch: char;
44    -1D 1 BEGIN
45    0   2  IF (eof) then
46    8   3    c:=ENDFILE
47    9   3  ELSE IF (eoln) then
48    21  4    Begin
49    21  4      Readln;
50    24  4      c:=NEWLINE
51    25  4    End
52    27  4  ELSE
53    30  4    Begin
54    30  4     Read(ch);
55    35  4     c:=ord(ch);
56    45  4    End;
57    45  2  getc:=c;
58    25  2 END; { of getc }
59    0   1
60    0   1 PROCEDURE GETPAGENUMBER(var pn: integer);
61    0   1 { getpagenumber -- gets the page number from the parameter }
62    0   1 { passed to it in SYSPARAM from the command line.         }
63    0   1 var
64    0D  1  i: integer;
65    -2D 1  RETURN: char;
66    -3D 1 Begin
67    0   2  RETURN:=chr(NEWLINE);
68    6   2  i:=0;
69    8   2  While (sysparam[i]<>' ') and (i<79) DO
70    32  3       i:=succ(i);
71    38  2  sysparam[i]:=RETURN;
72    51  2  i:=1;
73    53  2  IF sysparam[0]<>RETURN Then
74    67  3     i:=trunc(cnvtreal(sysparam));
75    77  2  pn:=i;
76    80  2 End; { of getpagenumber }
77    0   1
78    0   1 FUNCTION GETLINE(var s: string; maxsize: integer): boolean;
79    0   1 { getline - get a line of text from standard input }
80    0   1 Var
81    0D  1  i: integer;
82    -2D 1  ch: character;
83    -4D 1 Begin
84    0   2  i:=1;
85    4   2  Repeat
86    4   2    s[i]:=getc(ch);
87    27  3    i:=succ(i);
88    30  3  Until (ch=ENDFILE) or (ch=NEWLINE) or (i=maxsize);
89    45  2  IF ch=ENDFILE then { gone one too far }
90    52  3     i:=pred(i);
91    55  2  s[i]:=ENDSTR; {mark end of string}
92    68  2  getline:=(ch<>ENDFILE);
93    75  2 End; { of getline}
94    0   1
95    0   1 PROCEDURE OUTPUTDOUBLEPAGE;
96    0   1 { Takes two inputted text pages and outputs both onto }
97    0   1 { one page                                            }
98    0   1 Var
99    0D  1  i,n,x: integer;
100   -6D 1 Begin
101   0   2  i:=1;
102   4   2  While i<=PAGELEN Do
103   11  3   Begin
104   11  3    IF i>64 THEN
105   18  4      Begin
106   18  4        write('        ');
107   26  4        FOR x:=1 to MAXLINE-4 DO
108   39  5          write(' ');
109   57  4        write('PAGE ',pn:4);
110   72  4        pn:=succ(pn)
111   76  4      End
112   79  4    ELSE
113   82  4      Begin
114   82  4        IF ((lpage[i,1]<>ENDSTR) and (rpage[i,1]<>ENDSTR)) or

115   129 4           ((lpage[i,1]=ENDSTR) and (rpage[i,1]<>ENDSTR)) or
116   177 4           ((lpage[i,1]<>ENDSTR) and (rpage[i,1]=ENDSTR)) THEN
117   226 5         Begin
118   228 5           write('          ');
119   236 5           n:=1;
120   238 5           WHILE ((lpage[i,n]<>ENDSTR) and (n<MAXLINE) Do
121   278 6            Begin
122   278 6             write(chr(lpage[i,n]));
123   309 6             n:=succ(n)
124   311 6            End;
125   315 5           IF n<MAXLINE Then
126   322 6            Begin
127   322 6             FOR x:=n TO MAXLINE Do
128   333 7               write(' ');
129   351 6            End;
130   351 5           write('    ');
131   359 5
132   359 5           IF i<>3 THEN
133   365 6            Begin
134   365 6              n:=1;
135   367 6              While (rpage[i,n]<>ENDSTR) and (n<MAXLINE) Do
136   403 7               Begin
137   403 7                write(chr(rpage[i,n]));
138   434 7                n:=succ(n)
139   436 7               End;
140   440 6            end;
141   440 5       End;
142   440 4    End;
```

```
143   440  3    writeln;
144   443  3    i:=succ(i);
145   446  3   End;
146   449  2  End: { of outputdoublepage }
147     0  1
148     0  1 Procedure GETPAGE(var pg: page; var done: boolean);
149     0  1 { getpage - gets one page of text from standard input }
150     0  1 Var
151    08  1  i,n: integer;
152   -40  1  s: string;
153  -268D 1 Begin
154     0  2  FOR i:=1 TO PAGELEN DO
155    17  3   begin
156    17  3     IF (not(done)) and (getline(s,MAILINE)) then
157    35  4      begin
158    35  4       n:=1;
159    37  4       IF (s[n]<>NEWLINE) and (s[n]<>ENDSTR) then
160    77  5        begin
161    77  5         REPEAT
162    77  5           pg[i,n]:=s[n];
163   120  6           n:=succ(n)
164   122  6         UNTIL (s[n]=NEWLINE) or (s[n]=ENDSTR) or (n=MAILINE);
165   168  5        end;
166   168  4       IF n<MAILINE then
167   175  5          pg[i,n]:=ENDSTR
168   196  5       ELSE
169   201  5          pg[i,n-1]:=ENDSTR;
170   226  4       end
171   226  4     ELSE

172   229  4       Begin
173   229  4         pg[i,1]:=ENDSTR;
174   247  4         pg[i,2]:=ENDSTR;
175   266  4         done:=true
176   267  4       end;
177   270  3   End;  { of for next loop }
178   284  2  End; { of getpage }
179     0  1
180     0  1 { Main program }
181     0  1  Begin
182     0  1    pn:=1;
183     6  1    getpagenumber(pn);
184    12  1    done:=false;
185    17  1    WHILE not(done) DO
186    24  2     Begin
187    24  2       getpage(lpage,done);
188    33  2       getpage(rpage,done);
189    42  2       outputdoublepage;
190    45  2     End;
191    48  1  End. { of MDPAGE program }
```

PROC	NAME	PSEC	PSIZE	LOCAL	STACK	CSEC	CSIZE	DEBUG
0	MDPAGE	9	50	14787	9	10	0	0
1	GETC	1	56	1	15	2	0	0
2	GETPAGEN	2	81	3	16	3	0	0
3	GETLINE	3	77	4	13	4	0	0
4	OUTPUTDO	4	450	8	15	6	32	0
5	GETPAGE	7	286	270	13	9	0	0
			1000	15073	81		32	

191 Lines of source code compiled with no errors found

```
1     08  0 Program BPAGE;
2     00  0 { BPAGE is inspired by Kernigan and Plauger's book titled}
3     08  0 {  'Software Tools in Pascal'.                          }
4     00  0 { It simply takes a previously formatted file of text    }
5     08  0 { and builds a new file of dual column text pages.       }
6     00  0 { This particular program expects to read a file of text }
7     08  0 { formatted with 54 columns per line at up to 66 lines   }
8     00  0 { per page. This version does not strip header or footer }
9     08  0 { lines nor does it print page numbers.                  }
10    00  0 {                                                       }
11    08  0 { Typical command line:                                 }
12    00  0 {     Pascals <source >destination Bpage                }
13    00  0 {  or if compiled into native code:                     }
14    00  0 {     Bpage <source >destination                        }
15    00  0 {                                                       }
16    00  0 { By E.M.Bollinger on September 6, 1982.               }
17    00  0
18    00  0
19    00  0 CONST

20    00  0  ENDFILE = -1; { end of file marker }
21    00  0  NEWLINE = 13; { carraige return }
22    00  0  ENDSTR  =  0; { null }
23    00  0  SPACE = 32; { space character }
24    00  0
25    00  0  MAXSTR = 132; { maximum string length }
26    00  0  MAILINE = 56; { maximum text line length }
27    00  0  PAGELEN = 66; { maximum text page length in lines }
28    00  0
29    00  0 TYPE
30    00  0  character = -1..127; { ASCII plus ENDFILE }
31    00  0  string = array[1..MAXSTR] of character;
32    00  0  page = array[1..PAGELEN,1..MAILINE] of character;
33    00  0
34    00  0 VAR
35    00  0  lpage,rpage: page; { left and right text page arrays }
36-14704D 0  done: boolean;
37-14785D 0
38-14785D 0 FUNCTION GETC(var c: character): character;
39    00  1 { getc -- get one character from standard input }
40    00  1 VAR
41    08  1  ch: char;
42   -10  1 BEGIN
43     0  2  IF (eof) then
44     8  3    c:=ENDFILE
45     9  3  ELSE IF (eoln) then
46    21  4    Begin
47    21  4      Readln;
48    24  4      c:=NEWLINE
49    25  4    End
50    27  4  ELSE
51    30  4    Begin
52    30  4     Read(ch);
53    35  4     c:=ord(ch);
54    45  4    End;
55    45  2  getc:=c;
56    55  2 END; { of getc }
57     0  1

58     0  1 FUNCTION GETLINE(var s: string; maxsize: integer): boolean;
59     0  1 { getline - get a line of text from standard input }
60     0  1 Var
61    00  1   i: integer;
62   -2D  1  ch: character;
63   -40  1 Begin
64     0  2   i:=1;
65     4  2   Repeat
66     4  2     s[i]:=getc(ch);
67    27  3     i:=succ(i);
68    30  3   Until (ch=ENDFILE) or (ch=NEWLINE) or (i=maxsize);
69    45  2   IF ch=ENDFILE then { gone one too far }
70    52  3      i:=pred(i);
71    55  2   s[i]:=ENDSTR; {mark end of string}
72    68  2   getline:=(ch<>ENDFILE);
73    75  2 End; { of getline}
74     0  1
75     0  1 PROCEDURE OUTPUTDOUBLEPAGE;
76     0  1 { Takes two inputted text pages and outputs both onto }
77     0  1 { one page                                            }
78     0  1 Var
79    08  1  i,n,x: integer;
80   -68  1 Begin
81     0  2  i:=1;
82     4  2  While i<=PAGELEN Do
83    11  3   Begin
84    11  3    IF ((lpage[i,1]<>ENDSTR) and (rpage[i,1]<>ENDSTR)) or
85    58  3       ((lpage[i,1]=ENDSTR) and (rpage[i,1]<>ENDSTR)) or
86   106  3       ((lpage[i,1]<>ENDSTR) and (rpage[i,1]=ENDSTR)) THEN
87   157  4     Begin
88   157  4       write('          ');
89   165  4       n:=1;
90   167  4       WHILE ((lpage[i,n]<>ENDSTR) and (N<MAILINE)) Do
91   203  5        Begin
92   203  5         write(chr(lpage[i,n]));
93   234  5         n:=succ(n)
94   236  5        End;
95   240  4       IF n<MAILINE Then
96   247  5        Begin
97   247  5         FOR x:=n TO MAILINE Do
98   259  6           write(' ');
99   277  5        End;
```

```
100  277  4      write('    ');
101  285  4
102  285  4      n:=1;
103  287  4      while (rpage[i,n]<>ENDSTR) and (n<MAILINE) do
104  323  5       Begin
105  323  5        write(chr(rpage[i,n]));
106  354  5        n:=succ(n)
107  356  5       End;
108  360  4     End;
109  360  3    writeln;
110  363  3    i:=succ(i);
111  366  3   End;
112  369  2 End; ( of outputdoublepage )
113    0  2
114    0  1 Procedure GETPAGE(var pg: page; var done: boolean);
115    0  1 ( getpage - gets one page of text from standard input )
116    0  1 Var
117   0D  1  i,n: integer;
118  -4D  1  s: string;
119 -268D 1 Begin
120    0  2 FOR i:=1 TO PAGELEN DO
121   17  3  begin
122   17  3    IF (not(done)) and (getline(s,MAILINE)) then
123   35  4     begin
124   35  4      n:=1;
125   37  4      IF (s[n]<>NEWLINE) and (s[n]<>ENDSTR) then
126   77  5       begin
127   77  5        REPEAT
128   77  5          pg[i,n]:=s[n];
129  120  6          n:=succ(n)
130  122  6        UNTIL (s[n]=NEWLINE) or (s[n]=ENDSTR) or (n=MAILINE);
131  168  5       end;
132  168  4      IF n<MAILINE then
133  175  5        pg[i,n]:=ENDSTR
134  196  5      ELSE
135  201  5        pg[i,n-1]:=ENDSTR;
136  226  4      end
137  226  4    ELSE
138  229  4      Begin
139  229  4        pg[i,1]:=ENDSTR;
140  247  4        pg[i,2]:=ENDSTR;
141  266  4        done:=true
142  267  4      end;
143  270  3  End;  ( of for next loop )
144  284  2 End; ( of getpage )
145    0  1
146    0  1 ( Main program )
147    0  1 Begin
148    0  1   done:=false;
149    7  1   WHILE not(done) DO
150   14  2    Begin
151   14  2      getpage(lpage,done);
152   23  2      getpage(rpage,done);
153   32  2      outputdoublepage;
154   35  2    End;
155   38  1 End. ( of DPAGE program )

PROC NAME       PSEC  PSIZE  LOCAL  STACK   CSEC  CSIZE  DEBUG
  0 DPAGE          8     40  14785     11      9      0      0
  1 GETC           1     56      1     15      2      0      0
  2 GETLINE        2     77      4     13      3      0      0
  3 OUTPUTDO       3    370      8     15      5     17      0
  4 GETPAGE        6    286    270     13      8      0      0
                          829  15068     67             17

155 Lines of source code compiled with no errors found
```

TURBO

I needed more memory. I have an application which requires fast access to a data array. 64k just isn't enough memory on my OS-9™ level one system to keep everything going. Level one can't handle more than 64k. I had to have instant access to the data which was now nearly 16k all by itself, but I also wanted to use the system for other things while the application was running. Level two OS-9 seemed to be the only answer.

I found an alternative. A conversation with Jerry Kopple at AAA Chicago Computer Center lead me to consider the Computer Excellence 256k DRAM board. My Elektra™ CPU-8/9™ board doesn't have a dynamic address translator. I can't directly address 256k even if I had level two. I didn't really need level two any way I just needed to get to my data quickly. If I didn't need such quick access I could use a disk file. So what I really needed was not more memory but a very fast disk. The answer is a program which "looks" like a disk drive to OS-9 but with access that is just as fast as memory. There are some virtual disk programs around, but they also require a CPU board with resident DATs.

The board from Computer Excellence solves the problem. As the very complete documentation states, the Computer Excellence 256k DRAM board is built up on a double sided glass epoxy PC board with access to between one and four banks of dynamic address translators (DATs). It can accommodate several combinations of the currently available 41xx type dynamic RAMs including the new 256k chips. With 32 4164s the DATs control the placement of 64 4k pages. Any 16 of these blocks can be accessed at a particular time as part of the processor's 64k memory. Unfortunately a program which makes the memory board look like a disk drive did not exist. I liked the board itself though and took a chance that I would be able to write the virtual disk program. Before I went to OS-9 I had a SWTPc 6800™ system. I have written 68xx assembler for five or six years now and expected the virtual disk program to be a good way to learn OS-9 calling conventions.

The result is the accompanying program. VDSK took some time to write but was not difficult. I had a disk driver program as an example and decided to make the program resemble a floppy. The OS-9 RBFman interface makes it possible to use not only all disk access system calls but I could even use the FORMAT program supplied with my floppy drivers for initializing the virtual disk in memory. With 800 extra disk sectors at my disposal I even have room for all of the system CMDS directory which normally resides on drive zero. The data file can be read about 100 times faster with the virtual disk than from a floppy. The system commands are not accelerated to the same extent because the loader computes a check sum for a load module which takes time. In general, data file access is instant and a print file can be read from the virtual disk to the printer without the slightest pause from a terminal running at 9600 baud at the same time.

I think the program explains itself. I would welcome comments and questions. These should be sent to me at the following address:

O E Groves 10207 Gillette Lenexa Kan. 66215

* OS-9 is a trademark of Microware systems Corp; Elektra and CPU-8/9 are trademarks of AAA Chicago Computer Center; SWTPC 6800 is a trademark of South West Technical Products Corp.

```
*                    *** TURBO ***
*
* ********************************
* VIRTUAL DISK SIMULATOR FOR THE COMPUTER EXCELLENCE MEMORY BOARD
* ********************************
*
*     This program simulates a disk drive in memory. Using the
* onboard DAT of the Computer Excellence 256k board, this virtual
* disk simulator provides 800  256 byte sectors (less sector bit
* map) to use as a super fast disk drive.
```

```
*      This driver program provides an OS9 level one interface to
* the Random Block File Manager (RBFMan) which looks exactly like
* a single sided drive with 800 sectors on it.  Logical sector
* numbers are translated directly to physical 256 byte "sectors" in
* 4k physical page in the extended address space.
*
* Author:  DE Groves of KITTENWARE - a member company of E-LABS
*          Enterprizes, 10207 Gillette, Lenexa, Ks.  66215
*
*      To install the VDSK driver in an OS-9 Level one system
* the following command sequence may be used:
*
*       LOAD /DI/VDSK.OBJ   (DI= drive containing the VDSK
*                            program)
*       LINK VDSK           (So the system can find it)
*
*       FORMAT /V0          (FORMAT will default to a 50 track
*                           16 sector/track SS floppy drive)
*
*    If you decide to make VDSK a permanent part of your system
* do this:
*
*       COPY /DI/VDSK.OBJ /D0/VDSK    ie. put a copy of VDSK
*                                     on your system disk.
*
*           - put a formatted disk in drive 01 -
*
*       OS9GEN /D1
*       /D0/OS9BOOT                   use regular boot file
*       /D0/VDSK                      add VDSK
*       (esc)                         end of file
*
*  The disk in drive #1 will now have a boot file which
*   automatically loads VDSK
*
*
*          * * * * *  W A R N I N G  * * * *
*
*      Execution of RMB while accessing the virtual disk will
* leave the DAT in an INDETERMINATE state. The initialization
* routine for the DAT must be executed BEFORE going on.
*
*          DEVICE DESCRIPTOR FOR "V0"
*
*      This is the information IOMan needs to get to the Virtual
* disk number 0
*
* VIRTUAL DISK device descriptor
*
 NAM V0
 TTL Device Descriptor for "V0"
 IFP1
 EXDC
*
*      *******
*
*   Virtual DiSK device module
*
TYPE SET DEVIC+OBJCT
REV SET REENT+1
 MOD VDEND,VDNAM,TYPE,REV,VDMGR,VDDVR
 FCB $FF mode
 FCB $0F
 FDB $FFF0 device controller address
 FCB VDNAM-*-1
 FCB DT.RBF device type= RBF
*
* default path options
*
 FCB 0 drive number
 FCB 0 step rate na
 FCB 0 device type ="5","std","floppy"
 FCB 0 density    ="single","single"
 FDB 50 0 tracks
 FCB 1 num sides
 FCB 1 no verify
 FDB 16 sectors/track
 FDB 16 sectors on track 0
 FCB 1 no interleave
 FCB 1 sector/block
VDNAM FCS "V0" Device name
VDMGR FCS "RBF" File manager name
VDDVR FCS "VDSK" Device driver name
 EXOD
VDEND EQU *
*
*   THIS IS THE END OF THE VIRTUAL DISK DEVICE DESCRIPTOR
*   * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*
*  THIS IS THE BEGINING OF THE DEVICE DRIVER
*
 NAM VDSK
 TTL Device driver for Virt. DiSK
 IFP1
 USE /DI/ELEKTRA_DEFS/OS9DEFS get system definitions
 USE /DI/ELEATRA_DEFS/OS9RBFDEFS.2 random block defs
 EXDC
DRVCNT SET 1 only one virtual drive defined
*
*       * * * * * * *    ram space definition   * * * * * * *
*
 ORG DRVBEG put in place in static storage
 RMB DRVMEM*DRVCNT a table for each drive
CURTBL RMB 2 table number for this access
CURDRV RMB 1 drive number for this access
V.FREZ RMB 1 freeze DD.INFO
VDSKST EQU . total ram reserved
*
*       * * * * * * *   MODULE HEADER   * * * * * * *
*
TYPE SET DRIVR+OBJCT
REV SET REENT+1
 MOD DSKEND,DSKNAM,TYPE,REV,DSKENT,VDSKST
 FCB $FF access to public
DSKNAM FCS "VDSK"
 FCB 1 rev number
*
*        branch table
*
*  * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*  ENTRY POINT
*
DSKENT LBRA INVDSK
 LBRA VDSKRD
 LBRA VDSKWT
 LBRA VDSKGS
 LBRA VDSKPS
 LBRA VDSKTR
*
*  INITIALIZATION
*
INVDSK PSHS X
 LEAX DRVBEG,U point to drive table
 LDB #DRVCNT
 STB V.NDRV,U set max drives
 LDD #800
 STD DD.TOT+1,X
 STB V.TRAK,X set to high count
 CLR V.FREZ,X
 PULS X,PC go home
*
*
*  READ SECTOR
*
*       input -  B=MSB of logical sector number
*                X=rest of sector number
*                Y=path descriptor
*                U=global storage
*
*    The virtual disk is read by computing a 4k page/track number
*  in extended memory and a 12 bit offset into the page for a
*  256 byte "sector."  The computed page is swapped into the
*  program's address space at page zero.  In the case (very
*  rare) that the program's buffer lies on page zero, page
*  one (1000-1fff) will be used.
*
VDSKRD LEAX ,X read sector zero?
 BEQ RDZERO special processing
DOREAD  BSR RDSEC
 BCS RDRE
```

```
 CLRB
 RDWG RTS go home
 **

 RDSEC BSR GTADDR get page(trk) & offset(sectr)
  BCS RDWG
  PSHS CC,D,DP,I,Y,U save working regs
  LDI PD.BUF,Y pick up buffer address
  EIG I,D .  D= buffadr: I= sector #
  ANDA #$F0 where is the buffer?
  BNE RDR.0 buffer not in page 0
  INC 4,S put vdisk on page 1
 RDR.0 LDD 4,S recover track number
  LDY PD.BUF,Y get buffer addr
  LDU V.PORT,U get controller address
  TFR A,DP I needed a reg.: save mempage
  ORCC #$50 no interrupts while page 0 gone
  STB A,U swap in page (track)
  CLRB multiply A x $1000
  LSLA . to get logical addr
  LSLA
  LSLA
  LEAI D,I add addr to offset
 RDLP LDA ,I+ fm sec 0000-0F00 or 1000-1F00
  STA ,Y+ to buffer
  DECB transfer 256 bytes
  BNE RDLP
  TFR DP,A
  STA A,U swap page back
  CLR 2,S
  PULS CC,D,DP,I,Y,U,PC go home
* * * * * * * * * * * * * * * * *
 RDZERO BSR RDSEC
  BCS RDWG
  PSHS I,Y
  LDI PD.BUF,Y transfer volume info
  LEAY DRVBBG,U to drive table
  LDB #DD.SIZ-1
 RDZERI LDA B,I
  STA B,Y
  DECB
  BPL RDZERI
  CLRB
  PULS I,Y,PC go home
*          * * * * * * * *
 GTADDR TSTB 2 byte sector numbers only
  BNE ADERR
  PSHS B
  ANDCC #$FE clr carry bit
  TFR I,B . D=logical sector (0000-0F00)
  LSRA divide logical sector # by 16
  RORB
  ROR ,S .  put remainder on stack
  LSRA
  RORB
  ROR ,S
  LSRA
  RORB
  ROR ,S
  LSRA .  A=0
  RORB .  B=track # (0-31)
  ROR ,S .  ,S=offset x 16
  ADDB #$E . pages 0-D in use already
  TFR D,I .  I=track # now (E-3F)
  PULS B .  B=offset (sector # x 16)
  LSRB
  LSRB
  LSRB
  LSRB
  EIG A,B A=sector# (0-F) B=0
  RTS
 ADERR COMB
  LDB #ESSECT
 WTWG RTS
*  WRITE SECTOR
*
*            Input  -  B=MSB of logical sector number
*                      I=rest of logical sector number
*                      Y=path descriptor
*                      U=global storage
*
*    Writing a sector is the same as reading except that
*  transfer is from the buffer to the virtual disk sector.
*
 VDSKWT BSR GTADDR get page(trk) & offset(sectr)
  BCS WTWG
  PSHS CC,D,DP,I,Y,U save working regs
  LDI PD.BUF,Y pick up buffer address
  EIG I,D .  D= buffadr: I= sector #
  ANDA #$F0 where is the buffer?
  BNE OK.0 buffer not in page 0
  INC 4,S put vdisk on page 1
 OK.0 LDD 4,S recover track # (E-3F)
  LDY PD.BUF,Y get buffer addr
  LDU V.PORT,U get controller address
  TFR A,DP I needed a reg.: save mempage
  ORCC #$50 no interrupts while page 0 gone
  STB A,U swap in page (track)
  CLRB multiply A x $1000
  LSLA . to get logical addr
  LSLA
  LSLA
  LEAI D,I add addr to offset
 WTLP LDA ,Y+ from buffer
  STA ,I+ to sect 0000-0F00 or 1000-1F00
  DECB transfer 256 bytes
  BNE WTLP
  TFR DP,A
  STA A,U swap page back
  CLR 2,S clrb
  PULS CC,D,DP,I,Y,U,PC go home
* * * * * * * * * * * * * * * * *
*
*  PUT/SET STATUS
*
 VDSKPS LDI PD.R6S,Y point to parameters
  LDB R#B,I what status are we putting?
  CMPB #SS.RST restore ?
  BEQ NOPER
  CMPB #SS.WTK write (format) ?
  BEQ NOPER
  CMPB #SS.FRZ freeze DD.INFO?
  BEQ FREZINF
  CMPB #SS.SPT set sectors/track ?
  BEQ NOPER
*
*  GET STATUS
*
 VDSKGS COMB none of above or VDSKGS: error
  LDB #E$USVC get error code
  RTS
 FREZINF LDB #$FF
  STB V.FREZ,U
 NOPER CLRB no for this drive
  RTS
*
*  TERMINATE VIRTUAL DISK
 VDSKTM CLRB
  RTS no action needed
*  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*  END VIRTUAL DISK device driver module
*
  EMOD
 DSKEND EQU *
```

SINGLE BOARD COMPUTERS-6809

Single Board Computers
Serdis ST-2900 Update Report

When we started the series of reviews of single board 6809 computers, I realized that I would have to probably do some updates. That is exactly what I wanted. Product updates-upgrades-improvements-better values, what ever you want to call them, they all stand to benefit you, my readers. And that is what this thing has been

all about!

So, I am delighted to report to you any and all improvements of these fine products. The newer generation of micro-computers have nipped us here and there, but we have something that no other group of owner/users have; we can get to the 'guts' of the thing. Also, we can build it ourself, if we so desire. Try to build an 8087 system, I mean - COMPLETE. Right you are, you CANNOT! But, you can build a very powerful, complete 6809 computer, right here out of the pages of 68 MICRO JOURNAL™. And these very same boards are part of that project. In addition there are the bare boards and other hardware advertised, in our pages, that let you have the greatest variety of micro-computer building blocks offered anywhere to that special breed of individual who still takes pride in, "I built it myself and SAVED money in the process."

In addition, you can buy some of the worlds best micro-computers right here out of the pages of 68 MICRO JOURNAL. Then you can expand to your hearts content, with just what you need, 'store bought' or 'roll your own'. No source anywhere offers you as muc !

Sardis ST-2900 Update

We received a complete set of the new and 'improved' documentation for this system after our original review had gone to press. Still not "Heath' quality but completely sufficient, and much improved.

No dot-matrix printer typesetting. No pencilled overstrikes. No errors I could find. All diagrams and charts simple and easy to understand, and professionally done. Above all, simple instructions on adapting I/O direct addressing software such as STYLO™, DYNACALC™, RMS™ and SCREDITOR III™. These are the only software packages I can think of that need this special treatment. Once done they run the same as on any ot er 6809 system.

Below I will briefly outline the latest improvements:

1. The monitor has been changed to accommodate serial handshaking. Also, the "M" memory examine and change routine has been expanded.

2. The changes to the FLEX™ conversion package has resulted in improved utilities, such as FORMAT and DSKSET.

a. FORMAT: This utility which replaces the TSC newdisk routine has the following features:

a1. LOWER DENSITY - TSC format of 10 sectors per track single density and 18 sectors double density. Or the IBM(?) 3740 9 single, 16 double density.

a2. SWTPC FORMAT - this allows disks formatted with this option SWTPC compatibility. Therefore you have the choice of either the SWTPC or GIMIX formats in the event you swap programs on disk with other users. This has been a real hassle for some.

3. 35-40-80 track formatting now possible.

4. Some utilities have been added:

LOADO - this offset loads from disk to memory (but does not execute) a binary file. Offsetting is not necessary but then the TSC GET command would do.

PATCHES.OVR allows patching FLEX™, which has been a bear at times for some who wish to insert user code in front of the transfer address. FLEX normally stops loading when the transfer address is encountered at load time.

PRTSET - allows printer driver parameters to be changed - NC, nulls after C/R - NL, nulls after L/F - LM, left margin width - BR, printer port baud rate. Also the source code for all printer drivers (3) is included.

SYSGEN - creates a FLEX system file that boots direct from the monitor. It allows PATCHES.

BLIST - a LIST utility similar to the TSC version but it fills much more of memory with the called text file, causing less wear and tear on the disk system.

CHECKSUM - a utility that reports the checksum of any disk file.

DCHECK - a utility to allow checking visually on the CRT screen the rotational sp d of all disk drives, also measures the delay time from 'motor on' signal to the 'ready' signal to the 1793 disk controller.

DSKSET - improved version that allows complete parameters for practically any type disk system, including the newer Shugart SA300 3 1/2 inch types.

OS9.CMD - this utility allows the user to call the Radio Shack version of OS-9™ from FLEX. A prompt is issued to insert your OS-9 disk. In about 30 seconds up pops the TAN Y OS-9 banner and you are in OS-9.

Some portions have not been completed. Ours is an evaluation sample. For instance the clock is not implemented yet, but will be probably by the time you read this. Also Sardis has licensed from D.P. Johnson SDISK and SFORMAT. These allow both CoCo and standard OS-9 disk formats to run on the system. Considering the price of TANDY OS-9 and BasicO9, this makes for quite a savings. While not spending a lot of time with this version of OS-9 (we have several OS-9 systems, all larger, including the GIMIX III) I found little to fault, even with a 'Beta' test version. Also, because of the DUART used and the addressing space of the I/O, in OS-9 there is available 63.75K of RAM available. No 'holes' in the middle of the address map. This should be one of the 'better' OS-9 level I systems, due to the memory allocation.

Some enhancements being considered for the future are; booting from a 48 tpi disk in a 96 tpi drive. Expanded memory, and possibly a DAT configuration for extended memory applications.

All in all, as I said before, these little 'jewels' are great for those desiring a complete 64K FLEX system. And now OS-9 also.

As the others pass along to us the updates, upgrades and improvements of their systems, I will report them to you.

DMW

- - -

MICROKEY 4500

MICROKEY 4500

The Ukey 4500 is an entirely different type of SBC, as compared to the others. First, it has normally 128K bytes of RAM. Secondly, it sports many different CPU devices -W65SC802, W65SC816 6502, 65C112 and the 6809E. Thirdly, it also has fi er-optics I/O as well as hardwire. **And the color high speed, high resolution graphics are superior to most any microcomputer now available!!** In addition it can fall into the $1500 class, as the others do. However, fully loaded, it will exceed that price by a couple hundred dollars (special introductory price - see advertising). The normal price will be somewhat higher depending on USA distribution, shipping cost, import duties and all those other cost that get added on in the norm l course of business. But even at twice the introductory price it will still be a bargain!

ANOTHER VIEW

Below is a users comments of the Ukey 4500 as we received recently. Although we have a complete system inhouse, I thought you might like another view from an actual user, who has had somewhat more opportunity to evaluate the Ukey 4500 than we have so far.

Mr. Don Williams Sr.,
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68 Micro Journal,
5900 Cassandra Smith,
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U.S.A

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14 Nov. 1984

Dear Don,

Microkey 4500 Single Board Computer.

I was pleased to see in your December issue that you were about to add the Microkey 4500 to your list of single board 6809 computers, and I know that Eddie Kaouf is delivering a board to you as I write. I am a computer journalist and consultant, and as such I have had a Microkey for evaluation for some months. Over that period I have used the machine constantly, and maintained a dialogue with Dave Bunley, the designer of the board, as to my findings and suggestions. I think I can lay fair claim to having more experience with the computer, both in FORTH and with software running under Flex, than anyone else. I should also perhaps mention that I "found" FORTH through the Byte issues devoted to it, and since then I have used no other language, so you can imagine how thrilled I was to find that Microkey ran polyFORTH as well as Flex, for me it represented the best of all possible machines.

I will make no mention of my findings so far as the hardware is concerned other than to say that I have found it excellent, well thought out, robust and reliable. But I would like to make some points from a user's point of view.

The system as I have it is configured for two Sony Micro Drives as drives zero and one, and one 5" 35 track single-density single-sided drive as drive 2. The Sony drives are magnificent, a very large capacity and a very fast data rate, it's just like having a hard disk on line. And the 5" drive makes transferring software from other Flex systems very simple. I have two monitors, one color and one black and white, and two keyboards, plus my daisy-wheel printer hooked in. I also have communication with other computers in the house via RS232.

I was aware very early on of the problems of re-configuring some of my Flex software to run on Microkey because of the way software like Dynacalc and RMS tended to address the Motorola ACIA directly, and Microkey uses a very different system. Part of Dave's design philosophy, the reason there is so little provision for user I/O, was that most noise problems are associated with I/O lines, and the next stage in the design was to develop RS232-driven fibre-optic communications on a separate tiny board in order to more suit the 4500 for control purposes in factory environments.

The decision was made to not only provide the fibre-optic capability, but to use two Motorola ACIA's so that one could either hook up the fibre or just plug in a separate terminal, or both. I have the prototype board on my Microkey at this moment, and it works beautifully.

I can run all TSC's Flex software using the Microkey alone. All the software which uses Flex for all of its communications works very happily with the color monitor and Microkey's keyboard. For the difficult software I plug in my CT-82, type "TERM" on Microkey's keyboard, and I am running the Microkey using the CT-82 as a separate ACIA-driven terminal.

Dave is now going to "hook" the ACIA back into the system, and then you will not even need to plug in the separate terminal. Just direct communications to the ACIA and Microkey will behave as if you had plugged in a separate terminal. So you have the choice. Plug in a terminal and Microkey will work with it. Unplug the terminal and Microkey will behave as if it had a terminal on line as far as the software is concerned.

It seems to me to be the best of all possible worlds. Without terminal I have tested most of the major packages, all the TSC UTILITIES, TSC Pascal, Asmb, Edit, PR, Debug, Sort/Merge. I have also tested Lucidata Pascal, Lisp, SWT's Symbolic Disassembler, and the Windrush software like MACE and its family and PL/9. All of these run with little or no modification.

With the CT-82 plugged in I have tested Dynacalc, RMS, Basic09 and Extended Basic (of TSC), and John Alford's SCREDITOR III. All are well documented as to re-configuring for a different ACIA address which is often all that is needed. As readers will know, many of these programs come with configuration software which prompts for all the terminal and keyboard characteristics.

The only slight problem I had was with Dynacalc. That program is so User Friendly that it becomes a pain in the neck to re-configure it. I took the easy way out. I copied the version I had made for the CT-82 to Microkey's Sony drive and then changed the two bytes at $00AF from $DFC0 (SWI vector) to $CF00 (Microkey vector).

Of course, in the time available, I cannot claim to have exhaustively tested all of the software I have listed, but I have it running and I have put test programs through all of it.

Very early on I brought up Talbot's tFORTH+ on Microkey. I would not recommend any non-FORTH users to try this because it requires a little understanding of FORTH. As purchased for my SWT computer, Talbot is configured for two 5" drives as zero and one, and two 8" drives as two and three. Obviously the requisite parameters have to be changed in order for it to compile from the Sony disks. Secondly, the screen output of Talbot expects SBUG to take care of the eighth bit of ASCII characters (FORTH uses that bit in name fields), and Microkey, with its full color and high resolution graphics, passes all eight bits to the screen. The definition of the FORTH word "ID." must be re-written so as to kill the eighth bit, and then it must be patched into the kernel, otherwise a dictionary dump will be difficult to read. The words which set up and communicate with a serial interface (I-SER ?SER O$SER and CISER) need to be re-written in order to be able to use Microkey's user serial interface, although they must also be retained in their original form in order to access the two ACIA's on the communications board.

The screen editor has to be reconfigured in or so to make use of different control keys on the keyboard, although the fig line editor, of course, will work without any changes. And a few primitives and high-level words need to be written in order to uses Microkey's Rom routines for color graphics. Finally the "GO" screen, screen 6), has to be modified in order to incorporate the changes.

All the foregoing is trivial and very easy to do provided you understand tFORTH and the particular implementation you wish to host on Microkey. One advantage in using Talbot over against PolyFORTH is that Talbot uses disks formatted in Flex format whereas polyFORTH uses a quite different format. Talbot can read and write Flex text files as well as the normal FORTH virtual memory blocks, and it can use disks partitioned to be part virtual and part Flex. So it can take files of data output from RMS or Dynacalc, use that data in an application, and then read new data back into text files. If I am writing about FORTH, for instance, I can send a listing of FORTH screens to a Flex file where TSC's PR can incorporate it into the body of my article.

I have just completed a pseudo floating point in FORTH for Microkey, it looks and acts like floating point but is in fact entirely integer and scaled maths, including sine and cosine routines, which is used in a 3D color graphics package which uses matrix transformations in order to produce rotations, magnifications etc. The results are very fast and impressive, real-time color animation on Microkey's [illegible] 6809.

The Microkey support environment, read in from ROM at power-up, includes a host of subroutines which the user can call to invoke screen, keyboard and system functions. These are particularly easy for FORTH to access, the user has only to push any required parameters onto the stack and then execute an indirect JSR. Microkey function words can very easily be written to change to and from color and mono, change text color and graphics pixel color, draw lines between XY coordinates, plot points etc. Graphics and text can be freely intermixed on the screen as can the colors, so the user can create some really dazzling displays.

Another function, which I have tested but not really used in an application as yet, will switch software from one RAM bank to the other. Very useful because you can use it as a sort of "RAM DISK" in order to switch an application over to the other RAM at some point in its execution, invoke and execute a second application, and then switch back the first and continue its execution.

I have been looking for some time for a suitable single board 6809 with which to supplement my ageing SWT box. I have now decidedly found it! What is more, I am putting my money where my mouth is. This Microkey is mine. I have transferred all my work onto it, the SWT hasn't been switched on for three months, and Microkey has performed faultlessly. Don't be put off if you are not a FORTH man, this is a very very good Flex computer, good as a computer and good as a development and control system, but just add the FORTH capability as well and it has to be tried to be believed.

Finally, if you would like listings or other details, just ask. And anyone out there who has a problem with this board, just write. I'd be happy to help.

Yours sincerely,

Frank Dale

Frank Dale

While the system is capable of running both the 6502 and the 16 bit version the 65SC816 CPU, we will be devoting most of our attention to the 6809 aspects of the Ukey 4500. Therefore the following 6502-65SC816 discussion is far from a complete overview of their capabilities. However, the basic system remains the same, it is usually supplied (and priced) for each CPU or combination of CPUs.

The 6502 runs both Forth-79 and Fig Forth. Built in editors and assemblers are part of both Forths. As a control language Forth is ideal. In fact Forth was developed as a control language for one of the worlds largest telescopes. While the use of 'reverse Polish' has never quite agreed with me, I know many professional and hobby programmers who would use nothing but Forth. It is an excellent language and is probably one of the most easily expandable HLLs available today.

The 16 bit version (65SC816) can address 512K RAM configured as two 256K banks. Clock speeds for the 6809E and the 16 bit CPU are approximately two Mhz, but the 6502 runs at a slower clock speed.

The color graphics running under Forth are so dazzling that words cannot describe them! The speed and resolution is some of the best we have ever seen running on ANY microcomputer!

The 809E Version

The 6809E system runs FLEX™, Talbot's tForth+ and polyForth. Now talk about your color graphics speed and resolution, even better!! Also you can run all the other popular FLEX software with little change (see Frank Dale's comments above).

The FLEX system also allows you to run all those other applications - business, accounting, OEM and software development, spread sheet, word processing, etc. - **including** high resolution, fast speed color graphics. Text and graphics mixed if desired.

Of all the SBCs we have reviewed and tested todate, this is the most complex, and therefore, this review cannot cover all of the advanced features available on the Ukey 4500. However, below is a brief overlook of the specs:

DMA all devices except the 6502, from expansion port.

RAM - 128K, two 64K banks, expandable to 512K with W65SC816.

REFRESH by video controller, RAM first cycle, CPU second.

EPROM - 32K, two 27128, 16K, two 2764. EPROMs can be switched out completely or replaced by external plug-in EPROMs.

SERIAL interfaces - TX,CTS,DCD,DSR,DTR,RTS provided at RS232 port. Connector 25 pin D plug. 16 software programmable rate up to 19,200. Device is a 6551 ACIA.

PARALLEL interfaces - two, standard TTL, 15 pin D plug. Device is a 6522.

KEYBOARD interface - two IBM type keyboard interfaces provided. Connectors are 180 degree 5 pin DIN sockets.

CASSETTE interface - Apple protocol only as of this date.

EXPANSION port - All bus control, data and power signals are provided on a 50 pin IDC plug.

SCREEN 1 - video output is composite monochrome (B/W), resolution is 640X200 pixels, low resolution mode, 1280X200 high resolution mode. Connector is RCA type phono plug.

TTL COLOR video - RGB at TTL levels plus separate TTL sync (H/V), connector 6 pin DIN plug. 8 colors available in color mode. In monochrome this output is same a Screen 1. Same resolution as Screen 1 for low level in color, high level is monochrome.

ANALOG color - RGB at 1 volt peak analog levels. with composite TTL level sync. Connector 7 pin DIN plug. 16 colors possible. resolution same as TTL color.

DISK DRIVES - provisions and connectors for Sony type 3.5 inch drives, Epson 3.5 and any 5.25 inch drive. Single and/or double density. Data rates of 125K, 250K and 500K bit/sec possible. A total of four drives may be on line and connected. Drive types may be mixed.

AUTOMATIC 'boot' search all drives for system boot program, not restricted to drive 0.

Expansion Port

An expansion port has been provided to allow extended or extra I/O ** see fiber-optics discussion **, memory or CPUs to be added to the Ukey system bus. DMA is allowed provided it IS NOT the 6502 CPU in control. The bus is unbuffered, large numbers of external devices or long runs of cable will require buffering. Even though the 6502 used is the 3 Mhz version, much better timing margins are possible using the 68809E, and other CPUs.

External devices see the bus as a 100pf load with about 100uA leakage current. For data lines the load is

1 LSTTL and about 100pf.
The bus is capable of driving 30pf and 3 LSTTL loads. Cable lengths are critical.

Monitor

The monitor has most of the popular monitor functions. In addition there is the command 'F' to run Forth, 'H' set high resolution graphics, 'I' set inverse video, 'J' set monochrome with software scroll. 'K' demo interlace video (useful for OEM applications - 16 color with 640X384 pixel display), 'L' load RAM from communications port, 'N' set color video, 'S' send memory content to serial port, 'T' terminal mode (enable system to act as a terminal and 'Z' set color - a 2 digit hex number sets the following text or graphics to the specific color, if both digits are not equal then two different colors will be used.

Documentation

As with the other SBCs, the documentation is not 'Heath' quality. For the Ukey 4500 the documentation is sufficient and cover both monochrome and color generation of both text and graphics. An especially nice feature is that all graphics and any text may be displayed at the same time. Because of the extensive use of Forth, Forth is covered in extra detail. However, the user should be somewhat familiar with Forth to gain the full utilization of this system.
Included in the documentation is info concerning the memory mapping schemes, in different modes. The one thing missing (at least from our system) is the inclusion of diagrams, parts layouts and parts list, all of which could be vital in event service is required.
Speaking of service, it should be a remote point for the system is top quality and has been completely tested and burned-in prior to shiping. Our inspection of the system shows a lot of attention to even the small details. And it has been in production and use in Europe for some time, in various configurations.

Optical-Fiber Interface

There is available a fiber-optics interface for OEM and control operations in industrial environments. It consist of a small board that is driver from the serial port and eliminates the problems normally encounte ed in situations where long cables would have generated noise problems. (see Frank Dales review above) As noted above two additional ACIA's become available for system use.
Note should be made of those programs that address an ACIA directly. As with the Sardis system (reviewed earlier - and which this article is being written, using Stylo which addresses direct to an ACIA).

Conclusion

After using the Ukey 4500 it becomes somewhat mundane to go back to a B/W CRT display. You would be surprised as to how much time can be spent just playing with the high resolution color graphics. Having all this much power and versatility readily at hand makes thinking up new things to do lots of fun as well as being useful and productive.
If you order the complete system, you will find the quality of the keyboard (IBM type) and enclosure too quality and very professional. The addition of a CRT terminal, Color monitor or monochrome monitor makes a complete system, and at a price that is practically unbeatable, for all the features included. So either way, SBC or full system is a bargain at these intro prices.

Price as of this writing:

Full system, including 128K RAM, three drives (two 3.5 Sony or Epson and 5.25 standard, keyboard and enclosure w/power supply: $1,899.00

Fully burned-in and tested SBC - 128K RAM, less drives, keyboard and enclosure: $450.00.

Please note that shipping and taxes are extra.

For additional information contact:

MICROKEY Limited
98a, St. James Street
Brighton, Sussex, England
Tel 0273-672911

- - -

LOCAL

it is a utility called "LOCAL." which uses the SwTPC Dynamic Address Translator (DAT) to store command files in your system's extra memory and links them into FLEX's User Command Table so that they are copied directly from memory when invoked. System requirements are a DAT, 2K bytes of RAM from $E800 to $EFFF and, of course, enough extra memory.

The source of this program is written in WHIMSICAL, which is now available through '68' Micro Journal. We have found that a great advantage of WHIMSICAL is the ability to break programs into modules. These modules can be developed and compiled separately and over the last two years we have put together a library of them.

We have found that the WHIMSICAL language has been well designed and has a very consistant and intuative syntax (unlike many languages e.g. "C") thus making programs easy to write and just as easy to understand six months later.

We hope that the enclosed program will demonstrate the e features as well as being as useful for you as it is for us.

By the way, since Ron Anderson's review of WHIMSICAL in the Sept. '83 issue of '68' Micro Journal, REAL numbers (otherwi e known as floats) have been added to the compiler.

Regards,
(Mark Armstrong)

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```
I Make Command Files Reside "LOCALLY" in RAM (File E4LOCAL) 17 JUN 84
I ---- ------- ---- ------ --------- - --
I Compiled by WHIM VER 1.5:54

I by M G Armstrong
I 12 Saltburn Road, Milford
I Auckland 9,  New Zealand

I System Requirements:
I 1) SwTPC compatible DAT
I 2) 2K bytes RAM from $E800 to $EFFF

I Command Syntax:
I ***LOCAL(,(file spec)[,(file spec)]][(options)]

I File specs default to System drive with CMD extension.
I Options are   C  Catalogue the User Command Table
I               I  Provide extra information on memory usage
I               U  Unbreak Local (removes User Command Table)

* STACK=($CC28)                    Set STACK according to Memory End
* ORIGIN=($1000)                   Use $0000-$0FFF for DATing in blocks
* VERSION 4,'.E4LOCAL, by M G Armstrong'

begin
  DBYTE  CmdTableStart:= $E800,
         CmdTableEnd:=   $EAFF,
         ExecTableStart:=$EB00,
         ExecTableEnd:=  $EB6F,
         ProgramID($EFFE);
         proc EscapeToEOL=forward;
```

```
module Error= code from 'E4ERROR';      ! Error Handler
module Parse= code from 'E4PARSE';      ! Command Line Parser
module Block= code from 'E4BLOCK';      ! DAT Block Control
module ExTbl= code from 'E4EXTBL';      ! Execution Table
module CmdTbl=code from 'E4CMDTBL';     ! Command Table
module Load=  code from 'E4LOAD';       ! File Loader

do begin
! Err:=false;                           ! Reset error flag
! Parse;                                ! Next item from command line
! case ParseType of
! begin
!   1: LoadFile;                        ! Load file into RAM and generate load map
!      CmdTable;                        ! Enter file name into Command Table
!      ExecTable;                       ! Enter file data into Execution Table
!   2: if Catalog then                  ! Options (handled by Parse)
!      begin
!        CatCmdTable;
!        Catalog:=false;
!      end;
!      if UnhookLocal then
!      begin
!        Emit2(CmdTableStart, $0000);   ! Destroy Command Table
!        CmdTableStart:=$CC12;          ! Set variable to address of UCT
!        Emit2(CmdTableStart, $0000);   ! Unhook User Command Table
!        Emit2(ExecTableStart, $0000);  ! Destroy Execution Table
!        ProgramID:=$0000;              ! make LOCAL reinitialise
!
!        ParseType:=4;                  ! skip to end of program
!      end;
!   3: ;                                ! End of Command Line
!   else: Error($83);                   ! Invalid command line
! end;
end until ParseType>=3;
RestoreBlocks;                          ! Restore original DAT configuration
if ParseType<>4 then
begin
! CloseCmdTable;                        ! Close the Command Table
! if ExtraInfo then
! begin
!   write "^M^JTotal Blocks used: ",    TotalUsed;
!   write "^M^JFree Blocks remaining: ", FreeLeft;
!   write "^M^JTotal Bytes Stored: ",   TotalBytes;
! end;
end;
EscapeToEOL;                            ! Ensure TTYEOL recognised

end.

! ************************************************************

'TITLE="Error Handler" (File E4ERROR) 30 APR 84

module Error=
begin
public
  BOOL Err;
  proc Error(BYTE ErrNo);
external
  CBYTE ProgramID:$EFFE);
  proc EscapeToEOL;
private
  proc Error(BYTE ErrNo)=
! --- -----
  begin
    CHAR Answer;
    if NOT Err then
    begin
    ! Err:=true;
    ! write "^M^J";
    ! case ErrNo of
    ! begin
    !   $80:  write "Invalid drive number";
    !   $81:  write "Invalid file name";
    !   $82:  write "Drive specified twice";
    !   $83:  write "Invalid command line";
    !   $84:  write "Invalid options";
    !   $85:  write "File won't fit";
    !   $86:  write "Not a binary file";
    !   $87:  write "Can't transfer";
    !   $88:  write "Null file";
    !   $89:  write "Command Table overflow";
    !   $8A:  write "Execution Table overflow";
    !   $8B:  write "SYSTEM blocks have changed";
    !   $8C:  write "Invalid initialisation";
    !   else: reporterror(ErrNo);
    ! end;
    ! case ErrNo of
    ! begin
    !   $85:$89:$8A:$8B:$8C: EscapeToEOL; ProgramID:=$0000; STOP;
    !   else: write "^M^JContinue (Y/N)? "; read Answer;
    !         if Answer="N" OR Answer="n" OR Answer=CHR($0D) then
    !           (EscapeToEOL; ProgramID:=$0000; STOP);
    ! end;
    end;
  end;

end.

! ------------------------------------------------------------



'TITLE="Parse Command Line" (File E4PARSE) 1 MAY 84
! Adapted from module by WHIMSICAL DEVELOPMENTS

module Parse=
begin
public
  BOOL      Catalog,     ! True if User Command Table Catalog requested
            ExtraInfo,   ! True if block usage info requested
            UnhookLocal; ! True if Local to be unhooked
  SMALLINT  ParseType;   !  1 - File specification
                         !  2 - Options
                         !  3 - End of Command
                         ! 10 - Command Line Error
  CHAR ARRAY Name[14];
  proc EscapeToEOL;      ! Escape to End of Line
  proc Parse;            ! Parses Command Line; Returns Name and ParseType
external
  proc Error(BYTE ErrNo);
private
  CHAR Ch($CC18),        ! One character look ahead
       Alpha="A", Num="0",
       Sep=" ",   EOL=CHR($0D);

  proc NextCh=external($C927);


  CHAR proc Class=
! ---- ---- -----
  begin
    CHAR FlexEOL($CC02);
    if Ch>="A" AND Ch<="Z" OR Ch>="a" AND Ch<="z" then Class:=Alpha else
    if Ch>="0" AND Ch<="9" then Class:=Num else
    if Ch=" " OR Ch=",' then Class:=Sep else
    if Ch=EOL OR Ch=FlexEOL then Class:=EOL else
    Class:=Ch;
  end;

  proc EscapeToEOL=
! ---- ----------
  begin
    while Class<>EOL do NextCh; ! Escape to EOL
  end;

  proc Parse=
! ---- -----
  Begin
    BOOL DriveFound;

    CHAR proc FilterCh=
  ! ---- --- --------
    begin
      BYTE ULCFlag($CC49);     ! Upper/Lower Case Flag
      if ULCFlag=$60 then      ! Map lower case to upper
      begin
        if Class=Alpha then Ch:=CHR(ASC(Ch) AND $5F);
      end;
```

```
  end;

  BOOL proc NotEnd=          % True if not separator and not end of line
% ---- ---- ------
  begin
    NotEnd:=Class()Sep AND Class()EOL;
  end;

  BOOL proc NotFileCh=       % True if Ch is not a valid filename character
% ---- ---- ----------
  begin
    NotFileCh:=Class()Alpha AND Class()Num AND Ch()"-" AND Ch()"_";
  end;

  proc ParseDrive=
% ---- ----------
  begin
    if DriveFound then Error(82);
    DriveFound:=true;
    if Ch)="0" AND Ch(="3" then Name(0):=Ch else Error(80);
    NextCh;
  end;

  proc ParseName=
% ---- ---------
  begin
    BYTE     SysDrive@($CC08);
    SMALLINT NameNdx:=2, ExtNdx;
    Name[0]:=CHR(SysDrive+$30);
    Name[1]:=".";
    if Class=Num then
    begin
      ParseDrive;
      if Ch()"." then Error(81);
      NextCh;
      if Class()Alpha then Error(88);
    end;
    FilterCh;
    do begin
      Name[NameNdx]:=Ch;
      NextCh; FilterCh;
      NameNdx:=NameNdx+1;
    end until NotFileCh OR NameNdx=10;
    Name[NameNdx]:=  ".";  NameNdx:=NameNdx+1;
    Name[NameNdx]:=  "C"; % Set default extension
    Name[NameNdx+1]:="M";
    Name[NameNdx+2]:="D";
    Name[NameNdx+3]:=" ";
    if Ch="." then
    begin
    ! NextCh;
    ! case Class of
    ! begin
    !   Num:   ParseDrive;
    !   Alpha: FilterCh;
    !          do begin
    !            Name[NameNdx+ExtNdx]:=Ch;
    !            NextCh; FilterCh;
    !            ExtNdx:=ExtNdx+1;
    !          end until NotFileCh OR ExtNdx=3;
    !          Name[NameNdx+ExtNdx]:=" ";
    !          if Ch="." then (NextCh; ParseDrive);
    !   else:  Error(81);

    ! end;
    end;
  end;

  proc ParseOpts=
% ---- ---------
  begin
    NextCh;    % Skip "=" to get first option
    while NotEnd do
    begin
    ! case Ch of
    ! begin
    !   "C":"c": Catalog:=true;
    !   "I":"i": ExtraInfo:=true;
    !   "U":"u": UnhookLocal:=true;
    !   else:    Error(84);
    ! end;
      ! NextCh;
      end;
    end;

    while Class=Sep do NextCh;   % Skip leading separators
    case Class of
    begin
      Alpha:Num: ParseType:=1; ParseName;
      "=":       ParseType:=2; ParseOpts;
      EOL:       ParseType:=3;
      else:      ParseType:=10;
    end;
  end;

end.

% ------------------------------------------------------------------


'TITLE='Generate a table of 4K Blocks of RAM' (File [4BLOCK) 30 APR 84

module Block=
begin
public
  INTEGER    TotalUsed,
             FreeLeft;
  BYTE       CurrentBlock(@EFF0);
  DBYTE      BlockAddress(@EFF2);
  BYTE ARRAY Block(@0000);
  BYTE proc NextBlock;
  proc RestoreBlocks;
external
  BOOL Err;
  DBYTE ProgramID(@EFFE);
  proc Error(BYTE ErrNo);
private
  BYTE       Ndx;              % General purpose index
  DBYTE      Sample(@00F0);    % Location where RAM sampled for existance
  BYTE ARRAY Original[$F],     % Original configuration
             Image(@DFB0],     % BAT image
             BAT(@FFF0],       % BAT
             BlockInfo(@EE00]; % Array of block information,
                               %   BIT 7  allocated to CONTROL
                               %       6  allocated to SYSTEM
                               %       5  allocated to LOCAL
                               %       4  allocated to VDISK
                               %       3
                               %       2
                               %       1
                               %       0  RAM present

  BOOL proc OriginalBlocks=
% ---- ---- ---------------
  begin
    BYTE Ndx;
    for Ndx:=$0 to $F do
    begin
      Original[Ndx]:=Image[Ndx];     % Load original with standard BAT image
      if BlockInfo[Original[Ndx]]()$41 then OriginalBlocks:=true;
      BlockInfo[Original[Ndx]]:=$41; % Allocate to SYSTEM
    end;
  end;

  proc RestoreBlocks=
% ---- -------------
  begin
    BYTE Ndx;
    for Ndx:=$0 TO $F do
    begin
      Image[Ndx]:=Original[Ndx];
      BAT[Ndx]:=Original[Ndx];
    end;
  end;

  BYTE proc NextBlock=
% ---- ---- ---------
  begin
    BYTE Ndx;
    while BlockInfo[Ndx](>$01 do
```

```
    begin
      Ndx:=Ndx+$01;
      if Ndx=$00 then Error($05);
    end;
    if NOT Err then
    begin
      NextBlock:=Ndx;
      BlockInfo[Ndx]:=$21;
      Image[0]:=Ndx;
      DAT[0]:=Ndx;
      TotalUsed:=TotalUsed+1; FreeLeft:=FreeLeft-1;
    end;
  end;

  proc FindBlocks=
% ---- ---------
  begin
    BYTE Block;
    for Block:=$00 to $FF do
    if BlockInfo[Block]=$00 then
    begin
      Image[0]:=Block;
      DAT[0]:=Block;
      Sample:=COMBINE($99,Block);
      if Sample=COMBINE($99,Block) then BlockInfo[Block]:=$01;
    end;
    RestoreBlocks;            % Restore original configuration
  end;

  if Program[0]<>HEX(1984) then
  begin
    for Ndx:=$00 to $FF do BlockInfo[Ndx]:=$00;
    OriginalBlocks;
    FindBlocks;
    CurrentBlock:=NextBlock;
    BlockAddress:=$0000;
    Program[0]:=HEX(1984);
  end else
  begin
    if OriginalBlocks then Error($BB);
    if BlockInfo[CurrentBlock]<>$21 then Error($BC);
    Image[0]:=CurrentBlock;
    DAT[0]:=CurrentBlock;
  end;
  FreeLeft:=0;
  for Ndx:=$00 to $FF do if BlockInfo[Ndx]=$01 then FreeLeft:=FreeLeft+1;
end.

% ------------------------------------------------------------------------


'TITLE='Build Execution Table' (FILE E4EXTBL) 1 MAY 84

module ExTbl=
begin
public
  DBYTE         ExecAddr,
                XferAddr;
  INTEGER       Index;
  BYTE ARRAY    CurrBlock[127];
  DBYTE ARRAY   BlockAddr[127],
                LoadAddr[127];
  INTEGER ARRAY Count[127];

  proc Emit(DBYTE REF Addr; BYTE Data);
  proc Emit2(DBYTE REF Addr; DBYTE Data);
  proc ExecTable;
external
  BOOL      Err;
  DBYTE     ExecTableStart,
            ExecTableEnd;
  BYTE      CurrentBlock(#EFF0);
  DBYTE     BlockAddress(#EFF2);
  BYTE ARRAY Block(#0000);
  CHAR ARRAY Name[14];

  proc Error(BYTE ErrNo);
private
  BYTE ARRAY Memory(#0000);

  proc Emit(DBYTE REF Addr; BYTE Data)=
% ---- ----

  begin
    Memory[Addr]:=Data;
    Addr:=Addr+$0001;
  end;

  proc Emit2(DBYTE REF Addr; DBYTE Data)=
% ---- -----
  begin
    Emit(Addr, HIBYTE(Data));
    Emit(Addr, LOBYTE(Data));
  end;

  proc TableEnd=
% ---- --------
  begin
    while Memory[ExecAddr]=      $BD AND
          Memory[ExecAddr+$0001]=$EF AND
          Memory[ExecAddr+$0002]=$00 DO
    begin
      ExecAddr:=ExecAddr+$0008; % Skip constants etc
      if Memory[ExecAddr]=$7E then ExecAddr:=ExecAddr+$0003; % skip xfer addr
    end;
  end;

  proc ExecTable=
% ---- ---------
  begin
    BYTE    MapBlock;
    INTEGER Ndx;

    if NOT Err then
    begin
      while Ndx<=Index do
      begin
        MapBlock:=$A;
        if LoadAddr[Ndx]>$9000 then MapBlock:=$0;
        Emit(ExecAddr, $BD);
        Emit2(ExecAddr, $EF00);
        Emit(ExecAddr, MapBlock);
        Emit(ExecAddr, CurrBlock[Ndx]);
        Emit2(ExecAddr, BlockAddr[Ndx]);
        Emit2(ExecAddr, LoadAddr[Ndx]);
        Emit2(ExecAddr, HEX(Count[Ndx]));
        Ndx:=Ndx+1;
      end;
      Emit(ExecAddr, $7E);
      Emit2(ExecAddr, XferAddr);
      CurrBlock[0]:=CurrBlock[Index];
      BlockAddr[0]:=BlockAddr[Index]+HEX(Count[Index]);
      CurrentBlock:=CurrBlock[0];
      BlockAddress:=BlockAddr[0];
      Count[0]:=0;
      Index:=0;
      if ExecAddr>=ExecTableEnd then Error($BA);
    end;
  end;

  ExecAddr:=ExecTableStart;
  CurrBlock[0]:=CurrentBlock;
  BlockAddr[0]:=BlockAddress;
  TableEnd;
end.

% ------------------------------------------------------------------------

'TITLE='File Loader' (File E4LOAD) 25 APR 84

module Load=
begin
public
  LARGEINT TotalBytes;          % Total bytes emitted
  proc LoadFile;
external
  BOOL Err;                     % Error flag
  DBYTE XferAddr;               % Transfer address
  INTEGER Index;                % Load info index

  CHAR ARRAY    Name[14];       % File name
```

```
  BYTE ARRAY    Block(80000),   ; Data loaded into block
                CurrBlock(127); ; Current block
  DBYTE ARRAY   BlockAddr(127), ; Block address
                LoadAddr(127);  ; Load address
  INTEGER ARRAY Count(127);     ; Byte count


  proc Error(BYTE ErrNo);       ; Error handler
  BYTE PROC NextBlock;          ; Msgs in next free block
private

  proc LoadFile=
; ---- --------
  begin
    BYTE Header, Cnt, Data;
    BOOL NotFirstRecord, IterAddrFound;
    DBYTE LAddr, BAddr:=BlockAddr(0);
    BYTE FILE BinFile;

    BOOL proc BinHeader=
  ; ---- ---- ---------
    begin
      BinHeader:=(Header=$02 OR Header=$16 OR Header=$00);
    end;

    ; Index is 0, CurrBlock(0) is current block,
    ; BlockAddr(0) is next free byte within current block,
    ; Count(0) is 0.

    trap to Error from open BinFile as Name;
    if NOT Err then trap to Error from
    begin
    ; read from BinFile Header;
    ; if NOT BinHeader then Error($86);
    ; while BinHeader AND NOT EOF(BinFile) AND NOT Err do
    ; begin
    ;   if Header=$16 then
    ;   begin
    ;     read from BinFile IterAddr;
    ;     IterAddrFound:=true;
    ;   end else
    ;   if Header=$02 then
    ;   begin
    ;   ; read from BinFile LoadAddr[Index+1], Cnt;
    ;   ; if NotFirstRecord AND Count[Index]<>0 then
    ;   ; begin
    ;   ;   if LAddr<>LoadAddr[Index+1] then
    ;   ;   begin
    ;   ;     Index:=Index+1;
    ;   ;     CurrBlock[Index]:=CurrBlock[Index-1];
    ;   ;     BlockAddr[Index]:=BAddr;
    ;   ;     LAddr:=LoadAddr[Index];
    ;   ;     Count[Index]:=0;
    ;   ;   end;
    ;   ; end else
    ;   ; begin
    ;   ;   LAddr:=LoadAddr[Index+1];
    ;   ;   LoadAddr[Index]:=LAddr;
    ;   ;   NotFirstRecord:=true;
    ;   ; end;
    ;   ; TotalBytes:=TotalBytes+EXTEND(DEC(COMBINE($00,Cnt)));
    ;   ; while Cnt>000 AND NOT Err do
    ;   ; begin
    ;   ;   read from BinFile Data; Cnt:=Cnt-001;
    ;   ;   Block[BAddr]:=Data;
    ;   ;   Count[Index]:=Count[Index]+1;
    ;   ;   BAddr:=BAddr+00001; LAddr:=LAddr+00001;
    ;   ;   if BAddr=01000 then
    ;   ;   begin
    ;   ;     Index:=Index+1;
    ;   ;     CurrBlock[Index]:=NextBlock;
    ;   ;     BAddr:=$0000;
    ;   ;     BlockAddr[Index]:=BAddr;
    ;   ;     LoadAddr[Index]:=LAddr;
    ;   ;     Count[Index]:=0;
    ;   ;   end;
    ;   ; end;
    ;   end;
    ;   if NOT EOF(BinFile) then read from BinFile Header;
    ; end;
    ; close BinFile;
    ; if NOT IterAddrFound then Error($87);
    ; if Count[Index]=0 then
    ; begin
    ;   if Index=0 then Error($88) else Index:=Index-1;
    ; end;
    end;
  end;

end.

; ---------------------------------------------------------------


'TITLE="Build Command Table" (FILE E4CMDTBL) 30 APR 84

module CmdTbl=
begin
public
  proc CatCmdTable;
  proc CmdTable;
  proc CloseCmdTable;
external
  BOOL       Err;
  DBYTE      CmdTableStart,
             CmdTableEnd,
             ExecAddr;
  CHAR ARRAY Name(14);
  proc Error(BYTE ErrNo);
  proc Emit(DBYTE REF Addr; BYTE Data);
  proc Emit2(DBYTE REF Addr; DBYTE Data);
private
  DBYTE LocTable:=CmdTableStart,
        UserCmdTable($CC12);

  CHAR ARRAY Memory(80000);

  proc TableEnd=
; ---- --------
  begin
    if UserCmdTable=$0000 then
    begin
      UserCmdTable:=LocTable;
    end else
    begin
      if CmdTableStart<>UserCmdTable then CmdTableEnd:=$FFFF; ; UCT not LOCAL's
      CmdTableStart:=UserCmdTable;
      LocTable:=CmdTableStart;
      while Memory[LocTable]<>CHR($00) do
      begin
      ; while Memory[LocTable]<>CHR($00) do ; Skip name
      ; begin
      ;   LocTable:=LocTable+00001;
      ; end;
      ; LocTable:=LocTable+00003; ; Skip address
      end;
    end;
  end;

  proc CatCmdTable=
; ---- ------------
  begin
    DBYTE Ndx:=CmdTableStart;
    write "^M^JFILES IN USER COMMAND TABLE^M^J";
    while Ndx<LocTable do
    begin
    ; write "^M^J";
    ; while Memory[Ndx]<>CHR($00) do ; write name
    ; begin
    ;   write Memory[Ndx];
    ;   Ndx:=Ndx+$0001;
    ; end;
    ; Ndx:=Ndx+$0003; ; Skip address

    end;
  end;

  proc CmdTable=
; ---- --------
  begin
    BYTE Ndx:=$2;
```

```
  if NOT Err then
  begin
    while Name[NCx]<>'.' do
    begin
      Emit(LocTable, ASC(Name[NCx]));
      NCx:=NCx+1;
    end;
    Emit(LocTable, 000);
    Emit2(LocTable, ExecAddr);
    if LocTable>CodTableEnd then Error(#89);
  end;
end;

proc CloseCodTable=
------------------
begin
  if UserCodTable<>$0000 then Emit(LocTable, $00);
end;

TableEnd;
end.

------------------------------------------------------------------------



* Procedure to Copy a Program Into Main Memory (File E4COPY.ASM) 1 MAY 84
* ---------- -- ---- - ------ ---- ---- ------

* by R G Armstrong

          ORG $EF00         Use CPU Board memory

* Execution Tables should be set up as follows:
* JSR EF 00
* FCB MapBlockNdx           Index of block used to map in CurrBlock
* FCB CurrBlock             Block containing the program
* FDB BlockAddr             Start address of program within CurrBlock
* FDB LoadAddr              Start load address of program in main memory
* FDB Count                 The number of bytes to load
* .
* .                         Repeat above sequence as required
* .
* JMP IterAddr              Jump to transfer address

Image     EQU $DFD0         Base address of DAT image
DAT       EQU $FFF0         Base address of DAT
COPY      PULS Y            Pull return address into (Y)
          LEAY 8,Y          Skip the constants
          PSHS Y            Push new return address
          LDY #Image        Point (Y) to DAT image
          LDA 0,Y           Load MapBlockNdx into (A)
          LDB A,Y           Load Image[MapBlockNdx] into (B)
          PSHS B            Save index and original block on stack
          LDB 1,Y           Get CurrBlock
          STB A,X           Image[MapBlockNdx]:=CurrBlock
          LDX #DAT          DAT[MapBlockNdx]:=CurrBlock
          STB A,X           CurrBlock now resident in MapBlock
          ASLA              Calculate base address of CurrBlock
          ASLA
          ASLA
          ASLA
          CLRB
          ADDD 2,Y          AbsoluteBlockAddr:=BASE(CurrBlock)+BlockAddr
          TFR D,U           Transfer AbsoluteBlockAddr to (U)
          LDX 4,Y           Get LoadAddr
          LDY 6,Y           Get Count
COPY1     LDB 0,U+          Do Load Data
          STB 0,X+          Store Data
          LEAY -1,Y         Decrement Count
          BNE COPY1         Until Count=0;
          LDX #Image        Point (X) to DAT image
          PULS D            Recover index and original block
          STB A,X           Image[MapBlockNdx]:=OriginalBlock
          LDX #DAT          DAT[MapBlockNdx]:=OriginalBlock
          STB A,X
          RTS               Return

          END

* ********************************************************************
```

FROM TSC BASIC TO MICROSOFT BASIC

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INTRODUCTION

The TSC BASIC interpreters for FLEX and UNIFLEX are generally excellent implementations of BASIC for the earlier 6800 systems under FLEX and current 6809 systems under FLEX and UNIFLEX. A large amount of business, educational, recreational, technical and system software has been developed using those interpreters. With the advent of the Radio Shack TRS-80 Color Computer, the IBM Personal Computer, and other newer systems supporting Microsoft and similar BASIC implementations, many developers have been and are converting these TSC BASIC programs to Microsoft BASIC implementations.

The purpose of this article is to discuss the differences between TSC BASIC and Microsoft BASIC, and how they affect the conversion from the former to certain implementations of the latter.

MICROSOFT BASIC

Microsoft BASIC implementations have been performed on a large number of systems, unlike TSC BASIC, which has been implemented on a rather limited number. Microsoft offers both BASIC interpreters and compilers, with the advantages of size, speed, and security of a compiler, while still maintaining the ease of development of an interpreter. TSC offers only interpreters; their Pre-Compiler is not a compiler but rather is a tokenized interpreter.

Unfortunately, not all of Microsoft's (or TSC's) implementations are the same, so some attention must be given to the differences among the implementations of interest. The implementations discussed here are for the Color Computer and for the IBM Personal Computer, being fairly recent and complete implementations, with

extensions in similar areas for supporting color graphics and sound effects. Other implementations are generally similar in the core language, but differ in the extensions. Developers aware of the similarities and differences among the implementations can use the similarities to their advantage while minimizing the impact of the differences.

DIFFERENCES AND SIMILARITIES

This section provides a discussion of the primary points of difference and similarity between the TSC BASICs and the Microsoft BASICs. Note that the graphics, sound, and certain and other extended functions, such as cassette I/O, of some of the major Microsoft BASICs are not covered here since the thrust of this discussion is the translation of TSC BASIC programs to Microsoft BASIC, and TSC BASIC does not support graphics, sound, or the extended functions.

For the purpose of this discussion, the following mnemonics will be used as shorthand notation for the indicated implementations:

TSC	any TSC Extended BASIC (here)
XBASIC	TSC Extended BASIC Interpreter
XPC	TSC Extended BASIC Pre-Compiler
Microsoft	any Microsoft BASIC (here)
PC	IBM PC BASIC
COLOR	Radio Shack Extended BASIC

Naming Conventions

XBASIC supports a one or two character variable name, starting with a letter, and optionally followed by a letter or digit. It requires every statement to be labelled with a numeric integer in the range from 1 to 32767.

XPC supports a variable name of length one to 255 characters, starting with a letter, and composed of letters, digits, and underlines. It does not require every statement to be labelled, allowing only those statements which are the targets of GOTO, GOSUB, ERL, etc. to be labelled, and allows labels to be numeric integers or to follow the same rules as do variable names; a label must start in the first column.

TSC allows a variable name to be followed by '$' or '%', denoting that the variable represents a string or integer, respectively, rather than a floating point number. The optional suffix character is considered a part of the name.

COLOR supports a variable name of effectively any length, starting with a letter, and optionally followed by a letters and digits; however, only the first two characters are significant. It requires every statement to be labelled with a numeric integer in the range from 1 to 32767. It allows a variable name to be followed by '$', denoting that the variable represents a string, rather than a floating point number. The optional suffix character is considered a part of the name, although it is exempt from the two-character rule.

PC supports a variable name of effectively any length, starting with a letter, and optionally followed by a letters, digits, and periods; however, only the first 40 characters are significant. It requires every statement to be labelled with a numeric integer in the range from 0 to 65529. PC allows a variable name to be followed by '$', '%', '!', or '#', explicitly denoting that the variable represents a string, integer, short floating point number, or long floating point number, respectively, rather than either a short floating point number or the default declaration type implied by a DEFtype statement. The optional suffix character is considered a part of the name, although it is exempt from the 40 character rule. It also allows a numeric constant to be followed by '!' or contain the exponential form 'E' to force its representation as a short floating point number, or to be followed by '#' or contain the exponential form 'D' to force its representation as a long floating point number.

None of the BASICs discussed here distinguish between upper and lower case in variable, verb, or function names.

All of the BASICs discussed here allow variables to be subscripted, with one or two dimensions, through the use of the DIM statement. TSC extends this concept

with virtual arrays, which are actually random disk files, rather than tables in memory. All of them automatically clear numeric variables to zero and string variables to null. This includes subscripted variables, but not virtual arrays.

The diversity of legal names for XPC may cause compatibility problems when converting to Microsoft because of the possibility of using names which are proper in XPC, but are reserved words in the target Microsoft implementation. Usually, this will produce syntax errors, but sometimes will cause other problems, such as accidentally changing the system date or time, as will storing into DATE$ or TIME$ on PC. A good defense against this problem involves reviewing a sorted cross reference listing of the XPC program versus a list of the reserved words for the target language, and modifying the offending variable names.

Another problem caused by the differences among the naming conventions concerns the possibility that two unique XPC variables may be interpreted ambiguously as one variable in either COLOR or PC. While it is unlikely that two XPC variables would be the same for the first 40 characters, but different thereafter, causing a problem under PC, it is quite possible that two XPC variables would be the same for the first two characters, but different thereafter, causing a problem under COLOR. Again, the best defense involves reviewing a sorted cross reference listing of the XPC program for ambiguous names.

String and Numeric Representation

TSC supports strings of length zero to 32767 bytes and the following numeric representations:

integer
-32768 to +32767
2 bytes
floating point
17 digits
8 bytes

COLOR supports strings of length zero to 255 bytes and the following numeric representations:

integer
-32768 to +32767
2 bytes
floating point
7 digits
5 bytes

Note that the number of digits of precision provided by COLOR is only seven, and this may be insufficient for the purposes of the program. For instance, accounting programs on COLOR will be unable to exactly compute amounts greater than 99999.99 in magnitude using the floating point arithmetic provided, assuming two decimal places are required for dollars and cents representation.

PC supports strings of length zero to 255 bytes and the following numeric representations:

integer
-32768 to +32767
2 bytes
short floating point
6 digits
4 bytes
long floating point
17 digits
8 bytes

Since the PC default for short floating point provides only six digits of precision, compounding the accuracy problem discussed for COLOR, the following statement should normally be inserted in each program being converted from TSC to PC:

```
DEFDBL A-Z
```

before any other statements or declarations to cause the default declaration of PC variables to be long floating point, and thus avoid any loss of precision. Generally, the benefits derived from the use of this statement outweigh its cost; however, programs which are time or space critical should be more carefully reviewed to determine if the use short floating point may be more appropriate for some or all of the floating point arithmetic. PC has one other peculiarity not common among other BASICs in that it rounds, rather than truncates, when converting floating point numbers to integer format; this may cause subtle problems in many programs.

All the BASICs discussed here allow arbitrary contents for strings (as opposed to DG BASIC, which uses hex 00 to flag end of strings, etc.), although they all have length limits. The length limitation of Microsoft strings to 255 characters will cause no problems in some TSC programs and severe problems in other TSC programs being converted. A

general solution to the problem is not possible. Program logic must generally be carefully reviewed while testing to ensure that the 255 character length limitation is resolved. Usually, the BASIC interpreter or compiler will detect and flag such problems; however, the problems may be masked (at least under PC) by error handling routines not expecting string length errors.

Microsoft allows hexadecimal and octal constants to be explicitly coded, as follows:

```
hexadecimal
      &Hxxxx     (x=0-9,A-F)
octal
      &Oxxxxxx   (x=0-7)
      &xxxxxx
```

Hexadecimal and octal constants may be used in the same contexts as integer constants. In some Microsoft programs, the use of hexadecimal constants may alleviate some or all of the problems caused by the lack of the TSC HEX string conversion function, discussed later.

Operators and Expressions

All the BASICs discussed here share a similar set of arithmetic, string, and logical operators. PC has several unique operators ('\', MOD, XOR, EQV, IMP), UNIFLEX TSC has one unique operator (' '), and Microsoft has several ('><', '=>', '=<') not supported by TSC.

The table below provides a composite list of all of the BASIC operators, in decreasing hierarchial order:

```
(,)        parentheses
fcn()      functions
^          exponenation (caret)
-,+        unary negative/positive
*,/        multiplication/division
\,MOD      integer division/remainder
+,-        addition/subtraction/
                 string concatenation
<>,><,<=,=<,>=,=>,<,>,=,
           relational comparisons
NOT        logical complement
AND        logical conjunction
OR         logical disjunction
XOR        logical excl. disjunction
EQV        logical equivalence
IMP        logical implication
```

PC interprets the division operator ('/') as always producing a floating point result, whereas the other BASICs interpret it as producing a truncated integer result when both operands are integers. This is consistent with the fact that PC rounds, rather than truncating, when converting floating point numbers to integer format. The PC operator ('\') converts both of its operands to integers and produces a truncated integer result. The Uniflex approximately equal operator (' ') may usually be converted to the more conventional equal operator ('='), but each use must be evaluated. All of these differences will require attention in many programs to avoid subtle problems, such as a subscript value being incorrect by one, a relational operation that is never true, etc.

All of the BASICs discussed here allow Boolean expressions to be used in arithmetic contexts, returning non-0 for true and 0 for false. They interpret the logical operators as bitwise, rather than true/false. They all have the same operator hierarchies. They all interpret a binary '+' operator in a string context to represent concatenation.

They all evaluate expressions involving operators of equal precedence on a left to right basis, except for those involving exponentiation, which are evaluated on a right to left basis (for the exponentiation operation only).

Multiple Statements per Line

All of the BASICs discussed here support (and encourage) the placement of multiple statements per line, and all interpret the concatenated statements in a similar manner. TSC allows either ':' or '\' as representing statement concatenation,

whereas Microsoft allows only ':'. All of them allow lines of up to 255 characters in length. XPC allows lines to be continued by the use of the '\' and carriage return combination. PC allows lines to be continued by the use of a line feed, rather than a carriage return, although the 255 character limit applies to the entire concatenated statement, even on multiple lines, as opposed to XPC, which imposes the limit only on each line of a multiple line multiple statement. These considerations may occasionally cause problems beyond simple

character substitution, but such problems occur rarely in practice.

Non-I/O Functions and Statements

This section summarizes the primary differences among the TSC and Microsoft BASICs in terms of the non-I/O functions and statements. I/O functions and statements will be discussed in the next section.

The string manipulation functions LEFT$, MID$, and RIGHT$ are common in syntax and interpretation across all of the BASICs discussed here. However, many of the other string functions supported by TSC are either not supported by either COLOR or PC or are supported in a different manner.

The CVT group of TSC string conversion functions generally has correspondences under different names under PC and has only partial correspondences under COLOR. CVT$% corresponds to CVI and CVT%$ corresponds to MKI$ in both PC and COLOR, converting a two character internal representation of an integer to and from an integer. CVT$F corresponds to CVD and CVTF$ corresponds to MKD$ in PC only, converting an eight character internal representation of a floating point number to and from a floating point number. CVT$F loosely corresponds to CVN and CVTF$ loosely corresponds to MKN$ in COLOR only, in that the COLOR string functions process a five character internal representation of a floating point number. CVT$F also loosely corresponds to CVF and CVTF$ loosely corresponds to MKF$ in PC only, in that those PC string functions process a four character internal representation of a floating point number.

The TSC STR$ function always provides a trailing space, but the Microsoft STR$ function never provides a trailing space. PC supports a DATE$ function, but it returns a string with format MM-DD-YYYY, not DD-MMM-YY, as returned by the TSC DATE$ function. PC supports a TIME$ function, but it returns a string with format HH:MM:SS, not as returned by TSC UNIFLEX. COLOR does not support either DATE$ nor TIME$. Microsoft does not support the TSC UNIFLEX options of the DATE$ and TIME$ functions with parameters.

The TSC ASC function will accept a null argument, returning a zero, but the Microsoft ASC function requires a non-null argument; a simple manner to avoid this problem is to suffix the arguments of all questionable ASC functions with "+CHR$(0)". Microsoft does not support the TSC UNIFLEX MEM function, but it does support the TSC FLEX FRE function.

Microsoft has no equivalent for the TSC HEX function, which converts its argument from a string containing a hexadecimal number to an integer representing that number. At each occurrence of the use of HEX must be inserted substitute code to perform the function. Microsoft does not allow DEF functions with string arguments; however, a USR function call could potentially be substituted for the HEX function call to perform the conversion.

The error-handling capabilities of TSC and PC are syntactically identical, both using the ON ERROR and RESUME statements and the ERR and ERL functions to establish error-handling routines and to return to normal processing after an error has been detected and processed. The primary differences between the implementations lie in the interpretation of the error numbers returned by the ERR functions and in the fact that, once the PC version of ERR provides an error number, it will return zero until another error occurs. The following list provides a few of the most important error conditions and the values returned by the respective ERR functions:

TSC	PC	Condition
4	53	File Not Found
8	62	End Of File
9	57	I/O Error
16	71	Disk Drive Not Ready
80	7	Out Of Memory

COLOR does not support most error handling, severely limiting its ability to escape from error situations. Microsoft supports the EOF function, which indicates an end of file condition; this is the only error handling function internally provided by COLOR.

Microsoft has no equivalents for the TSC UNIFLEX multitasking statements and functions (such as SLEEP, TASK$, TERM$,

TSTAT%, UNLOCK), nor for the TSC statement EXEC. Such functions must be either deleted or replaced by USR functions to request the operating system to perform similar tasks.

Microsoft supports the TSC FLEX PEEK and USR functions under the same names and the PTR function under the name VARPTR. It also supports the POKE statement. However, the manner in which USR and PTR functions are handled is different in essentially every implementation. Also, the uses of the PEEK function and POKE statement are highly dependent upon the hardware and software configuration on which the program is expected to run. Thus every occurrence of any of these functions and statements must be carefully evaluated in every case.

I/O Functions and Statements

This section summarizes the primary differences among the TSC and Microsoft BASICs in terms of the I/O functions and statements.

I/O file numbers are used in similar manners by TSC and Microsoft, although there are several differences in interpretation. One potentially major difference concerns the use of file number zero. TSC interprets file number zero to be the user's terminal, unless the file is opened for output, in which case it is interpreted to be a printer, or unless the file is opened for input, in which case the input prompts to the terminal are deleted. Microsoft does not support any use of file number zero, so that any TSC programs using it will require modification. PC supports only three file numbers (1-3) by default; however, a command line parameter may be used to increase this number to twelve, if enough memory is available to support that many buffers.

Another important area of difference concerns file specifiers. File naming rules are generally more dependent upon operating system requirements than upon BASIC conventions. The BASICs discussed here conform to the following four sets of file naming rules, discussed below:

TSC FLEX
TSC UNIFLEX
COLOR
PC

TSC FLEX file specifiers reference disk files only. They are composed of an optional drive number (0-3), a file name of 1 to 8 characters, and an optional suffix of 1 to 3 characters. The file name and suffix must start with a letter and may be composed of letters, digits, and certain special characters. The drive number, if present, is separated from the file name with a colon. The suffix, if present, is separated from the file name with a period. Letter case is significant. If drive number is omitted, the default work drive is assumed.

TSC UNIFLEX file specifiers reference any device. They are composed of a tree-structured file reference, which is an optional set of directory levels separated by slashes, followed by a file name. Each directory level and file name must start with a letter and may be composed of letters, digits, and certain special characters, excluding slashes. If the file specifier is not preceded by a slash, UNIFLEX prepends pre-specified directory levels to the name. Letter case is significant.

COLOR file specifiers reference disk files only. They are composed of a file name of 1 to 8 characters, an optional suffix of 1 to 3 characters, and an optional drive number (0-3). The file name and suffix must start with a letter and may be composed of letters, digits, and certain special characters. The suffix, if present, is separated from the file name with a slash or period. The drive number, if present, is separated from the file name or suffix with a colon. Letter case is insignificant. If drive number is omitted, the default drive number is assumed.

PC file specifiers reference any device. They are composed of an optional device id, an optional file name of 1 to 8 characters, and an optional suffix of 1 to 3 characters. The file name and suffix, if present, must start with a letter and may be composed of letters, digits, and certain special characters. The device id, if present, is separated from the file name with a colon. The suffix, if present, is separated from the file name with a period. Letter case is insignificant. PC device ids are interpreted as follows:

```
A:      disk drive A
B:      disk drive B
C:      disk drive C
D:      disk drive D
CAS1:   cassette adapter
COM1:   communications adapter 1
COM2:   communications adapter 2
KYBD:   keyboard adapter
LPT1:   printer adapter 1
LPT2:   printer adapter 2
LPT3:   printer adapter 3
SCRN:   screen adapter
```

If the device id is omitted, the currently assigned disk drive is used. File names are required for disk and are optional for all other device types.

The OPEN statements perform essentially the same functions in all of the BASICs discussed here; however, the formats for the statements are different. All require a file number, a file specifier, a mode, and some allow a logical record length to be stated. As just noted, TSC allows file number zero, whereas Microsoft does not. Also, the formats for file specifiers differ among the versions of BASIC, as do the interpretations of the modes.

TSC supports the following formats for OPEN statements:

```
OPEN OLD filespec AS filenumb
OPEN NEW filespec AS filenumb
OPEN     filespec AS filenumb
```

and TSC UNIFLEX supports the following additional parameter for random files only:

```
,SIZE recordsize
```

where recordsize specifies the length of all records in a random file; by default, it is assumed to be 252, which is the same record length always used by TSC FLEX for random files. Mode OLD requires the disk file to pre-exist and opens the file for input only. Mode NEW always creates a new file, deleting any old one by the same name on the same drive, and opens the file for output only. The null mode opens an existing file or creates a new one, and opens the file for both input and output (random access only).

COLOR supports the following formats for OPEN statements:

```
OPEN mode, filenumb, filespec
OPEN mode, #filenumb, filespec
```

where mode is a string expression with the following interpretations of the first character in the string:

```
I    input
O    output
R    random
```

and COLOR supports the following additional parameter for random files only:

```
,recordsize
```

where recordsize specifies the length of all records in a random file; by default, it is assumed to be 256. For conversion from TSC FLEX, the recordsize parameter should be stated as 252. For conversion from TSC UNIFLEX, it should be stated as the same value stated or assumed originally, unless the value is greater than 256, in case further manual intervention will be required to reduce the record length or split up length always used by TSC FLEX for random files. Mode "I" requires the disk file to pre-exist and opens the file for input only. Mode "O" always creates a new file, deleting any old one by the same name on the same drive, and opens the file for output only. Mode "R" opens an existing file or creates a new one, and opens the file for both input and output (random access only).

PC supports the following formats for OPEN statements:

```
OPEN filespec FOR APPEND AS filenumb
OPEN filespec FOR APPEND AS #filenumb
OPEN filespec FOR INPUT  AS filenumb
OPEN filespec FOR INPUT  AS #filenumb
OPEN filespec FOR OUTPUT AS filenumb
OPEN filespec FOR OUTPUT AS #filenumb
OPEN filespec            AS filenumb
OPEN filespec            AS #filenumb
OPEN mode, filenumb, filespec
OPEN mode, #filenumb, filespec
```

where mode is a string expression with the following interpretations of the first character in the string:

```
I    input
O    output
R    random
```

and PC supports the following additional parameters for random files only:

```
,LEN=recordsize (for OPEN filespec)
,recordsize     (for OPEN mode)
```

where recordsize specifies the length of all records in a random file; by default, it is assumed to be 128. For conversion from TSC FLEX, the recordsize parameter should be stated as 252. For conversion from TSC UNIFLEX, it should be stated as the same value stated or assumed originally, unless the value is greater than 1024, in case further manual

intervention will be required to reduce the record length or length always used by TSC FLEX for random files. Mode "I" (or INPUT) requires the disk file to pre-exist and opens the file for input only. Mode "O" (or OUTPUT) always creates a new file, deleting any old one by the same name on the same drive, and opens the file for output only. Mode "R" (or null) opens an existing file or creates a new one, and opens the file for both input and output (random access only). In many cases, it is necessary to attempt to open a random file as an input file, close it, then open it random, to prevent the automatic creation of the random file caused by the PC random file OPEN statement. If a printer is opened as mode "R" and record length 255, the normal automatic line feed after carriage return will be suppressed. Mode APPEND opens an existing file or creates a new one, and opens the file for output only, starting at the end of the file. File records may be no longer than 128 bytes, by default; however, this limit may be

increased to 1024 and the default limit of file numbers 1-3 may be increased to 1-12 (both memory size permitting) thru the use of command line parameters.

TSC FLEX sets the width of a printer thru TTYSET parameters, which are external to BASIC, but may be manipulated from BASIC thru the use of the EXEC statement or may be established before BASIC is executed. TSC UNIFLEX sets the width of the printer with the following statement:

```
WIDTH width
```

PC sets the width of the printer with the following statements:

```
WIDTH filenumb,width
WIDTH deviceid,width
```

with which the first type statement requires that the file be open and the second type does not; also, the second form applies to any access to the device, and thus affects the LLIST and LPRINT statements, which the first form does not. In most cases, the second form should be used. However, the first form may be required if several printers, with different widths, must be driven, and, for some reason, the second form is not convenient to use.

In order to overcome the problem caused by the use by TSC of file number zero, the Microsoft LPRINT statement may in many cases be used to replace the TSC PRINT statement. This has the advantage of being a simple substitution, but unconditionally sends its output to the printer, whereas TSC printer output is conditional on an OPEN statement attaching a printer driver to file number zero, and normally always sends its output to a particular printer ("LPT1:" under PC). If this is not convenient, the file number may be changed to a legal one and the file may be opened to device "SCRN:" to send output to the PC screen or "LPT1:", etc. to send output to alternate devices. The other use of the TSC file number zero, to inhibit input prompts, requires manual intervention and review, if it is to be maintained.

There are several other miscellaneous differences among the corresponding I/O statements in TSC and Microsoft. Most of them are minor and will require only

cursory review and simple modification. The most important differences are summarized below.

In the MICROSOFT statement "PRINT#n", "n" must be followed by a comma, even if there are no other parameters. Also, in the MICROSOFT "PRINT USING s$" statement, all delimiters after "s$" must be semicolons, whereas TSC allows semicolons or commas.

The only manner in which to set the cursor on the PC screen to a given position is to use the following statement:

```
LOCATE row,column,cursor,start,stop
```

where row represents the row number (1-25), col represents the column number (1-80), cursor determines whether the cursor is invisible or visible (0,1), start is the cursor start scan line (0-31), and stop represents the cursor stop scan line (0-31). The only manner in which to set the cursor on the COLOR screen to a given position is to use a PRINT statement of the following format:

```
PRINTn, ...
```

where n represents the character number on the screen, which represents the following expression:

```
((row-1)*32)+column)
```

with row values from 1 to 16 and column values from 1 to 32. TSC has no standard for setting the cursor or issuing other

terminal commands, but the PRINT statement is normally used to output a character string representing commands to the terminal; this will require review.

The word RECORD in the TSC statements GET and PUT must be deleted when converting those statements to their Microsoft equivalents. Also, the statement "INPUT LINE" must be reversed to "LINE INPUT" when converting a program to Microsoft BASIC.

Although the syntax for the INPUT statements is similar among the implementations, there are differences. The TSC INPUT statement always starts on a new line, whereas the Microsoft INPUT statement does not necessarily start on a new line. If a comma follows the prompt string in a Microsoft INPUT statement, rather than a semicolon, the question mark normally output after the prompt is omitted.

The TSC function "INCH$(n)" inputs one character from file "n". The nearest Microsoft equivalent function is "INPUT$", which has the following forms:

```
INPUT$(1)
INPUT$(1,n)
```

where the first form inputs from the keyboard and the second form inputs from file "n". In addition, PC allows the "INKEY$" function, which returns a zero, one, or two character string if no key is struck, a normal key is struck, or an extended key is struck, respectively.

The Microsoft CHAIN statement does not close files which are currently open, unlike the TSC CHAIN statement, which closes all open files. PC supports the "CHAIN MERGE" option, which causes new BASIC text to be read into memory as an overlay, rather than as a replacement.

SUMMARY

This article has discussed the similarities and differences among the various implementations of TSC BASIC and Microsoft BASIC from the viewpoint of the conversion of TSC BASIC programs to Microsoft BASIC. In particular, it covered the peculiarities of the COLOR and PC BASIC Microsoft implementations and the TSC FLEX and UNIFLEX, Extended BASIC and Pre-compiler versions and how they affect the conversion process.

The following trademarks were used in this article:

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PC is a trademark of IBM.

BIT BUCKET

Computer Publishing Centre
68 MICRO JOURNAL,
5900 Cassandra Smith,
P.O. Box 849,
Hixson, TN 37343,
U.S.A.

Dear Editor, Program Light Switch.

I have been a reader of the 68MJ since buying my first Micro Computer in '79. A SWTPC 6800 kit plus fore for 68MJ. Previous to this I spent many years with Mini computers used for Data input & processing.

Thank you for the many helpful & interesting articles in the journal over the years and I regret having waited so long before writing you.

It is hoped that this short program may encourage more interest in Computer control projects especially since OS9 permits 'concurrent' running without interfering with other uses such as Editing & Assembly.

The hardware for this project is :- 1 GND wire & 1 A7 data wire from 'A' section of a GIMIX two channel ('A' 'B') PIA board. A LED & 300 ohm resister from GND to (anode)Data bit A7.

The LED can be replaced after the initial tests by a solid state relay (in 3-24 volts d.c. out 120 v.1A max AC).

This program is written for use with a Gimix 6809 CPU board having software switched Flex/OS9. If the terminal is run with its' own keyboard & the printer is parallel, the 'A' section of Printer PIA will be available.

Please note that any 'A' or 'B' section of any PIA could be used if the relative address & initialization is changed.

	GIMIX PIA.	OTHER PIA may have.
Address = 'X'	DDRA,DRA = X	DDRA,DRA = X
	CRA = 1,X	DDRB,DRB = 1,X
	DDRB,DRB = 2,X	CRA = 2,X
	CRB = 3,X	CRB = 3,X

With Program in /D0/CMDS :- OS9:LITES & will produce 0003 and OS9:
Enter <procs> 'Enter TIME OFF & TIME ON' will appear. Type in the required times (24 hour clock) and the OS9 will output the 'procs' request. i.e. 3 @ active LITES etc.. The Program LITES is now running and cannot be cancelled except by calling:- OS9:LITES and entering a new time plus control C or 0 or entering 00 which will cancel the LITES program.

Yours sincerely,

F.W.Jones,
7,Frontenac,
Aylmer J9J 1C3
Quebec Prov.CANADA.

F.W.Jones 18 Nov.'84

```
00001
00002          *       * PROGRAM TO USE 'A' SECTION OF PIA
00003          *       *
00004          *       * TO OUTPUT 8 BITS FOR CONTROL USE.
00005
00006          *         by F.W.Jones,Aylmer,Quebec
00007
00008          *         Use 24 hour clock system and enter
00009          *         OFF-ON or ON-OFF times.
00010          *
00011          *         Enter 00 = Nil time,for OS9 return.
00012
00013                                  NAM   LITES
00014                                  OPT   O,W78,D65
00015                                  TTL   LIGHT SWITCH
00016  0003            IORDLN          SET   $03
00017  000C            IOWRLN          SET   $0C
00018  000A            FSELXP          SET   $0A
00019  0004            FSEXIT          SET   $04
00020
00021  0000 B7CD00BE                   ADD   MEMO.NAME.all.mod,ENTRY,MEMSIZE
```

```
00022
00023   E840            PIAOUT  EQU   $E840     PIA PRINTER.
00024   E550            TIME    EQU   $E550     Store ON-OFF times.
00025   E220            CLOCK   EQU   $E220
00026 D 0000            BUFFER  RMB   0
00027 D 0000            STACK   RMB   100
00028 D 006C            MEMSIZE EQU   .
00029   0000 4C4F5445   NAME    FCS   /LITE$/
00030
00031   0012 BEE840     ENTRY   LDX   #PIAOUT    Initiate PIA.
00032   0015 6F01               CLR   1,X
00033   0017 86FF               LDA   #$FF
00034   0019 A784               STA   ,X          DDRA all outputs.
00035   001B 8604               LDA   #$04
00036   001D A701               STA   1,X         Enable CRA.
00037   001F 308D007E   START   LEAX  ORDER,PCR   Get ON-OFF time
00038   0023 108E001A           LDY   #STRLEN
00039   0027 8601               LDA   #1
00040   0029 103F8C             SWI   IRQRLN      Write command
00041   002C 25AF               BCS   ERROR
00042   002E 30C4               LEAX  BUFFER,U    Temporary store
00043   0030 108E0008           LDY   #8
00044   0034 8600               LDA   #0
00045   0036 103F8B             SWI   IRQRLN      keyBoard entry
00046   0039 25A2               BCS   ERROR
00047   003B CE0000             LDU   #0000       Zero U for offset
00048   003E 8D46               BSR   HEXCVT      ASCII to Hex.
00049   0040 EDC9E550           STD   TIME,U      Store ON-OFF time
00050   0044 2029               BRA   CNTROL      in  Ram & Go.
00051   0046 3478       HEXCVT  PSHS  X,Y,U
00052   0048 108E0000   HXCVTa   LDY   #0
00053   004C E680       HXCVT1  LDB   ,X+         Get character
00054   004E C030               SUBB  #$30        less ASCII offset.
000     0050 C109       HXCVT2  CMPB  #9
0056    0052 2304               BLS   HXCVT3      If 0-9 Ok.
00057   0054 C111               CMPB  #$11
00058   0056 2515               BLS   HXCVT9      If :-? Exit.
00059   0058 C007               SUBB  #7          Adjust for A-F.
00060   005A C5F0               BITB  #$F0
00061   005C 26EF               BNE   HXCVT9      End if not 0-6f.
00062   005E 4F         HXCVT3  CLRA              Clear MS byte of D
00063   005F 1E02               EXG   D,Y         Swap new nibble &
00064   0061 58                 ASLB              total.
00065   0062 49                 ROLA
00066   0063 58                 ASLB
00067   0064 49                 ROLA
00068   0065 58                 ASLB
00069   0066 49                 ROLA
00070   0067 58                 ASLB
00071   0068 49                 ROLA
00072   0069 31A8               LEAY  D,Y         Add back 4 bits.
00073   006B 20DF               BRA   HXCVT1      Get next character
00074   006D 1F20       HXCVTe  TFR   Y,D
00075   006F 35F8               PULS  X,Y,U,PC
00076   0071 BEE550     CNTROL  LDX   #TIME
00077   0074 4F                 CLRA
00078   0075 A184               CMPA  ,X
00 9    0077 2724               BEQ   ERROR
00080   0079 A6C9E220   ONTIME   LDA   CLOCK+8,U   Clock HOUR time.
00081   007D A184               CMPA  ,X
00082   007F 2606               BNE   OFFT        Not ON go.
00083   0081 8680               LDA   #$80        MSB of 1000.
00084   0083 A7C9E840           STA   PIAOUT,U    On Data out 1.
00085   0087 E6C9E224   OFFT    LDB   CLOCK+4,U   Is it OFF ?
00086   008B E101               CMPB  1,X         Check preset time.
00087   008D 26E2               BNE   CNTROL      Not Off Go check ON.
00088   008F C400               LDB   #$00        Yes off bit 1.
00089   0091 E7C9E840           STB   PIAOUT,U
00090   0095 8E0001     LOOP    LDX   #$0001      W it for 1 tick.
00091   0098 103F0A             SWI   FASLEP
00092   009B 2004               BRA   CNTROL      Go check ON again.
00093   009D 3F         ERROR   CLRB
00094   009E 103F06             SWI   F.EXIT      Error Go home.
00095   00A1 4545E5445  ORDER   FCC   /ENTER TIME ON & TIME OFF/
00096   00B9 0A0D               FCB   $0A,$0D
00097   00BA            STRLEN  EQU   *-ORDER
00098   00BE 19FF884            DAA
00099   00BE            MEMO    EQU   *
00100                   END

00000 error(s)
00000 warning(s)
00BE 00190 Program bytes generated
00BE 00108 data bytes allocated
01C9 00457 bytes used for symbols
```

COMPUTER EXCELLENCE INC.
4834 N.E. 12th Ave
Fort Lauderdale, FL 33334
305 752-8321

Nov. 12, 1984

Don Williams Sr.
P. O. Box 849
Dixon, TN 37343

Dear Don:

The price of 256K DRAM chips has dropped significantly in the last 90 days. We would like to announce an immediate price reduction. The 1 Meg. card will be $1595.. the 512K card will be $1095. and the 256K and 128K cards remain the same, $750. & $595. We will also sell the PC card for $100.

Thank you:

T. D. Farnsworth
Vice President

4208 49th Street
Lubbock TX 79413
16 November 1984

6800 Micro Journal
PO Box 848
Dixon TN 37343

Dear Ed:

HELP

I have enjoyed my 6800 system (mixture of SW.Dixie,etc) for many years with the aid of your great magazine. Finally however I decided to upgrade to the 6809 using Data Systems 68 boards. First the mother board with my old 6800 system. All went well and I became to busy to continue. Now some nine months (give or take a few more) later I am trying to bring up the rest of the system, still using the boards from Data Systems 68. I kept the same address I/O option and put my terminal at $D004. So far I have not even been able to bring up the D-bug prompt with just the CPU an memory installed. Yes I did change the I/O address switch and I have memory continuous from 0000to DFFF.

Certainly many of your readers must have tried this system with varying degrees of success. Have I forgotten some simple little thing? Your help will be gratefully received. Thanks.

Respectfully

Bill

W. B. Jarzembski

P.S. I would have put this on disk but my system is down.

FLEX Equates

The listing of FLEX equates contains most of the storage locations, DOS user callable subroutines, and various dummy data structures and equates needed for proper 6809 assembly language programming. All equated values were taken from the TSC FLEX Programmer's Manual for the 6809 version of FLEX.

Any of you out there who have programmed in IBM 360/370 assembler know the use of a DSECT (Dummy Section). I have defined Dsects for an FCB (File Control Block) and a SIR (System Information Record). The format described by a Dsect may be associated with a particular area of storage. For example, to access the various fields within an FCB, an index register should contain the address of an FCB storage area. It is then just a matter of using the variables in the FCB Dsect, along with the index register, to access any field in the area.

```
Example:
          LDX   #SYSFCB   X-> FCB storage area
          LDD     #SIRTS    point to System Info
Record
          STD   FCBCP,X   set trk/sec in FCB
          LDA   #XRSS     get function code to read
          STA   FCBFC,X   save code in FCB
          JSR   FMSCAL    read the SIR from disk
          BCS   ERROR     branch if error
          LDY     #SIRFCB+FCBSB  point to SIR's
sector buffer
          LDD   SIRVOL,Y  get volume# of disk
                .
                .
                .
```

```
*
* FLEX Subroutine Linkages
*
CD00  FLEX    EQU   $CD00
CD00  COLDS   EQU   FLEX+$00   coldstart entry point
CD03  WARMS   EQU   FLEX+$03   warmstart entry point
CD06  RENTER  EQU   FLEX+$06   DOS main loop re-entry point
CD09  INCH    EQU   FLEX+$09   input character
CD0C  INCH2   EQU   FLEX+$0C   input character
CD0F  OUTCH   EQU   FLEX+$0F   output character
CD12  OUTCH2  EQU   FLEX+$12   output character
CD15  GETCHR  EQU   FLEX+$15   get character
CD18  PUTCHR  EQU   FLEX+$18   put character
CD1B  INBUF   EQU   FLEX+$1B   input into line buffer
CD1E  PSTRNG  EQU   FLEX+$1E   print string with crlf
CD21  CLASS   EQU   FLEX+$21   classify character
CD24  PCRLF   EQU   FLEX+$24   print CR and LF
CD27  NXTCH   EQU   FLEX+$27   get next buffer character
CD2A  RSTRIO  EQU   FLEX+$2A   restore I/O vectors
CD2D  GETFIL  EQU   FLEX+$2D   get file specification
CD30  LOAD    EQU   FLEX+$30   file loader
CD33  SETEXT  EQU   FLEX+$33   set extension
```

```
0000 BIN    EQU   0          **
0001 TXT    EQU   1          **
0002 CMD    EQU   2          **
0003 BAS    EQU   3          **
0004 SYS    EQU   4          **
0005 BAC    EQU   5          **
0006 SCR    EQU   6          **
0007 DAT    EQU   7          **
0008 BAC    EQU   8          **
0009 DIR    EQU   9          **
000A PRT    EQU   10         **
000B OUT    EQU   11         **
CD36 ADDBX  EQU   FLEX+$36   add B-register to X-register
CD39 OUTDEC EQU   FLEX+$39   output decimal number
CD3C OUTHEX EQU   FLEX+$3C   output hexadecimal number
CD3F RPTERR EQU   FLEX+$3F   report error
CD42 GETHEX EQU   FLEX+$42   get hexadecimal number
CD45 OUTADR EQU   FLEX+$45   output hexadecimal address
CD48 INDEC  EQU   FLEX+$48   output decimal number
CD48 DOSCMD EQU   FLEX+$4B   call DOS as a subroutine
CD4E STAT   EQU   FLEX+$4E   check terminal input status
            *
            * File Management System Entry Points
            *
C840 SYSFCB EQU   $C840      System FCB
D400 FMS    EQU   $D400      File Management System entry
D400 FMSINT EQU   FMS+$00    FMS Initialization
D403 FMSCLS EQU   FMS+$03    FMS close
D406 FMSCAL EQU   FMS+$06    FMS call


            *
            * Global Variables
            *
0409 FCBASE EQU   FMS+$09    FCB base pointer
0408 FCBCUR EQU   FMS+$08    current FCB address
0435 FCBVER EQU   FMS+$35    verify flag
            *
            * DOS memory map
            *
C080 LNEBUF EQU   $C080      to $C0FF (128 byte line buf)
CC00 MAP    EQU   $CC00      start of map
CC00 BS     EQU   MAP+$00    TTYSET backspace char
CC01 DEL    EQU   MAP+$01    TTYSET delete character
CC02 EOL    EQU   MAP+$02    TTYSET end of line character
CC03 DEPTH  EQU   MAP+$03    TTYSET depth count
CC04 WIDTH  EQU   MAP+$04    TTYSET width count
CC05 NULL   EQU   MAP+$05    TTYSET null count
CC06 TAB    EQU   MAP+$06    TTYSET tab character
CC07 BSE    EQU   MAP+$07    TTYSET backspace echo character
CC08 EJECT  EQU   MAP+$08    TTYSET eject count
CC09 PAU    EQU   MAP+$09    TTYSET pause control
CC0A ESC    EQU   MAP+$0A    TTYSET escape character
CC0B SYDRV  EQU   MAP+$0B    system drive number
CC0C WKDRV  EQU   MAP+$0C    work drive number
CC0D SYSCR1 EQU   MAP+$0D    system scratch
CC0E SYDR   EQU   MAP+$0E    system date registers
CC11 LSTRM  EQU   MAP+$11    last terminator
CC12 UCTA   EQU   MAP+$12    user command table address
CC14 BUFPNT EQU   MAP+$14    line buffer pointer
CC16 ESCRR  EQU   MAP+$16    escape return register
CC18 CURC   EQU   MAP+$18    current character
CC19 PREVC  EQU   MAP+$19    previous character
CC1A CLN    EQU   MAP+$1A    current line number
CC1B LAO    EQU   MAP+$1B    loader address offset
CC1D TRFLG  EQU   MAP+$1D    transfer flag
CC1E TRADDR EQU   MAP+$1E    transfer address
CC20 FMSERR EQU   MAP+$20    error type
CC21 IOFLG  EQU   MAP+$21    special I/O flag
CC22 DSWTCH EQU   MAP+$22    output switch
CC23 ISWTCH EQU   MAP+$23    input switch
CC24 FOA    EQU   MAP+$24    file output address
CC26 FIA    EQU   MAP+$26    file input address
CC28 CMDFLG EQU   MAP+$28    command flag
CC29 COC    EQU   MAP+$29    current output column
CC2A SYSCR2 EQU   MAP+$2A    system scratch
CC2B MEMEND EQU   MAP+$2B    memory end
CC2D ERV    EQU   MAP+$2D    error name vector
CC2F FIEF   EQU   MAP+$2F    file input echo flag
CC30 SYSCR3 EQU   MAP+$30    system scratch
CC4E SYSCON EQU   MAP+$4E    system constants
CCC0 PRINIT EQU   MAP+$C0    printer initialize
CCD8 PRCHK  EQU   MAP+$D8    printer readr check
CCE4 POUT   EQU   MAP+$E4    printer output
CCF8 SYSCR4 EQU   MAP+$F8    system scratch


            *
            * Dsect for an FCB
            *
0000                ORG   $0000
0000        FCBFC   RMB   1          function code
0001        FCBESB  RMB   1          error status byte
0002        FCBAS   RMB   1          activity status
       0001 ASREAD  EQU   1          **open for read
       0002 ASWRIT  EQU   2          **open for write
0003        FCBDN   RMB   1          drive number
0004        FCBNAM  RMB   8          file name
000C                RMB   3          extension
000F        FCBFA   RMB   1          file attributes
       0080 FAWP    EQU   %10000000 **write protect
       0040 FADP    EQU   %01000000 **delete protect
       0020 FARP    EQU   %00100000 **read protect
       0010 FACP    EQU   %00010000 ** catalog protect
0010        FCBRS1  RMB   1          reserved for future use
0011        FCBSDA  RMB   2          starting disk addr of file
0013        FCBEDA  RMB   2          ending disk addr of file
0015        FCBFS   RMB   2          file size
0017        FCBFSM  RMB   1          file sector map indicator
       0000 FSMSEQ  EQU   0          **sequential file
       0002 FSMRAN  EQU   2          **random file
0018        FCBRS2  RMB   1          reserved for future use
       0019 FCBFCD  EQU   *          file creation date
0019        FCDMTH  RMB   1          **month
001A        FCDDAY  RMB   1          **day
001B        FCDYR   RMB   1          **year
001C        FCBLP   RMB   2          FCB list pointer
001E        FCBCP   RMB   2          trk/sec currently in sec buff
0020        FCBCRN  RMB   2          current record number
0022        FCBDI   RMB   1          data index
0023        FCBRI   RMB   1          random index
0024        FCBNAB  RMB   11         name work buffer
002F        FCBCDA  RMB   3          current directory address
0032        FCBFDD  RMB   3          first deleted dir ptr
0035        FCBSCH  RMB   11         scratch bytes
0038                ORG   FCBSCR+6
0038        FCBSCF  RMB   1          space compression flag
       0000 SCFSC   EQU   $00        **perform space compr.
       00FF SCFNSC  EQU   $FF        **perform no space compr.
0040                ORG   FCBSBR+11
       0040 FCBSB   EQU   *          sector buffer
0040        SBLINK  RMB   2          next trk/sector in chain
0042        SBRS1   RMB   2          reserved for future use
0044        SBDATA  RMB   252        data storage
       0140 FCBLEN  EQU   *          length of FCB

            *
            * Function Codes
            *
0000 IRWNB  EQU   0          read/write next byte/char
0001 IOREAD EQU   1          open for read
0002 IOWRIT EQU   2          open for write
0003 IOUPDT EQU   3          open for update
0004 ICLOSE EQU   4          close file
0005 IREWND EQU   5          rewind file
0006 IODIR  EQU   6          open directory
0007 IGIR   EQU   7          get information record
0008 IPIR   EQU   8          put information record
0009 IRSS   EQU   9          read single sector
000A IWSS   EQU   10         write single sector
000B IRES1  EQU   11         reserved for future use
000C IDELET EQU   12         delete file
000D IREMAM EQU   13         rename file
000E IRES2  EQU   14         reserved for future use
000F INSS   EQU   15         next sequential sector
0010 IOSIR  EQU   16         open system info rec
```

```
                0011  XGRB    EQU   17        get random byte from sector
                0012  XPRB    EQU   18        put random byte in sector
                0013  XRES3   EQU   19        reserved for future use
                0014  XFND    EQU   20        find next drive
                0015  XPOSN   EQU   21        position to record n
                0016  XBOR    EQU   22        backup one record
                      *
                      * Dsect for a SIR
                      *
0000                  SIR     ORG   $0000
0000                          RMB   16        16 byte header
0010                  SIRNAM  RMB   8         volume name
0018                          RMB   3         extension
001B                  SIRVOL  RMB   2         volume number
001D                  SIRFSB  RMB   2         beginning of free chain
001F                  SIRFSE  RMB   2         end of free chain
0021                  SIRFSS  RMB   2         # sectors in free chain
                0023  SIRCRE  EQU   *         creation date of disk
0023                  SIRMTH  RMB   1         ##month
0024                  SIRDAY  RMB   1         ##day
0025                  SIRYR   RMB   1         ##year
0026                  SIRMTS  RMB   2         maximum trk/sec available
                0028  SIRLEN  EQU   *         SIR length
                      *
                      * Miscellanious equates
                      *
0003  SIRTS   EQU   $0003    trk/sec of SIR
0005  DIRTS   EQU   $0005    trk/sec of 1st node in dir
                      *
0004  EOT     EQU   4         end of text delimiter
000A  CRLF    EQU   $0D0A     carriage return, line feed
000D  CR      EQU   $0D       carriage return
000A  LF      EQU   $0A       line feed
0007  BELL    EQU   $07       bell
0020  SP      EQU   $20       space
                      *
0000  URAM    EQU   $0000     to $BFFF (User RAM area)
C000  STKA    EQU   $C000     to $C07F (SP inited to C07F)
C100  UCA     EQU   $C100     to $CAFF (Util Cmd Area)
C700  SPS     EQU   $C700     to $C83F (Schdlr & Spooler)
C980  SFA     EQU   $C980     to CBFF (System Files Area)
CC00  DOS     EQU   $CC00     to D3FF (DOS)
F700  CLOCK   EQU   $F700     real time clock (DOS)
DE00  DDRV    EQU   $DE00     to DFFF (Disk Drivers)
                      OPT   LIS
```

SYMBOL TABLE:

```
ADDBX  CD36  ASREAD 0001  ASWRIT 0002  BAC    0008  BAK    0005
BAS    0003  BELL   0007  BIN    0000  BS     CC00  BSE    CC07
BUFPNT CC14  CLASS  CD21  CLN    CC1A  CLOCK  F700  CMD    0002
CMDFLG CC28  COC    CC29  COLDS  CD00  CR     000D  CRLF   000A
CURC   CC18  DAT    0007  DDRV   DE00  DEL    CC01  DEPTH  CC03
DIR    0009  DIRTS  0005  DOCMND CD4B  DOS    CC00  EJECT  CC08
ENV    CC2D  EOL    CC02  EOT    0004  ESC    CC0A  ESCRX  CC16
FACP   0010  FADP   0040  FARP   0020  FAWP   0080  FCBAS  0002
FCBASE D409  FCBCDA 002F  FCBCP  001E  FCBCRN 0020  FCBCUR D40B
FCBDI  0022  FCBDN  0003  FCBEDA 0013  FCBESB 0001  FCBFA  000F
FCBFC  0000  FCBFND 0019  FCBFRD 0032  FCBFS  0015  FCBFSM 0017
FCBLEN 0140  FCBLP  001C  FCBNAM 0004  FCBNAB 0024  FCBRI  0023
FCBRS1 0010  FCBRS2 0018  FCBSB  0040  FCBSCF 003B  FCBSCR 0035
FCBSDA 0011  FCBVER D435  FCBDAY 001A  FCBMTH 0019  FCBYR  001B
FIA    CC26  FIEF   CC2F  FLEX   CD00  FMS    D400  FMSCAL D406
FMSCLS D403  FMSERR CC20  FMSINT D400  FOA    CC24  FSMRAM 0002
FSMSBQ 0000  GETCHR CD15  GETFIL CD2D  GETHEX CD42  INBUF  CD1B
INCH   CD09  INCH2  CD0C  INDEC  CD48  IOFLG  CC21  ISWTCH CC23
LAO    CC1B  LF     000A  LNEBUF CC80  LOAD   CD30  LSTRM  CC11
MAP    CC00  MEMEND CC2B  NULL   CC05  NXTCH1 CD27  OSWTCH CC22
OUT    0008  OUTADR CD45  OUTCH  CD0F  OUTCH2 CD12  OUTDEC CD39
OUTHEX CD3C  PAU    CC09  PCRLF  CD24  POUT   CDE4  PRCHK  CCD8
PREVC  CC19  PRINIT CCC0  PRT    000A  PSTRNG CD1E  PUTCHR CD18
RENTER CD06  RPTERR CD3F  RSTRIO CD2A  SBDATA 0044  SBLINK 0040
SBRS1  0042  SDFNSC 00FF  SDFSC  0000  SDR    0006  SETEXT CD33
SFA    C980  SIRCRE 0023  SIRDAY 0024  SIRFSB 001D  SIRFSE 001F
SIRFSS 0021  SIRLEN 0028  SIRMTH 0023  SIRMTS 0026  SIRNAM 0010
SIRTS  0003  SIRVOL 0018  SIRYR  0025  SP     0020  SPS    C700
STAT   CD4E  STKA   C000  SYDR   CC0E  SYDRV  CC0B  SYS    0004
SYSCON CC4E  SYSCRI CC0D  SYSCR2 CC2A  SYSCR3 CC30  SYSCR4 CCF8
SYSFCB C840  TAB    CC06  TRADDR CC1E  TRFLG  CC1D  TXT    0001
UCA    C100  UCTA   CC12  URAM   0000  WARMS  CD03  WIDTH  CC04
WKDRV  CC0C  XBOR   0016  XCLOSE 0004  XDELET 000C  XFND   0014
XGIR   0007  XGRB   0011  XNSS   000F  XODIR  0006  XOREAD 0001
XOSIR  0010  XOUPDT 0003  XOWRIT 0002  XPIR   0008  XPOSN  0015
XPRB   0012  XRENAM 0000  XRES1  000B  XRES2  000E  XRES3  0013
XREWND 0005  XRSS   0009  XRWNB  0000  XWSS   000A
```


DAVID V. OADBY
2, LUPIN CLOSE
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LEICESTERSHIRE LE10 2UJ
ENGLAND

JUST A COUPLE OF PROGRAMS THAT MAY BE USEFUL TO FELLOW 68XX USERS. I'M SORRY THERE IS NO LOWER CASE BUT MY USED ADM3 HASNT GOT A LOWER CASE GENERATOR FITTED YET.. [ANYONE GOT A MANUAL ?].

THE FIRST SET OF PROGRAMS IS A PASCAL PROGRAM [LUCIDATA] WHICH DOES DIRECT INPUT-OUTPUT WITH THE TERMINAL USING AN EXTERNAL PROCEDURE. IF NOTHING ELSE IT SHOWS THAT IT WORKS. ACTUALLY IT IS PART OF AN ON-SCREEN WORD PROCESSING SYSTEM THAT I AM DEVELOPING..

IF YOU ARE A FLEX09 USER AND YOU HAVE ALWAYS WANTED A FUNCTION KEY FACILITY THEN READ ON. THERE ARE TWO PROGRAMS AND THEY WORK TOGETHER. THE FKEY CODE OVERLAYS THE FLEX INPUT VECTORS AND INTERCEPTS ALL KEY INPUTS IN ORDER TO TRAP THE FUNCTION KEY REQUEST (CURRENTLY THE TAB KEY).

THE FUNLOAD PROGRAM ALLOWS YOU TO LOAD PRESET FUNCTION KEY VALUES FROM A TEXT FILE. THE COMMENTED CODE SHOULD PROVIDE ALL THE OTHER DETAILS..

FINALLY I HAVE JUST JOINED A COMPANY WHICH IS SELLING A 68000 BASED MACHINE SO ITS MOTOROLA ALL THE WAY.....

```
 0 PROGRAM KEYIO;
 0 (*
 0    AUTHOR  : D.V.OADBY
 0    CREATE  : 29/ /82
 0    EDIT    : 25/6/82
 0    FILENAME: LINEDIA
 0    VERSION : 1.2 - { LUCIDATA PASCAL V 3.9 }
 0
 0    THIS PROGRAM ALLOWS DIRECT KEYBOARD INPUT/OUTPUT
 0    USING AN EXTERNAL PROCEDURE KEYIO. ALL KEYBOARD
 0    CODES ARE RETURNED TO THE PROGRAM AND THIS ALLOWS
 0    THE PROGRAMMER TO USE CONTROL CODES WHICH ARE NOT
 0    NORMALLY PASSED BACK TO THE PROGRAM.
 0    KEYIO IS CALLED WITH A FUNCTION CODE WHICH DETERMINES THE
 0    ACTION OF THE EXTERNAL PROCEDURE. ALTHOUGH ONLY READ,WRITE
 0    AND ECHO ARE IMPLEMENTED MANY OTHER POSSIBILITIES EXIST.
 0 *)
 0
 0 CONST
 0    EXTKEY =$F200; (* ADDRESS OF EXTERNAL PROCEDURE *)
 0    FREAD  =$01; (* READ KEYBOARD *)
 0    FWRITE =$02; (* WRITE TO SCREEN *)
 0    ECHOFF =$03; (* TURN ECHO OFF *)
 0    ECHOON =$04; (* TURN ECHO ON *)
 0    FINISH =CHR($16); (* TERMINATE CHARACTER *)
 0
 0 VAR
 0    CHR1:CHAR;
 0
 0 PROCEDURE KEYIO(VAR CHR:CHAR;FUNCTION:BYTE);
 4 EXTERNAL EXTKEY;
 4
 4 (* MAIN PROGRAM - TO SEE HOW IT WORKS *)
 4 BEGIN
 8    WRITELN(' KEYIO TEST PROGRAM TYPE CTRL Z TO TERMINATE.');
44    KEYIO(CHR1,ECHOFF); (* TURN OFF ECHO *)
84    REPEAT
84       WRITELN;
88       WRITE(' INPUT A CHARACTER :');
116      KEYIO(CHR1,FREAD);
136      WRITE(' CHARACTER IS:');
156      KEYIO(CHR1,FWRITE);
176      WRITELN (' CHAR VAL IS '.ORD(CHR1));
212   UNTIL CHR1=FINISH;
224   WRITE('NOW ENTER A CHARACTER :');
256   KEYIO(CHR1,ECHOON); (* RESTORE ECHO*)
276   KEYIO(CHR1,FREAD);
296   WRITELN('<-- IF ECHO WAS RESTORED THEN LAST INPUT SHOULD BE SEEN');
344 END.
344 BYTES
END OF PASS 1
END OF PASS 2
OK  TO RUN
```

```
                        NAM     KEYIO

                * AUTHOR   : D.V.GOADBY
                * CREATE   : 24/6/82
                * EDIT     : 25/6/82
                * FILENAME : INOUT1.ASM
                * VERSION  : 1.1 - I FOR USE WITH LUCIDATA PASCAL V 2.9 & PS

                * THIS CODE IS THE EXTERNAL PROCEDURE KEYIO
                * CALLED EXTERNALLY FROM THE PASCAL PROGRAM.
                * THE FORMAT IS EXPLAINED IN THE PASCAL LISTING.

                * LUCIDATA PARAMETERS ARE PLACED ON A STACK POINTED TO
                * BY A TERM CALLED MARKUS. THE FIRST 6 BYTES ARE THE
                * ACTIVATION RECORD AND ARE NOT TO BE TOUCHED.
                * MARKUS+6 CONTAINS THE POINTER TO THE CHARACTER VARIABLE.
                * MARKUS+8 CONTAINS THE ACTUAL FUNCTION CODE .

                * EQUATES

           F200 PROLOC  EQU     $F200      LOCATION OF THIS PROGRAM
           0144 MARKUS  EQU     $144       BASE OF STACK FOR USER CALL
           F06C ECHO    EQU     $F06C      CONTAINS ADDRESS OF ECHO ROUTINE 1
           F05E ECHOAD  EQU     $F05E      ACTUAL ADDRESS OF ECHO ROUTINE
           F044 PSYINP  EQU     $F044      PSYMON INPUT ROUTINE
           F058 PSYOUT  EQU     $F058      PSYMON OUTPUT ROUTINE

                * FUNCTION CODE EQUATES

           0001 READ    EQU     1          READ KEYBOARD
           0002 WRITE   EQU     2          WRITE TO SCREEN
           0003 ECHOFF  EQU     3          TURN OFF ECHO
           0004 ECHON   EQU     4          RESTORE ECHO

F200                    ORG     PROLOC

           F200 ENTRY   EQU     *
F200 BE    0144         LDX     MARKUS     GET STACK POINTER
F203 A6    08           LDA     8,X        GET FUNCTION CODE
F205 81    01           CMPA    &READ
F207 27    1A           BEQ     READ1
F209 81    02           CMPA    &WRITE
F20B 27    1D           BEQ     WRITE1
F20D 81    03           CMPA    &ECHOFF
F20F 26    09           BNE     ECHOON
F211 108E 0000          LDY     &0
F215 10BF F06C          STY     ECHO       CLEAR ECHO ADDRESS
F219 39                 RTS
F21A 10BE F05E  ECHOON  LDY     &ECHOAD
F21E 10BF F06C          STY     ECHO       PUT BACK ECHO ADDRESS
F222 39                 RTS                IGNORE OTHER CODES

                * READ ROUTINE

F223 BD    F044 READ1   JSR     PSYINP     GET KEY VALUE
F226 A7    98 06        STA     [6,X]      PUT RESULT ON STACK
F229 39                 RTS

                * WRITE ROUTINE

F22A A6    98 06 WRITE1 LDA     [6,X]      GET DATA
F22D BD    F058         JSR     PSYOUT
F230 39                 RTS

                        END

0 ERROR(S) DETECTED

SYMBOL TABLE:

ECHO   F06C  ECHOAD F05E  ECHOFF 0003  ECHON  0004  ECHOON F21A
ENTRY  F200  MARKUS 0144  PROLOC F200  PSYINP F044  PSYOUT F058
READ   0001  READ1  F223  WRITE  0002  WRITE1 F22A
```

```
*****************************************************
* PROGRAM  : FUNCTION KEYS                          *
* AUTHOR   : DAVID V. GOADBY                        *
* CREATE   : 9/9/80                                 *
* EDIT     : 19/3/81                                *
* FILENAME : 14.FKEY09.TXT                          *
* VERSION  : 1.3 FLEX09/PSYMON                      *
*****************************************************

* THIS PROGRAM ALLOWS THE USER TO DEFINE 9 FUNCTION
* KEY STRINGS.
* THE PROGRAM INTERCEPTS THE NORMAL FLEX INPUT
* FROM THE KEYBOARD AND CHECKS FOR THE TAB KEY.
* THE TAB KEY WAS MY CHOICE FOR THE TRIGGER BUT YOU
* CAN CHANGE IT TO ANYTHING YOU LIKE.
* IF THE TAB CHARACTER IS DETECTED THEN THE NEXT
* CHARACTER IS CHECKED FOR A VALUE OF 1-9 SIGNIFYING
* A FUNCTION KEY REQUEST. IF THE VALUE IS 0 THEN THIS
* INDICATES AN EDIT REQUEST. THE EDIT FUNCTION ALLOWS
* THE USER TO DISPLAY AND ALTER ANY OF THE FUNCTION
* STRINGS CURRENTLY HELD. THE SYSTEM HAS A STANDARD
* SET OF COMMANDS INITIALLY.
* THERE ARE 9 FUNCTION KEYS AND EACH KEY CAN HAVE A
* 24 CHARACTER STRING ASSIGNED TO IT. THE STRING LENGTH CAN
* BE ALTERED BY CHANGING THE CONSTANT LINEL.
* IF THE STRING IS TERMINATED WITH A \ THEN FURTHER USER
* INPUT IS WAITED FOR. OTHERWISE A COMPLETE STRING PLUS
* A CARRIAGE RETURN IS SENT TO FLEX.
* THE ACTUAL FUNCTION KEY CONSISTS OF A TWO KEY
* SEQUENCE TAB-NUM .THE TAB KEY (09) TRIGGERS
* A TRAP WHICH CHECKS THE FOLLOWING KEY VALUE.
* IF THE KEY IS 1 TO 9 THEN THE PARTICULAR FUNCTION
* DESCRIBED BY THAT KEY IS SENT TO FLEX.
* A KEY VALUE OF 0 INDICATES THAT THE
* USER WISHES TO EDIT ONE OF THE PREDESCRIBED
* FUNCTIONS. AFTER A 0 THE NEXT CHARACTER SHOULD
* BE 1-9 AND THE FUNCTION VALUE WILL BE DISPLAYED.
* THE USER THEN ENTERS N FOR NO ACTION OR R FOR
* REPLACE FOLLOWED BY THE NEW STRING.
* A COMPANION PROGRAM CALLED FUNLOAD CAN BE USED
* TO PRELOAD THE TABLE WITH OTHER STRING SETS.
* THE USER CAN HAVE A DIFFERENT SET OF FUNCTION KEYS
* FOR DIFFERENT APPLICATIONS EG BASIC,ASSEMBLER ETC.

* MY SYSTEM HAS A FULL COMPLEMENT OF MEMORY SO
* I LOCATED THE CODE BELOW $C000. A CLOSE
* LOOK AT THE ORG STATEMENTS SHOULD REVEAL HOW
* I DID IT. (HINT: I ASSEMBLED IT TWICE).

        * SPECIFIC EQUATES

0018 LINEL   EQU    24         LINE LENGTH ( INCL CR)
0009 TRIGGR  EQU    $09        TAB CHARACTER FOR TRIGGER

        * FLEX EQUATES

           C000 BACK    EQU     $C000      BACKSPACE ON TERMINAL
           CD03 FWARMS  EQU     $CD03      WARM START
           CD09 FINP1   EQU     $CD09      FLEX CALLS EIAC HERE.
           CD0C FINP2   EQU     $CD0C      AND HERE.....
           FD58 OUTPUT  EQU     $FD58      PSYMON OUTPUT ROUTINE
           FD44 INPUT   EQU     $FD44      PSYMON INPUT ROUTINE

           FDA2 CRLF    EQU     $FDA2      PSYMON CRLF

                * FLEX OVERLAYS

CD0A                    ORG     FINP1+1    FLEX INPUT VECTOR
CD0A BE56               FDB     START
CD0D                    ORG     FINP2+1
CD0D BE56               FDB     START

                * ORIGIN AS HIGH AS POSSIBLE

           01AA PROGL1  EQU     PROGEND-START LENGTH OF CODE
           01AA PROGL   EQU     $01AA      FROM ABOVE
BE56                    ORG     $C000-PROGL PUT RIGHT OUT OF THE WAY

                * MAIN PROGRAM

BE56 34    04   START   PSHS
BE58 BF    BE70         STX     XSAVE
BE5B 7D    BE75         TST     FLAG       IS DIVERT STILL ON
BE5E 26    27           BNE     FINPT      GET BUFFER INPUT
BE60 BD    FD44 START1  JSR     INPUT      GET CHARACTER AS NORMAL
BE63 81    09           CMPA    &$09       TAB ? ** CHANGE T IS IF YOU LIKE
BE65 27    0F           BEQ     TRAP1
BE67 BF    BE72 RETURN  STX     XSAVE1     SAVE BUFFER POINTER
BE6A 35    04           PULS
BE6C BE    BE70         LDX     XSAVE
BE6F 39                 RTS
BE70            XSAVE   RMB     2
BE72            XSAVE1  RMB     2
BE74            FNUM    RMB     1          FUNCTION KEY NUMBER
BE75 00         FLAG    FCB     0          DIVERT FLAG

           BE76 TRAP1   EQU     *
                * JSR BACKSPACE  NEEDED FOR SOME TERMINALS
BE76 BD    FD44         JSR     INPUT      GET NEXT CHARACTER
BE79 BD    BF1C         JSR     BSPACE
BE7C 81    30   EDITCH  CMPA    &'0        EDIT REQUIRED ?
BE7E 27    25           BEQ     EDIT
BE80 8D    7C           BSR     VALID      CHECK 1-9 AND GET ADDRESS OF CMD.
BE82 25    DC           BCS     START1     INVALID
BE84 73    BE75         COM     FLAG       SET DIVERSION
BE87 BE    BE72 FINPT   LDX     XSAVE1
BE8A A6    84           LDAA    0,X        GET NEXT CHARACTER
BE8C 81    0D           CMPA    &$0D       END OF STRING ?
BE8E 26    05           BNE     CHKNXT
BE90 7F    BE75 FUNCNT  CLR     FLAG       SET TO NORMAL
BE93 20    D2           BRA     RETURN
BE95 81    5C   CHKNXT  CMPA    &'\        USER INPUT REQUIRED ?
BE97 26    05           BNE     DISPL1
BE99 7F    BE75         CLR     FLAG       SET TO NORMAL
BE9C 20    C2           BRA     START1     GET USER INPUT
BE9E BD    FD58 DISPL1  JSR     OUTPUT     SEND CHARACTER TO TERMINAL
BEA1 30    01           INX                POINT TO NEXT ENTRY
BEA3 20    C2           BRA     RETURN

BEA5 BD    FD44 EDIT    JSR     INPUT      GET FUNCTION NO.
BEA8 8D    72           BSR     BSPACE
BEAA 8D    52           BSR     VALID      SEE IF 1-9 AND GET ADDRESS
BEAC 25    B2           BCS     START1     ERROR
BEAE BF    BE72         STX     XSAVE1     SAVE ENTRY VALUE

                * DISPLAY FUNCTION KEY CONTENTS

BEB1 86    46   DISPLAY LDAA    &'F

BEB3 BD    FD58         JSR     OUTPUT
BEB6 B6    BE74         LDAA    FNUM       GET NUMBER
BEB9 BD    FD58         JSR     OUTPUT
BEBC 86    3D           LDAA    &'=
BEBE BD    FD58         JSR     OUTPUT
BEC1 BE    BE72         LDX     XSAVE1
BEC4 A6    80   PLOOP   LDAA    0,X+       GET CHARACTER
BEC6 81    0D           CMPA    &$0D       EOL ?
BEC8 27    09           BEQ     EDNEXT
BECA BD    FD58         JSR     OUTPUT
BECD 20    F5           BRA     PLOOP      PRINT THE REST
BECF 86    0D   START2  LDAA    &$0D       SEND CR TO FLEX
BED1 20    94           BRA     RETURN
                * NOW CHECK FOR R
BED3 86    3A   EDNEXT  LDAA    &':        SEPERATOR
BED5 BD    FD58         JSR     OUTPUT
BED8 BD    FD44         JSR     INPUT      GET OPTION
BEDB 81    52           CMPA    &'R        REPLACE ?
BEDD 26    F0           BNE     START2
                * ENTER NEW STRING
BEDF 86    3D           LDAA    &'=        SIGNIFY START OF STRING
BEE1 BD    FD58         JSR     OUTPUT
BEE4 BE    BE72         LDX     XSAVE1     GET TABLE ENTRY
BEE7 C6    17           LDAB    &LINEL-1   LENGTH OF BUFFER-1
BEE9 BD    FD44 EDLOOP  JSR     INPUT      GET NEXT CHARACTER
BEEC A7    80           STAA    0,X+       SAVE ASSIGNED STRING IN TABLE
BEEE 81    0D           CMPA    &$0D       FINISHED ?
BEF0 27    07           BEQ     DONE
BEF2 5A                 DECB
BEF3 26    F4           BNE     EDLOOP     GET SOME MORE
BEF5 86    0D           LDAA    &$0D       FORCE CR
BEF7 A7    80           STAA    0,X+
BEF9 BD    FDA2 DONE    JSR     CRLF
BEFC 20    B3           BRA     DISPLAY    SHOW NEW ENTRY AND WAIT FOR R OR N

                * THIS ROUTINE VALIDATES THE FKEY NUMBER 1-9 AND
                * RETURNS THE ACTUAL ADDRESS OF THE STRING IN X
                * IF VALIDATION FAILS THEN THE CARRY BIT IS SET.

BEFE B7    BE74 VALID   STAA    FNUM       SAVE FUNCTION NUMBER
BF01 81    30           CMPA    &'0
BF03 23    14           BLS     ERROR
BF05 81    39           CMPA    &'9
BF07 22    10           BHI     ERROR
BF09 80    31           SUBA    &'1        SET TO BINARY-1
BF0B 8E    BF27         LDX     &TABLE
                * MULTIPLY A BY LINEL TO INDEX INTO TABLE
                * THANKS FOR 6809
                * THEN ADD TO X TO POINT TO ENTRY.
BF0E C6    18           LDB     &LINEL     GET LINE LENGTH
BF10 3D                 MUL                A*B->D
BF11 30    8B           LEAX    D,X        X=X+D
BF13 BF    BE72         STX     XSAVE1
BF16 1C    FE           CLC                OK
BF18 39                 RTS
BF19 1A    01   ERROR   SEC                NOT OK
BF1B 39                 RTS
BF1C 34    02   BSPACE  PSHA
```

```
BF1E B6 CD00            LDAA   BACK      GET BACKSPACE CHAR
BF21 BD FD58            JSR    OUTPUT
BF24 35 02              PULA
BF26 39                 RTS

                * TABLE OF PRESET COMMANDS


                BF27    TABL   EQU    *
BF27 44 49 52           FCC    /DIR/
BF2A 0D                 FCB    $D
BF2B                    ORG    1+LINEL+TABLE
BF3F 4C 49 53 54        FCC    /LIST.\/
BF43 2C 5C
BF45 0D                 FCB    $D
BF57                    ORG    2+LINEL+TABLE
BF57 50 44 45 4C        FCC    /PDEL.\/
BF5B 2C 5C
BF5D 0D                 FCB    $D
BF69                    ORG    3+LINEL+TABLE
BF6F 45 44 49 54        FCC    /EDIT.\/
BF73 2C 5C
BF75 0D                 FCB    $D
BF87                    ORG    4+LINEL+TABLE
BF87 41 53 4D 42        FCC    /ASMB.\/
BF8B 2C 5C
BF8D 0D                 FCB    $D
BF99                    ORG    5+LINEL+TABLE
BF99 42 4F 50 59        FCC    /BOPY.O,1.\/
BFA3 2C 30 2C 31
BFA7 2C 5C
BFA9 0D                 FCB    $D
BFB7                    ORG    6+LINEL+TABLE
BFB7 44 49 52 2C        FCC    /DIR:O..CMD/
BFBB 3A 2C 2E 43
BFBF 4D 44
BFC1 0D                 FCB    $D
BFCF                    ORG    7+LINEL+TABLE
BFCF 4D 41 50 2C        FCC    /MAP.\/
BFD3 5C
BFD4 0D                 FCB    $D
BFE7                    ORG    8+LINEL+TABLE
BFE7 42 41 53 49        FCC    /BASIC/
BFEB 43
BFEC 0D                 FCB    $D
BFFF                    ORG    9+LINEL+TABLE
BFFF 0D                 FCB    $D          DUMMY END
                                           SHOULD BE BFFF HEX
                CD00    PROGEND EQU    *   TO ALLOW FOR FREE
                * NOW JAP MEMAL IN FLEX
CC2B                    ORG    $CC2B       MEMEND
CC2B BE55               LDS    START+1
                        END    FWARMS

0 ERROR(S) DETECTED

SYMBOL TABLE:

BACK    CB00    BSPACE  BF1C    CHKINIT BE93    CRLF    FDA2    DISPLI  BE9E
DISPLA  BED1    DONE    BEF9    EDIT    BEA5    EDITCE  BE3C    EDLOOP  BEE9
EDNEIT  BED3    ERROR   BF19    FINP1   CD09    FINP2   CD0C    FINPT   BE87
FLAG    BE75    FMGR    BE74    FUNCRT  BE90    FWARMS  CD03    INPUT   FD44
LINEL   0018    OUTPUT  FD58    PLOOP   BEC4    PROGEN  CD00    PROGL   01AA
PROGL1  01AA    RETURN  BE07    START   BE56    START1  BE60    START2  BECC
TABLE   BF27    TRAP1   BE76    TRIBGR  0009    VALID   BEFE    xSAVE   BE70
xSAVE1  BE72
```

```
                        NAM    FUNLOAD FLEX09 VERSION

                        OPT    PAG

                ********************************************************
                * PROGRAM : FUNCTION KEY  LOADER                       *
                * AUTHOR  : DAVID V. GOADBY                            *
                * CREATE  : 9/9/80                                     *
                * EDIT    : 12/12/80                                   *
                * FILENAME: 14.FUNLOAD9.TXT                            *
                * VERSION : 1.3 FLEX09/FREV09 V 1.3                    *
                ********************************************************

                * THIS PROGRAM RELOADS THE STRING TABLE IN THE
                * FUNCTION KEY MODULE WITH A SET OF PREDEFINED
                * STRINGS FROM A TEXT FILE.
                *
                * COMMAND FORMAT:FUNLOAD.TEXTFILENAME
                *
                * IF ANY LINE IS TOO LONG OR THERE ARE LESS THAN 9
                * ENTRIES ON THE FILE THEN AN ERROR MESSAGE IS DISPLAYED.

                * THE FILE CAN BE CREATED USING THE EDITOR AND
                * CONSISTS OF ONE LINE PER KEY STARTING AT KEY 1

                * SPECIAL EQUATES ( REFER TO FKEY LISTING )

                BF27    TABLE  EQU    $BF27       TABLE ADDRESS IN FUNCTION KEY MODU
                0018    LINEL  EQU    24          LINE LENGTH

                * FLEX EQUATES

                CB40    FCB    EQU    $CB40       SYSTEM FCB
                D406    FMS    EQU    $D406       FLEX ENTRY
                CD03    WARMS  EQU    $CD03
                CD2D    GETFIL EQU    $CD2D       FILE SPEC
                CD3F    RPTERR EQU    $CD3F       PRINT ERROR
                D403    FMSCLS EQU    $D403       CLOSE ALL FILES
                CD33    SETEXT EQU    $CD33       SET EXTENSION
                CD1E    STRING EQU    $CD1E       PRINT STRING

C100                    ORG    $C100       TRANSIENT AREA

C100 20 01      START   BRA    START1
C102 03         VN      FCB    3           VERSION
C103 8E CB40    START1  LDX    #$CB40      USE SYSTEM FCB
C106 BD CD2D            JSR    GETFIL      GET FILE NAME
C109 25 69              BCS    ERROR       BAD NAME
C10B 86 01              LDA    #1          OPEN FOR READ
C10D A7 84              STA    ,X          PUT INTO FCB
C10F BD CD33            JSR    SETEXT      SET TO .TXT
C112 BD D406            JSR    FMS         OPEN FILE
C115 26 59              BNE    ERROR
                * SETUP TABLE PARAMETERS
C117 8E BF27            LDX    #TABLE      GET TABLE LOCATION
C11A 9F C186            STX    CURPOS      1ST CHAR OF 1ST LINE
C11C 108E 0008          LDY    #9*LINEL    LENGTH OF TABLE

C120 109F C184          STY    EOFTAB      END OF TABLE +1
C124 8E B 27            LDX    #TABLE
C127 C6 18              LDB    #LINEL      LENGTH OF SINGLE ENTRY
C129 3A                 ABX
C12A 9F C182            STX    EOFLIN      END OF FIRST LINE +1

C12C C6 09              LDB    #9          LINE COUNT
C12E F7 C188            STB    LINECT
                * READ DATA FROM DISK INTO TABLE
C131 8E C840    READLP  LDX    #FCB        POINT TO FCB
C134 BD D406            JSR    FMS         GET CHAR
C137 26 42              BNE    ERROR1
C139 9E C186    STORLP  LDX    CURPOS      NEXT POSITION
C13C BC C182            CMPX   EOFLIN      END OF LINE +1 ?
C13F 27 0B              BEQ    LINEND
C141 A7 80              STA    ,X+         PUT IN TABLE
C143 9F C186            STX    CURPOS      STORE NEXT POSITION
C146 81 0D              CMPA   #$0D        CR ?
C148 26 E7              BNE    READLP
C14A 20 E0              BRA    STORLP      FILL TO END OF LINE WITH CR
                * END OF LINE PROCESSING
C14C A6 1F      LINEND  LDA    -1,X        GET LAST CHAR
C14E 81 0D              CMPA   #$0D        SHOULD BE CR..
C150 26 31              BNE    ERROR2
C152 9E C182            LDX    EOFLIN      GET START OF NEXT LINE
C154 9F C186            STX    CURPOS      SET READY FOR NEXT LINE
C157 CB 18              LDB    #LINEL
C159 3A                 ABX
C15A 9F C182            STX    EOFLIN
C15D 7A C188            DEC    LINECT      BUMP COUNT
C160 26 CF              BNE    READLP      OK TO CONTINUE
C162 86 04      ENDIT   LDA    #4          CLOSE FILE
C164 8E C840            LDX    #FCB
C167 A7 84              STA    ,X
C169 BD D406            JSR    FMS
C16C 26 03              BNE    ERROR       COULD BE SERIOUS !
C16E 7E CD03            JMP    WARMS

                * ERROR PROCESSING

C171 BD CD3F    ERROR   JSR    RPTERR      REPORT ERROR
C174 BD D403            JSR    FMSCLS      CLOSE ALL FILES
C177 7E CD03            JMP    WARMS       RETURN TO FLEX
                * THE FOLLOWING ARE SOFT ERRORS
C17A 8E C18A    ERROR1  LDX    #MSG1
C17D BD CD1E    ERREXT  JSR    STRING
C180 20 E0              BRA    ENDIT
C182 8E C19E    ERROR2  LDX    #MSG2
C185 20 F6              BRA    ERREXT

                * ERROR MESSAGE STRING

C187 4C 45 53 53 59     MSG1   FCC    /LESS THAN 9 ENTRIES/
C18C 20 54 48 41
C190 4E 20 39 20
C194 45 4E 54 52
C198 49 45 53
C19B 04                        FCB    4
C19C 4C 49 4E 45        MSG2   FCC    /LINE >24 CHARACTERS/
C1A0 20 3E 32 34
C1A4 20 43 48 41
C1A8 52 41 43 54
C1AC 45 52 53
C1AF 04                        FCB    4

                * DATA AREA

C1B0                    EOFLIN RMB    2           END OF CURRENT LINE
C1B2                    EOFTAB RMB    2           END OF TABLE
C1B4                    CURPOS RMB    2           NEXT TABLE ENTRY
C1B6                    LINECT RMB    1           LINES COUNT

                        END    START

0 ERROR(S) DETECTED

SYMBOL TABLE:

CURPOS C1B4    ENDIT  C165    EOFLIN C1B2    EOFTAB C1B4    ERREXT C17D
ERROR  C171    ERROR1 C17A    ERROR2 C185    FCB    CB40    FMS    D406
FMSCLS D403    GETFIL CD2D    LINECT C1B6    LINEL  0018    LINEND C14C
MSG1   C18A    MSG2   C19E    READLP C131    RPTERR CD3F    SETEXT CD33
START  C100    START1 C103    STORLP C139    STRING CD1E    TABLE  BF27
VN     C102    WARMS  CD03
```


Mr. Don Williams
68 Micro Journal
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Hixson, Tn. 37343

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19 Oct. 1984
818-280-6377

Dear Mr. Williams,

I read with interest, and some amusement, your review of "Fire in the Valley". It is not too surprising that the book is so inaccurate. My observation is that almost all printed material concerning microcomputers shares this fault. I live near a very large bookseller and visit it regularly in hopes of finding useful information. This store carries every micro magazine, save 68 Journal, of which I have ever heard, as well as numerous books on the subjects of soft- and hard-ware, incidentally. 68 J. is the only magazine to which I subscribe although I do leaf through about twenty each month.

Since I have worked in electronics since the early 1950's and have been into microcomputing since 1975 perhaps I could be permitted a few comments on the state of the microcomputing world.

It seems to me that the publishing industry has perfected the alchemical miracle of our era, and one previously in the domain of governments, which is the turning of paper into money via the application of ink. Evidently the main purpose of most magazines is to sell advertising and eventually, products, rather than being committed to the dissemination of useful information. Most of the publications coming into my view contain nothing of value, and the balance contain little. Even the advertisements seldom describe items adequately and some of them lie outright. Perhaps this is more a comment on the present day computerist rather than the manufacturers and publishers as, looking through my collection of old magazines I find a much more considerate approach. I think that somewhere after 1978-79 the industry graduated from a enthusiast viewpoint to a commercial, dollar driven approach to the field.

A similar transition took place in the post WW2 days of Ham Radio. With the release of much service related equipment at surplus prices tremendous interest was generated and magazines were full of articles on conversion and use of such equipment as well as scratch-building (hacking). This period of interest was very important to the progress of electronics in the U.S. as many of us, myself included, came into commercial electronics through beaming. Within a few years, however, there was a rush of "tailor-made" equipment to the market, and this period marked a distinct change in the magazines. Advertisements for factory equipment began to crowd out articles, and the articles changed to describing uses for equipment rather than construction and modification. I regard this as the direct precursor to the Citizens Band craze which reduced an interesting, educational hobby to a pursuit for leather lunged Neanderthals. The result was that many of the manufacturers went out of business and many of the hobbyists did likewise. Today Ham Radio is an empty desert, and this source of enthusiastic amateurs has been lost.

It may be possible to derive a parallel pertinent to the micro-computing field, if only those directly dollar-driven are to create equipment and programs for computing then the result would seem to be monopolisation of information because of its value. While I do not decry computer games, especially of the simulation type, I feel that serious progress in the field can only be assured when amateurs are encouraged to realise the creatures of their own imaginations.

The secrecy surrounding hardware documentation, operating systems, and application programs constitutes an almost impassable block for many hobby computerists. It may be argueble that disassembling an operating system is a salutary educational experience. As one who has completed such a task I can assure you that the techniques can be acquired in easier ways. Tracing circuit boards may be the ogly way to accumulate sufficient knowledge to assist one in building a "dream" interface but much gratitude is due the manufacturer who supplies such information without any demur or indignant suspicion. Worst of all is one a manufacturer who sells unreadable Xerox copies of incorrect, unusable data.

If the future of microcomputing is to follow the history of the once proud automobile industry we will soon have three or four major manufacturers left, and we will all be the poorer for it. I believe that the neglect of the 6809 and now the 68000 is directly due to the preponderance of useful data about processors that are obviously technically inferior.

I must thank those, such as yourself and TSC, who understand this need and attempt to fill it. I can only encourage you to extend your efforts in this direction by your reviews and criticisms of equipment and programs in the 68XX field and so helping to maintain a high standard of excellence in hardware and software.

Sincerely yours,

M. J. Kreinik

P.S. I am looking forward with great interest to your review of the Digital Systems "Mailboard". It is not well supported by the manufacturer, and deserves some notice as a serious alternative to the Color Computer.

M. J. K.

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New Zealand
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68 Micro Journal
P.O. Box 849
Mineola, TX 75343

Dear Sirs,

Recently I completed the design of a 256k dynamic Ram board and thought that, since there aren't many hardware projects in your publication, it may be suitable for publication. If you so desire I could arrange to send you a completed one for evaluation.

Details: the board is designed to look like 4x64k blocks. Rather than make the logic design difficult it was decided not to make the board look like 8x32k blocks or 16x16k blocks. It can start on any 64k boundary within the 1Mbyte addressing range of any 6809 system with mapping ram. The only weird bit is the delay line which is part number TTLDM 75, available from Engineered Components Company, 3580 Sacramento Drive, P.O. Box 7, San Luis Obispo, CA 93406. The phone numbers are (805) 544-3800 or (800) 235-4144. The price was around $21-$22 the last I heard. Boards are available from me at the above address for $65 U.S including shipping. I only sell boards, not built up units as this project was done for the local 6809 community and I can't afford to build them up. However the boards are available to those who want to build up their own.

The circuit is enclosed and the set up details are as follows.

1) S1-S4 set the barring. All open here F000-FFFF. Sk closed here 8000-FFFF

2) S5-S8 set the 64k start, depending on the setting of the 256k start.
   All closed, start at 00000,40000,80000,C0000
   All open, start at 10000,50000,90000,D0000
   S8 closed, start at 20000,60000,A0000,E0000
   S7 closed, start at 30000,70000,B0000,F0000

3) Links A-D set the 256k start 00000,40000,80000,C0000 respectively

The power is arranged by conventional means. Each bank of 64k is powered by a 7805 with decoupling capacitors at 100uF per memory chip and 10uF bulk decoupling. The logic is powered by either an LM 309 or LM323 with plenty of 100uF decoupling capacitors.

People using 1Mbit systems can use LS series TTL for the logic. Those with 256k systems must use either S series or F series TTL so that the set up time required by the 6809 is fulfilled.

At the moment there are 38 of these boards in use in New

Zealand, so I believe the design is reliable. If anyone does want to buy one the boards are ordered as orders come in so it may take some weeks to fulfil orders. Payment must be either by check,cash or any other way except credit cards.

The circuit is enclosed for you to publish if you so desire.

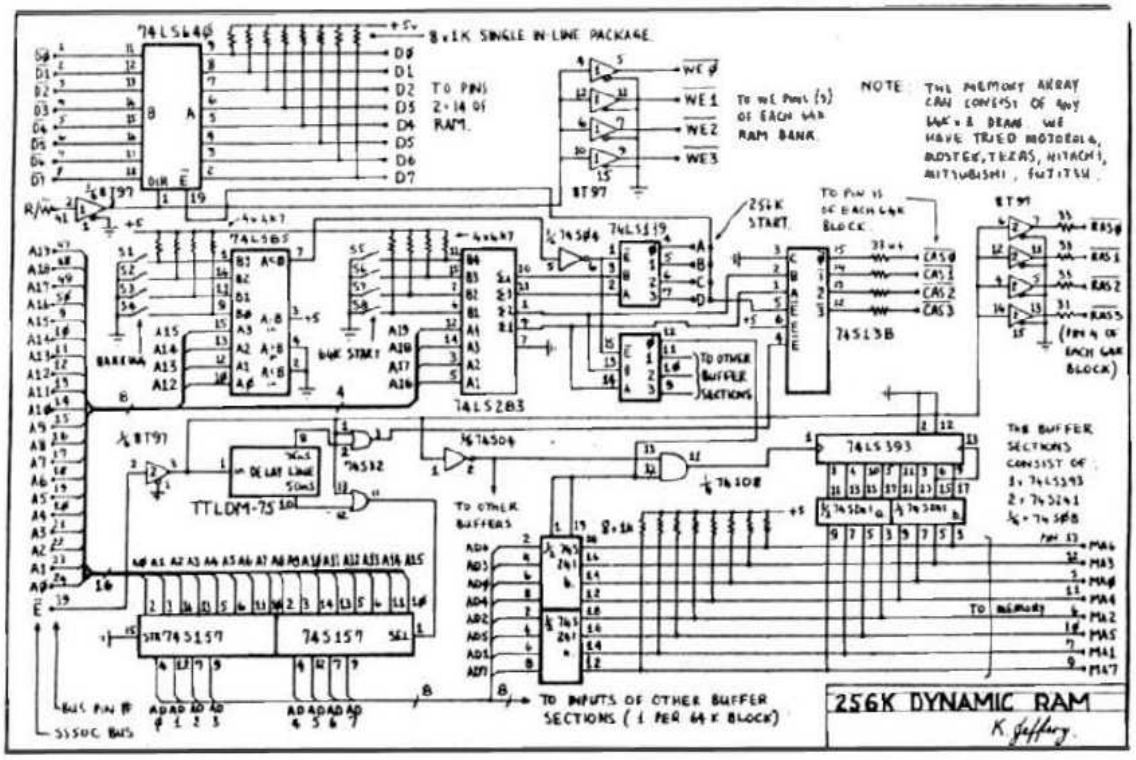
I consider your magazine excellent value for money with more useful articles than many other magazines. Long may you keep up the good work. Comments on 68000-- this computer doesn't really fit in home computers , at least in this country, because of cost and lack of an extensive software base. However I anticipate that this will change as silicon and hopefully, software costs fall. Until then I feel that the level of support you give to the 68000 is adequate.

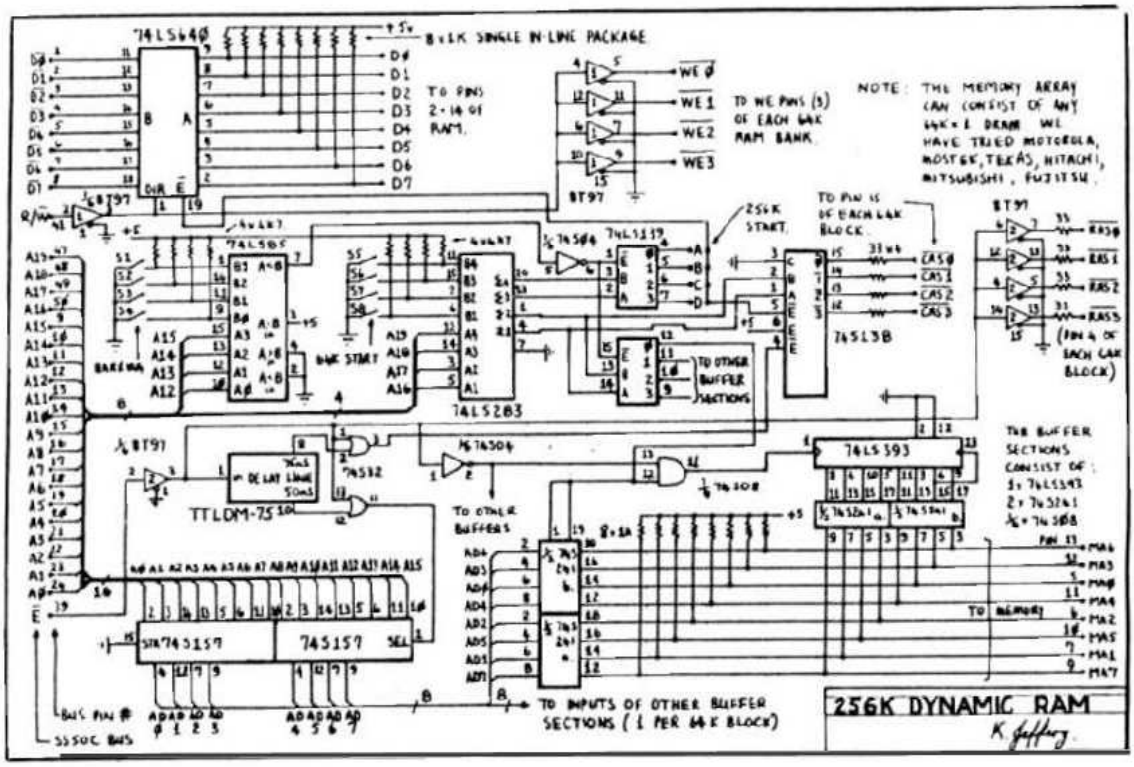
Wishing you luck in the future,

Regards

K. Jeffery

Keith Jeffery.





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6809 COMPUTER SOFTWARE: EDITORS, ASSEMBLERS, COMPILERS

November 2, 1984

'68' Micro Journal
Don Williams
5900 Cassandra Smith Road
Hixon, TN 37343

Dear 6809 User:

The following names are used exclusively by LLOYD I/O as trademarks of LLOYD I/O, a computer software house and consulting service business.

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The past uses of these names were understood to have been trademarked by LLOYD I/O and were assumed to have been trademarked all the time.

The use of these names hereafter will be used by LLOYD I/O in referring to computer software developed by LLOYD I/O. The name LLOYD I/O will be used by this business in referring to itself.

Sincerely yours,

Frank L. Hoffman
President
LLOYD I/O

Enclosed is a copy of a command I wrote for my 68B DOS 8.51. It is an alternative to SDC.3 (Single Disk Copy) to be used when a number of files and/or commands are to be copied.

The program cycles through all files and commands in the disk directory and asks the user if each should be copied. The program responds to Y or N only; any other response will result in the question being asked again. If the file already exists on the target disk, the user is informed and the process continues. This program is my style of programming (Brute Force) and is not an example of efficiency. However, it works.

One note: the call is not the same as SDC.3 because 1) no file name is specified and 2) no memory limit can be entered. The memory limit is assumed to be 16K ($4000) but can be changed in line 16h.

Sincerely,

John Pramis
245 N.W. Wildwood Ln.
Bremerton Wa. 98310

```
                    1:        NAM   SINGLE DISK CONTINUOUS COPY
                    2:
                    3: *****************************************************
                    4: *                                                   *
                    5: * TRANSIENT COMMAND TO CONTINUOUSLY COPY ON A       *
                    6: * SYSTEM WITH ONLY ONE DISK DRIVE                   *
                    7: *                                                   *
                    8: *****************************************************

T269                9: EINCR  EQU   $T269
T2A9               10: ITYPDE EQU   $T2A9
T783               11: CDFN   EQU   $T783
T263               12: EWARMS EQU   $T263
T7B6               13: DFM    EQU   $T7B6
T2A6               14: EXUTST EQU   $T2A6
T266               15: IOUTDE EQU   $T266

0100               16:        ORG   $0100
0100 CE 02BA       17: START  LDX   #CRLF
0103 BD T2A6       18:        JSR   EOUTST
0106 7F 0308       19:        CLR   FCB+3       SET UNIT NUMBER = 0
0109 86 0A         20:        LDA A #10         SETUP DIRECTORY READ
010B B7 0306       21:        STA A FCB
010E BD 01EE       22:        JSR   FILOC
0111 7F 026D       23:        CLR   COUNT       COUNT = # OF FCBS READ; INITIALLY ZERO
0114 86 0B         24: LOOP1  LDA A #11         READ FCB
0116 7C 026D       25:        INC   COUNT
0119 B7 0306       26:        STA A FCB
011C BD 01EE       27:        JSR   FILOC
011F CE 027A       28:        LDX   #MSG1       PRINT "FILE:"
0122 BD T2A6       29:        JSR   EOUTST
0125 BD 021D       30:        JSR   PRFNAM      PRINT FILE NAME
0128 CE 027B       31: LOOP2  LDX   #MSG2       ASK IF USER WISHES TO COPY
012B BD T2A6       32:        JSR   EOUTST
012E BD T269       33:        JSR   EINCR       ASERVE Y OR N
0131 36            34:        PSH A
0132 CE 02BA       35:        LDX   #CRLF       PRINT CARRIAGE RETURN / LINE FEED
0135 BD T2A6       36:        JSR   EOUTST
0138 32            37:        PUL A
0139 81 4E         38:        CMP A #'N         IF "N", READ NEXT FCB
013B 27 07         39:        BEQ   LOOP1
013D 81 59         40:        CMP A #'Y
013F 26 F7         41:        BNE   LOOP2       IF NOT "Y", ASK AGAIN
0141 CE 03AC       42:        LDX   #FILE       IF "Y", POINT TO BEGINNING OF STORAGE AREA
0144 86 04         43:        LDA A #4          OPEN FILE FOR READ
0146 B7 0306       44:        STA A FCB
0149 BD 01EE       45:        JSR   FILOC
014C 86 05         46:        LDA A #5          READ FROM FILE
014E B7 0306       47:        STA A FCB
0151 BD 0218       48: RDTAGN JSR   FILRW
0154 7D 026E       49:        TST   FLAG        END OF FILE?
0157 26 13         50:        BNE   RDTCLS      YES, BRANCH
0159 BC 0269       51:        CPX   MEMAX       MEMORY LIMIT REACHED?
015C 27 05         52:        BEQ   MEMERR      YES, BRANCH
015E A7 00         53:        STA A 0,X
0160 08            54:        INX
0161 20 EE         55:        BRA   RDTAGN      IF READ SUCCESSFUL, READ AGAIN
0163 CE 027D       56: MEMERR LDX   #MSG3       PRINT "MEMORY LIMIT" AND RESTART DOS
0166 BD T2A6       57:        JSR   EOUTST
0169 7E 0207       58:        JMP   OUT

016C 7F 026E       59: RDTCLS CLR   FLAG
016F 09            60:        DEX
0170 FF 026B       61:        STX   LAST        STORE ADDRESS OF LAST DATA BYTE
0173 86 06         62:        LDA A #6          CLOSE FILE
0175 B7 0306       63:        STA A FCB
0178 BD 01EE       64:        JSR   FILOC
017B CE 0285       65:        LDX   #MSG8       TELL USER TO CHANGE DISKETTES
017E BD T2A6       66:        JSR   EOUTST
0181 BD T269       67:        JSR   EINCR
0184 CE 02BA       68:        LDX   #CRLF
0187 BD T2A6       69:        JSR   EOUTST
018A 86 01         70:        LDA A #1          OPEN FILE FOR WRITE
018C B7 0306       71:        STA A FCB
018F BD 01EE       72:        JSR   FILOC
0192 7D 026E       73:        TST   FLAG        ON RETURN, CHECK FLAG
0195 26 15         74:        BNE   FLOBET      BRANCH IF SET
0197 86 02         75:        LDA A #2          IF NOT, SETUP TO WRITE FILE
0199 B7 0306       76:        STA A FCB
019C CE 03AC       77:        LDX   #FILE
019F A6 00         78: WRTAGN LDA A 0,X         GET BYTE
01A1 BD 0248       79:        JSR   FILRW
01A4 BC 0268       80:        CPX   LAST        END OF DATA?
01A7 27 0F         81:        BEQ   WRTCLS
01A9 08            82:        INX               NO, CONTINUE
01AA 20 F3         83:        BRA   WRTAGN
01AC 7F 026E       84: FLOBET CLR   FLAG        RESET FLAG
01AF CE 0282       85:        LDX   #MSG7       TELL USER FILE ALREADY EXISTS
01B2 BD T2A6       86:        JSR   EOUTST
01B5 7E 01C6       87:        JMP   RENTRY
01B8 CE 02AD       88: WRTCLS LDX   #MSG5       PRINT "FILE COPIED"
01BB BD T2A6       89:        JSR   EOUTST
01BE 86 03         90:        LDA A #3          CLOSE FILE
01C0 B7 0306       91:        STA A FCB
01C3 BD 01EE       92:        JSR   FILOC
01C6 CE 02BD       93: RENTRY LDX   #MSG6       TELL USER TO REMOVE SOURCE DISK
01C9 BD T2A6       94:        JSR   EOUTST
01CC BD T269       95:        JSR   EINCR
01CF CE 02BA       96:        LDX   #CRLF
01D2 BD T2A6       97:        JSR   EOUTST
01D5 F6 026D       98:        LDA B COUNT       GET # OF FCBS ALREADY READ
01D8 86 0A         99:        LDA A #10         SETUP DIRECTORY READ
01DA B7 0306      100:        STA A FCB
01DD BD 01EE      101:        JSR   FILOC
01E0 86 0B        102:        LDA A #11         READ FIRST FCB
01E2 B7 0306      103:        STA A FCB
01E5 BD 01EE      104: LOOP3  JSR   FILOC
01E8 5A           105:        DEC B
01E9 26 FA        106:        BNE   LOOP3       LOOP THROUGH FCBS ALREADY READ
01EB 7E 0114      107:        JMP   LOOP1

                  108: ***************************************************
                  109: * SUBROUTINE TO OPEN AND CLOSE FILES              *
                  110: ***************************************************

0   FF 0269       111: FILOC STX   SAVX        SAVE INDEX REG
01F1 36           112:       PSH A
01F2 CE 0306      113:       LDX   #FCB       LOAD ADDRESS OF FCB
01F5 BD T7B6      114:       JSR   DFM        DFM I/O REQUEST
01F8 27 16        115:       BEQ   OK         RETURN IF NO ERROR
01FA A6 01        116:       LDA A 1,X        GET ERROR STATUS CODE
01FC 81 06        117:       CMP A #6         CHECK FOR END OF DIRECTORY
01FE 27 15        118:       BEQ   END
0200 81 02        119:       CMP A #2         CHECK FOR "FILE ALREADY EXISTS" ERROR
0202 27 09        120:       BEQ   EXISTS
0204 BD T2A9      121:       JSR   ITYPDE     PRINT ERROR CODE, CLOSE FILES, RESTART DOS
0207 BD T783      122: OUT   JSR   CDFN
020A 7E T263      123:       JMP   EWARMS
020D 7C 0268      124: EXISTS INC  FLAG       SET FLAG IF FILE ALREADY EXISTS
0210 FE 0269      125: OK    LDX   SAVX
0213 32           126:       PUL A
0214 39           127:       RTS
0215 CE 0281      128: END   LDX   #MSG9       PRINT "END DIRECTORY" AND EXIT
0218 BD T2A6      129:       JSR   EOUTST
021B 20 EA        130:       BRA   OUT

                  131: ***************************************************
                  132: * SUBROUTINE TO PRINT FILE NAME                   *
                  133: ***************************************************

021D FF 0269      134: PRFNAM STX   SAVX       SAVE INDEX REG
0220 C6 06        135:       LDA B #6         PRINT FIRST 6 CHARACTERS
0222 CE 0309      136:       LDX   #FCB+3
0225 A6 00        137: PRLOP1 LDA A 0,X
0227 BD T266      138:       JSR   IOUTDE
022A 08           139:       INX
022B 5A           140:       DEC B
022C 26 F7        141:       BNE   PRLOP1
022E 86 2E        142:       LDA A #'.        PRINT DECIMAL PT
0230 BD T266      143:       JSR   IOUTDE
```

```
0233 C6 03    151:        LDA B #3          PRINT EXTENSION
0235 CE 0307  152:        LDX  #FCB+9
0238 A6 00    153: FRLOP2 LDA A 0,X
023A BD 7286  154:        JSR  ZOUTEX
023D 08       155:        INX
023E 5A       156:        DEC B
023F 26 F7    157:        BNE  FRLOP2
0241 CE 02BA  158:        LDX  #CRLF
0244 BD 72A6  159:        JSR  ZOUTST
0247 39       160:        RTS

              162: ********************************************
              163: * SUBROUTINE TO READ AND WRITE FILE          *
              164: ********************************************

0248 F7 0269  166: FILRW  STB  SAVI         SAVE INDEX REG
024B CE 0306  167:        LDX  #FCB         LOAD ADDRESS OF FCB
024E BD 7786  168:        JSR  DFN          DFN I/O REQUEST
0251 27 12    169:        BEQ  RWCK         RETURN IF NO ERROR
0253 A6 01    170:        LDA A 1,X         CHECK FOR END OF FILE
0255 81 06    171:        CMP A #6
0257 27 09    172:        BEQ  ENDRD
0259 BD 72A9  173:        JSR  ZTYPIE
025C BD 7783  174:        JSR  CDFN
025F 7E 7283  175:        JMP  ZWARM$
0262 7C 0268  176: ENDRD  INC  FLAG
0265 7E 0269  177: RWCK   LDX  SAVI
0268 39       178:        RTS

0269 00 00    180: SAVI   FDB  0000
026B 00 00    181: LAST   FDB  0000
026D 00       182: COUNT  FCB  0
026E 00       183: FLAG   FCB  0
026F A0 00    184: MEMAX  FDB  $A000      16K MEMORY ASSUMED
0271 20       185: MSG1   FCC  / FILE: /
0272 00       186:        FCB  0
0273 20       187: MSG2   FCC  / COPY? /
0000 00       188:        FCB  0
0281 A3       189: MSG3   FCC  /NEW DIRECTORY/
028E 00       190:        FCB  0
028F A3       191: MSG4   FCC  /CHANGE DISKS AND HIT ANY KEY /
02AC 00       192:        FCB  0
02AD 20       193: MSG5   FCC  / FILE COPIED /
02BA 0A       194: CRLF   FCB  $0A,$0D,0
02BD 52       195: MSG6   FCC  /REMOUNT SOURCE DISK AND HIT ANY KEY /
02E1 00       196:        FCB  0
02E2 A6       197: MSG7   FCC  /FILE ALREADY EXISTS /
02F6 0A       198:        FCB  $0A,$0D,0
02F9 AD       199: MSG8   FCC  /MEMORY LIMIT/
0305 00       200:        FCB  0
0306          201: FCB    RMB  166
03AC          202: FILE   RMB  1
0100          203:        END  START
    NO ERROR(S) DETECTED
```

```
SYMBOL TABLE:
CDFN    7783    CDUST   0260    CRLF    02BA    DFN     7786
END     0215    ERROR   0262    EXISTS  0200    FCB     0306
FILE    03AC    FILOC   01EE    FILRW   0248    FLAG    0268
FLOKEY  01AC    LAST    0269    LOOP2   0134    LOOP3   0120
LOOP3   01E5    MEMAX   026F    MEMERR  0163    MSG0    0279
MSG3    0281    MSG4    028F    MSG5    02AD    MSG6    02BD
MSG7    02E2    MSG8    02F9    OK      0210    OUT     0207
PRFRAM  021D    PRLOP1  0225    PRLOP2  0238    READIN  0151
RECYCLE 016C    RESTRT  0106    RWCK    0265    SAVE    0269
START   0100    WRTAGN  0197    WRTCLS  0188    ZCRLF   7289
ZOUTEX  7286    ZOUTST  72A6    ZTYPIE  72A9    ZWARM$  7283
```

```
 FILE: DFM68C.352
 COPY? N
 FILE: DFM68C.353
 COPY? N
 FILE: LIST.3
 COPY? Y
CHANGE DISKS AND HIT ANY KEY
FILE ALREADY EXISTS
REMOUNT SOURCE DISK AND HIT ANY KEY
 FILE: SDCC3.BAK
 COPY? Y
CHANGE DISKS AND HIT ANY KEY
FILE ALREADY EXISTS
REMOUNT SOURCE DISK AND HIT ANY KEY
 FILE: DELETE.3
 COPY? N
 FILE: SDCC3.BIN
 COPY? N
 FILE: README.3
 COPY? Y
CHANGE DISKS AND HIT ANY KEY
 FILE COPIED
REMOUNT SOURCE DISK AND HIT ANY KEY
 FILE: SDCC.TXT
 COPY? N
 FILE: EDIT.3
 COPY? N
 FILE: ASMB.3
 COPY? Y
CHANGE DISKS AND HIT ANY KEY
 FILE COPIED
REMOUNT SOURCE DISK AND HIT ANY KEY
 FILE: SDCC.BAK
 COPY? Q
 COPY? N
 FILE: SDCC.3
 COPY? N
 FILE: SAVE.3
 COPY? N
 FILE: SUBS.3
 COPY? N
END DIRECTORY
```


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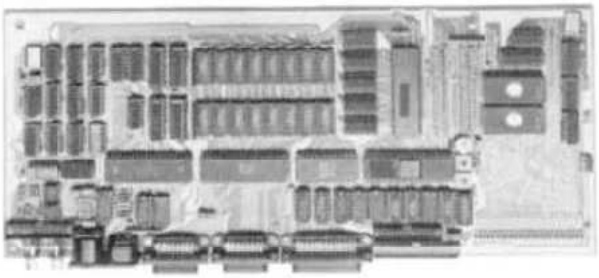

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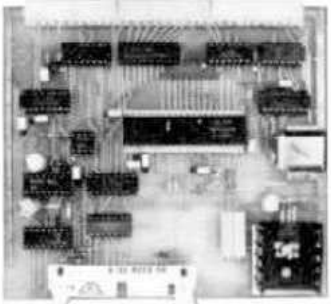

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CoCo OS-9™ FLEX™
SOFTWARE

'C' COMPILERS

Windrush Micro Systems

C Compiler

By James McCosh. Full featured C Compiler for the FLEX Operating System (lacking ONLY "bit-fields"), including an Assembler. Requires the TSC Relocating Assembler IF the user wishes to implement his own Libraries.

F and CCF - $295.00

Introl

C Compiler

A full-featured C, streamlined for the 6809. Generates very efficient object code. Output "benchmarks" close to 10MHz 68000 in 8 Bit Operations; 1.5 times faster than a 4 MHz Z80 when using a 2MHz 6809 System (Re. p 43, "68" Micro Journal, May '83). Floats, etc.

F, CCF, and O - $375.00
U - $425.00
One Year Maint. - $100.00

PASCAL COMPILERS

TSC

PASCAL Compiler

Native Code Compiler (UCSD Oriented).

F and CCF - $200.00

Lucidata

PASCAL Compiler

P-Code Compiler (ISO Standard). Designed especially for Microcomputer Systems; Run-time System checks available resources for each task, allowing operation on even minimal computer systems. Allows linkage to Assembler Code for maximum flexibility.

F and CCF 5" - $190.00
F 8" - $205.00

OmegaSoft

PASCAL Compiler

For the PROFESSIONAL; ISO Based, Native Code Compiler, Primarily for Real-Time and Process Control applications. Use custom I/O devices in place of the Pascal INPUT and OUTPUT; Long Int. (32 Bit); Dynamic length strings; Interrupt processing, ROM-able, PIC, Re-Entrant Code, etc. POWERFUL! Includes Source for the Symbolic Debugger, Runtime, and several Utilities. Requires a "Motorola Compatible" Relocating Assembler and Linking Loader.

F and CCF - $425.00
One Year Maint. - $100.00

DECOMPILERS

Southeast Media

DU8 (A UniFLEX "basic" De-Compiler)

Re-Create a Source Listing from UniFLEX Compiled basic Programs. Easy to Use; works w/ ALL Versions of UniFLEX basic; Output to Disk or Terminal. Time TESTED and PROVEN; SOLID!

U - $219.95

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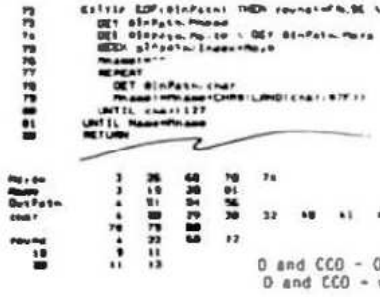
UTILITIES

Southeast Media

BasicO9 XRef

This BasicO9 Cross Reference Utility is a BasicO9 Program which will produce a "pretty printed" listing with each line numbered, followed by a complete cross referenced listing of all variables, external procedures, and line numbers called. Also included is a Program List Utility which outputs the listing without the overhead of building the cross reference table, which allows it to run considerably faster when only a "pretty printed" listing with line numbers is desired. Requires BasicO9 or RunB for operation.



D and CCO - Obj. Only -- **$39.95**
D and CCO - w/ Source - **$79.95**

Southeast Media

OS-9 VDisk

Give your OS-9 Level I System the speed of memory access that can be several orders of magnitude over your present floppy disk drive. Use that Extended Memory capability of your SWTPC or Gimix CPU card (or any other that has the same format DAT). The size of the Virtual Disk is completely variable in whole increments of 4K up to 960K, which is all that these systems can address beyond the base page that OS-9 Level I uses. By putting all of your CMDS Directory on your Virtual Disk, you can have the fastest execution speed possible (next to eating up System Memory with all of them). You can also set up high speed inter-process communications via random virtual disk files and not eat up valuable system memory with pipe buffers. Some Assembly Required - Level I OS9.

O, obj. only - **$79.95**
w/ Source - **$149.95**

Southeast Media

O-F

---- OS/9 to FLEX - FLEX to OS/9 ----

Finally; the barrier has been removed between OS/9 and FLEX formatted disks! Now you can READ **from** and WRITE **to**, a Single Sided 5" or 8" FLEX diskette from OS-9 with O-F. O-F is a new and unique program, written in BASICO9 (with Source), that performs the following functions;

REFORMAT: A BASICO9 Program that reformats a chosen amount of an OS-9 disk to FLEX Format so it can be used normally by FLEX.

FLEX: A BASICO9 Program that does the actual read or write function to the special O-F Transfer Disk, all selected from a user-friendly menu. Functions provided include reading the FLEX Directory, Deleting FLEX Files, Copying both directions, etc. All selections are interactive and complete, including all necessary prompts to the operator.

FLEX users can read, write and use the special disk as any other FLEX disk, provided the FLEX directory is not allowed to continue beyond track zero (too many files).

O - **$79.95**

Southeast Media

COPYMULT

--- Copy **LARGE** Disks to several **smaller** disks ---

The following FLEX utilities allow the backup of **ANY** size disk to any SMALLER size diskettes (Winchester to 8's or 5's, 8" to 5's, etc.). By simply inserting diskettes as requested by COPYMULT, a large disk system may be downloaded to your present floppy disk system, any size. No need to fiddle with directory deletions or any of the other tedious operations that must be done using the normal copy routines.

COPYMULT.CMD understands normal "copy" syntax and always keeps up with files already copied by maintaining directories for both host and receiving disk system, eliminating hours of tedious keyboard entries and other time consuming cleanup chores.

BACKUP.CMD is a special program that downloads "random" type files, any size.

RESTORE.CMD a special program to restructure copied "random" files for copying, or recopying back to the host system.

FREELINK.CMD a "bonus" utility that "relinks" the free chain of floppy or hard disk thereby eliminating fragmentation.

Completely documented source files included.

ALL 4 Programs (FLEX, 8" or 5") $99.50

Southeast Media

XDATA

A COMMUNICATION Package
for the UniFLEX Operating System

Allows UniFLEX Based Systems to Transmit and Receive files to and from other Computer Systems via Modem. Use with CP/M, Main Frames, other UniFLEX Systems, etc.

-- Verifies Transmission Integrity using checksum or CRC
-- Automatically Re-Transmits bad blocks
-- Transmits data in 128 byte blocks

U - **$299.99**

Lucidata

PASCAL UTILITIES
Requires LUCIDATA Pascal ver 3.

XREF -- produce a Cross Reference Listing of any text; oriented to Pascal Source.

F and CCF - **$25.00**

INCLUDE -- allows the inclusion of other Files in a Source Text; has unlimited nesting capabilities. Also allows Binary File inclusions.

F and CCF - **$25.00**

PROFILER -- produces an Indented, Numbered, "Structogram" of a Pascal Source Text File. Allows viewing the overall structure of large programs, and provides clues as to the integrity of the program. Supplied as Source Code; requires compilation.

F and CCF - **$25.00**

VISA MasterCard

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Availability Legends —
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CCT = Color Computer Tape

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™OS9 is a trademark of Microware

Lucidata

COPYCAT

Pascal MOT required

Allows reading TSC Mini-FLEX, SSB DOS68, and Digital Research CP/M Disks while operating under FLEX 1.0, FLEX 2.0, or FLEX 9.0 with 6800 or 6809 Systems. COPYCAT will not perform Miracles, but, between the program and the manual, you stand a good chance of accomplishing a transfer. Includes Utilities to List Directories, Copy Files, and convert Text Files when required. Also includes a Utility for investigating Physical Compatibility problems. Programs supplied in **Modular Source Code** (Assembly Language) to make it easier to solve unusual problems.

Computer Systems Consultants

FLEX DISK UTILITIES

Eight (8) different FLEX Utilities that should be a part of every FLEX Users Toolbox; Assembly Language (Source Code):

Copy a File with CRC Errors, so it can possibly be salvaged; Test Disk for errors; Compare two Disks; a fast Disk Backup Program; Edit Disk Sectors; Linearize Free-Chain on the Disk; print Disk Identification; and Sort and Replace the Disk Directory (in sorted order).

PLUS

Ten BASIC Programs to:

A **BASIC Resequencer with EXTRAs** over "RENUM"; works with ALL versions of FLEX BASIC AND the Precompiler, checks for missing label definitions, processes Disk to Disk instead of In Memory.

Compare, Merge, or Generate Updates between two BASIC Programs, check BASIC Sequence Numbers, compare two unsequenced files, and 5 Programs for establishing a **Master Directory** of several Disks, and sorting, selecting, updating, and printing paginated listings of these files.

A BASIC **Cross-Reference** Program, written in Assembly Language, which provides an X-Ref Listing of the Variables and Reserved Words in **TSC BASIC, XBASIC,** and **PRECOMPILER BASIC** Programs.

ALL Utilities include Source (either BASIC or Source Code). An EXCELLENT Value!

F and CCF - $50.00

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SOFTWARE

Great Plains Computer Co.

STYLOGRAPH

A full-screen oriented WORD PROCESSOR -- (now runs on the **Data-Comp** and FHL **Color FLEX** Systems; uses the 51 x 24 Display Screens). Full screen display and editing (i.e., what you see is what you get); supports the Daisy Wheel proportional printers.

SPECIAL CCF - $195.00

F and O - $295.00 U - $395.00

SPELL

Fast Computer Dictionary.

F, CCF, OS/9 - $125.00 U - $175.00

MAIL MERGE

Greatly extends the power and flexibility of STYLOGRAPH.

F, CCF, O - $145.00 U - $195.00

BUSINESS

WORD PROCESSING

Windrush Micro Systems

SCREDITOR III

EXTREMELY Powerful Screen-Oriented Editor/Word Processor. Almost 50 different commands; EXCELLENT Documentation (over 300 pages), including a full Tutorial Section to help you learn how to use the system. Features Cursor-based editing, dynamic Screen Formatting (what you see is what you get), Multi-Column display and editing, "decimal align" columns (AND add them up automatically, if wanted), define multiple keystroke macros, even and odd page number headers and footers, imbed printer control codes in text, full justification series of commands, full "help" support, store common command series on disk for future use, etc. Easy "Set-Up" (for example, you just hit the key you want to use for a specific function, such as "cursor up", and the System reads an stores that key - no digging into tech manuals for codes, etc.); use supplied "set-ups", or remap the keyboard to what you are used too. Except for proportional printing, this package will DO IT ALL!

6800 or 6809 FLEX or SSB DOS, OS-9 - $175.00

Southeast Media

SPELLB "Computer Dictionary"

OVER 120,000 words!

No more "Let your fingers do the walking through the Dictionary" while you are entering Text with your favorite Editor or Word Processor. SPELLB is more than just "another Spelling Checker"; it allows you to **look up** a word from within your Editor or Word Processor so that you **KNOW** it is right WHEN YOU TYPE IT IN with the SPK.CMD Utility (which operates in the FLEX Utility Space). Yes, it ALSO allows you to check and update the Text after you are finished; along with allowing you to ADD WORDS to the Dictionary, "Flag" questionable words in the Text for evaluation later, "View a word in context" before changing or ignoring, etc. SPELLB first checks a "Common Word Dictionary", then the normal Dictionary, then a "Personal Word List", and finally, any "Special Word List" you may have specified. SPELLB also allows the use of **Small Disk Storage** systems.

F and CCF - $129.95

Southeast Media

JUST

Text Formatter

JUST, a Text Formatter developed by Ron Anderson, provides numerous features which make it a valuable addition to any FLEX Users Software Library. JUST is designed for formatting Text Output for Dot Matrix Printers and provides many unique features:

- Output the "Formatted" Text to the Display for format analysis and change.
- Output the "Formatted" Text to a Text File for use with the supplied FPRINT.CMD for producing multiple copies of the Text on the Printer (INCLUDING IMBEDDED PRINTER COMMANDS (this Utility is very useful at other times also, and worth the price of the program by itself).
- **"User Configurable"** for adapting to other Printers (comes set up for Epson MX-80 with Graftrax); provides for up to ten (10) imbedded "Printer Control Commands", such as Italics on and off, boldface on and off, etc.
- Automatic compensation for a "Double Width" printed line.
- Includes the normal line width, margin, indent, paragraph, space, vertical skip lines, page length, page numbering, centering, fill, justification, etc.
- Use with ANY Editor.
- Supplied with "Structured Source" (Windrush PL/9); easy to see the flow of the program.

F and CCF - $49.95

VISA MasterCard

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SOFTWARE

DATA BASE MANAGEMENT SYSTEMS

Westchester Applied Business Systems
XDMS

Possibly one of the most powerful Database Management Systems' available, this machine language program is small enough to operate on a single sided 5" disk, yet provides the speed of M.L. and power limited only by the user's imagination. This DMS supports Relational, Sequential, Hierarchical, and Random Access File Structures, and has Virtual Memory capabilities for those Giant Data Bases. XDMS Level I provides a functional "entry level" System which provides for defining a Data Base, entering and changing the Data, and producing Reports. **XDMS Level II** adds the POWERFUL "GENERATE" facility which uses an English Language Command Structure in manipulating the Data to create new File Structures, Sort, Select, Calculate, etc. XDMS Level III adds several special "Utilities" which provide additional ease of working with the various structures, changing System Parameters, etc.

XDMS Lvl I - F & CCF - $129.95
XDMS Lvl II - F & CCF - $199.95
XDMS Lvl III - F & CCF - $269.95
XDMS System Manual only - $24.95

The Virginia Company
BIZPACK

BIZPACK is used for storing accounting, numeric, and financial data which can then be used for planning, budgeting, forecasting, analyzing, etc. While "Electronic Spreadsheets" are extremely useful in many situations, BIZPACK excels in businesses where there are numerous expense columns, revenue sources, significant business indicators, large numbers, erratic week-to-week and month-to-month fluctuations, etc. BIZPACK helps determine statistical relationships, establish trend lines, "smooths" data via moving averages, analyze seasonal data, adjusts for inflation, lags data in Statistics or Column functions, plots data, etc. BIZPACK is oriented toward time series analysis of businesses. The Program displays information on the screen in Columns of information with each Row conforming to a defined Period of Time (weeks, months, years, etc.), and is very easy to use (data is easy to enter, change, and modify; commands can be renamed to suit the users requirements; unlimited ability to create specialized commands using common BASIC Statements; etc.). Requires TSC's Extended BASIC.

F and CCF - $135.00
with Source - $250.00

Computer Systems Consultants
TABULA RASA SPREADSHEET

TABULA RASA is similar to DESKTOP/PLAN and provides for the generation and maintenance of tabular computation schemes often used for analysis of business, sales, and economic scenarios. Its menu-driven user interface provides these capabilities even to those users with no programming experience. Its extensive report-generation capabilities allow the user to generate professional results with minimum effort. It requires TSC's Extended BASIC.

F and CCF - $100.00. U - $200.00

Computer Systems Center
DYNACALC

THE Electronic Spread Sheet for 6809 Computer Systems. An extremely POWERFUL Business Tool, this Program will find an unlimited number of "non-business" applications, also (for example, a full Junior College Electronics Curriculum was set up using DYNACALC). Advanced features like "Table Lookup" make Income Tax work easy; Column or Row Sorting for numerous applications; etc. Completely "Memory Resident", Machine Language, this Program is FAST. Provides STANDARD FLEX Text File output for use with BASIC, Word Processors, Pascal, "C", etc. Also available for Data-Comp and FHL FLEX systems using the 50 x 24 Displays.

F and SPECIAL CCF - $200.00
U - $395.00

ACCOUNTING PACKAGES

Great Plains Computer Co. and **Universal Data Research, Inc.** both have Business Packages written in TSC XBASIC for FLEX, CoCo FLEX, and UniFLEX ----

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- - - - Call 800-338-6800 for more information - - - -

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Computer Systems Consultants
FULL SCREEN INVENTORY/MRP

The Full Screen Inventory System provides a means of maintaining small inventories. Using a linked, keyed random file structure based upon the item field, it keeps the file in alphabetical order for easier inquiry. With the FIND command, the user may locate and/or print all records matching on partial or complete item, description, vendor, or attributes. Items in backorder or below minimum stock levels may be located and/or printed thru the same process. Printed output may be produced in item or vendor order. A materials requirement planning (MRP) capability for manufacturing environments is included to allow the maintenance and analysis of Hierarchical assemblies of items in the inventory file. It requires TSC's Extended BASIC.

F and CCF - $100.00, U - $150.00

ODDS AND ENDS

Computer Systems Consultants
FULL SCREEN FORMS DISPLAY

This package supports any Serial Terminal with cursor control of Memory-Mapped Video Displays. The package substantially extends the screen Input/Output capabilities of TSC's Extended BASIC programs by providing a simple, table-driven method of describing and using full screen displays. These table entries are easy to set up and maintain, and are normally stored on disk and read as required. A simple, interactive means of generating the forms and the data field definitions is provided.

F and CCF - $50.00, U - $75.00

Computer Systems Consultants
FULL SCREEN MAILING LIST

The Full Screen Mailing List System provides a means of maintaining simple mailing lists. Using a random fill structure based on the first character of the name field, it maintains the file in alphabetical order for easier inquiry. With the FIND command, the user may locate all records matching on partial or complete name, city, state, zip, or attributes. Printed listings and output to labels may also be produced on the same selective basis. It requires TSC's Extended BASIC.

F and CCF - $100.00, U - $110.00

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Southeast Media

CHESS 6809

Requires FLEX and DISPLAYS On Any Type Terminal

Features:

*Four levels of play.
*Swap side. *Point scoring system.
*Two display boards. *Change skill level.
*Solve Checkmate problems in 1-2-3-4 moves.
*Make move and swap sides. *Play white or black.

This is one of the strongest CHESS programs running on any microcomputer, estimated USCF Rating 1600+ (better than most 'club' players at higher levels).

F and CCF - $79.95

Southeast Media

DIET-TRAC Forecaster

DIET-TRAC Forecaster is an XBASIC program that plans a diet in terms of either calories and percentage of carbohydrates, proteins and fats (C P G%) or grams of Carbohydrate. Protein and Fat food exchanges of each of the six basic food groups (vegetable, bread, meat, skim milk, fruit and fat) for a specific individual.

Sex, Age, Height, Present Weight, Frame Size, Activity Level and Basal Metabolic Rate for normal individual are taken into account. Ideal weight and sustaining calories for any weight of the above individual are calculated. When a weight goal is given (either gain or loss), and a calorie plan is agreed upon between the computer and the individual, the number of days to reach the weight goal is projected. The starting and ending rate of weight loss is calculated, and a daily calendar with each day's weight for a 30-day period is printed.

F - $59.95
U - $89.95

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SOFTWARE

COLOR COMPUTER SOFTWARE

Stearns Electronics

FORTH

Intrigued by Forth??? Here is a FORTH package tailored to the Color Computer! This package is supplied on Tape, with instructions for transferring it to disk if you wish. Written primarily in machine language, it's speed is unparalleled. A full Semigraphic-8 Editor is provided, along with "goodies" like Graphics and Sound Commands, Printer Commands, Auto-Repeat and Control Keys, etc. If you are interested in Learning FORTH, a Trace Feature is provided which is invaluable. If you are a FORTH Pro, this package provides CPU carry Flag accessibility, Fast Task Multiplexing, Clean Interrupt Handling, etc. (Or; you won't "out grow" the Basic capabilities of this Implementation). Combine this package with Leo Brodie's EXCELLENT Book "Starting FORTH", and you will be a FORTH Expert before you know it (and have a lot of fun doing it!).

Color Computer TAPE - $58.95

Custom Software Engineering, Inc.

Color Computer **GRAPHIC SCREEN PRINT** Programs

Dumps any "PHODE" Screen to the Printer with the BASIC USR Function. Shift the Printout Left or Right or Reverse Print (Dark for Light Screen and Vice Versa). All Programs on Tape.

GSPR	for R.S. LP-VII/VIII & DMP 100/200/400	$7.95
GSPRE	for Epson w/ Graftrax and Graftrax +	$9.95
GSPRG	for Gemini 10 and 15	$9.95
GSPRP	for the Prowriter Printers	$9.95

Custom Software Engineering, Inc.

DATE-O-BASE CALENDAR Program

A Menu Driven EXTENDED BASIC Program which allows the entry of up to 12 Memos per Day, each of which may contain up to 28 Characters, for any day of the Month between the years 1700 and 2099. A Graphic Calendar shows which days contain Memos, and a "Key Word" Search is provided which can be output to the Screen or Printer.

TAPE DATE-O-BASE CALENDAR
(Each Tape File will hold up to 400 Memos) $16.95

DISK DATE-O-BASE CALENDAR
(4,000 Memos at 300/Month per Disk) $19.95

Custom Software Engineering, Inc.

That's INTEREST-ing

Interested in INTEREST (the Money Kind)? An EXTENDED BASIC Program that will help you deal with numerous problems requiring interest calculations. Present Value, Rate of Return, Current Bond Yield and Rate of Return to maturity, Loan Repayment Amortization Schedules, etc.

TAPE - $29.95

Custom Software Engineering, Inc.

DISK DATA HANDLER 64K

An EXTENDED BASIC Data Management System w/ Mach. Lang. Routines. Allows a max of 246 Chars. and 14 Fields per Record, and another Record can be linked to the first; 8 Char. Field Names, up to 99 Chars. per Field. Powerful On-Screen editor for Input and update. Flexible Output capabilities including output to Disk Files for use by other Programs. Change File Definition without re-entering the Data, Split Files, etc. Allows Multiple Field Sorts, Select on any combination of Fields, etc. An extremely POWERFUL TOOL; instructions provide examples of Mailing Lists and a Financial Stock Profit and Loss Tracking System.

DISK - $54.95

Custom Software Engineering, Inc.

DISK DOUBLE ENTRY

DISK EXTENDED BASIC Accounting Program w/ Mach. Lang. Routines. A "Traditional" Accounting Package for Small Business, Clubs, Churches, Personal Use, etc. Up to four levels of subtotals with Trial Balance, Income Statement, and Balance Sheet Reports. DDE allows up to 300 accounts and a Trial Balance of $9,999,999.99. Transactions may be up to 14 lines long, and comments and explanations may be freely used. Accounts are traceable to the journal transaction, which may include comments. Screen reports allow review of past transactions and current balances.

DISK - $44.95

VISA MasterCard

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!!! Please Specify Your Operating System & Disk Size !!!

TEN MOST-ASKED QUESTIONS about DYNACALC™

THE ELECTRONIC SPREAD-SHEET FOR 6809 COMPUTERS

1. What is an electronic spread-sheet, anyway?
Business people use spread-sheets to organize columns and rows of figures. DYNACALC simulates the operation of a spread-sheet without the mess of paper and pencil. Of course, corrections and changes are a snap. Changing any entered value causes the whole spread-sheet to be re-calculated based on the new constants. This means that you can play, 'what if?' to your heart's content.

2. Is DYNACALC just for accountants, then?
Not at all. DYNACALC can be used for just about any type of job. Not only numbers, but alphanumeric messages can be handled. Engineers and other technical users will love DYNACALC's sixteen-digit math and built-in scientific functions. You can build worksheets as large as 256 columns or 256 rows. There's even a built-in sort command, so you can use DYNACALC to manage small data bases — up to 256 records.

3. What will DYNACALC do for ME?
That's a good question. Basically the answer is that DYNACALC will let your computer do just about anything you can imagine. Ask your friends who have VisiCalc™, or a similar program, just how useful an electronic spread-sheet program can be for all types of household, business, engineering, and scientific applications. Typical uses include financial planning and budgeting, sales records, bills of material, depreciation schedules, student grade records, job costing, income tax preparation, checkbook balancing, parts inventories, and payroll. But there is no limit to what YOU can do with DYNACALC.

4. Do I have to learn computer programming?
NO! DYNACALC is designed to be used by non-programmers, but even a Ph.D. in Computer Science can understand it. Even experienced programmers can get jobs done many times faster with DYNACALC, compared to conventional programming. Built-in HELP messages are provided for quick reference to operating instructions.

5. Do I have to modify my system to use DYNACALC?
Nope. DYNACALC uses any standard 6809 configuration, so you don't have to spend money on another CPU board or waste time learning another operating system.

6. Will DYNACALC read my existing data files?
You bet! DYNACALC has a beautifully simple method of reading and writing data files, so you can communicate both ways with other programs on your system, such as the Text Editor, Text Processor, Sort/Merge, STYLOGRAPH™ word processor, RMS™ data base system, or other programs written in BASIC, C, PASCAL, FORTRAN, and so on.

7. How fast is DYNACALC?
Very. Except for a few seldom-used commands, DYNACALC is memory-resident, so there is little disk I/O to slow things down. The whole data array (worksheet) is in memory, so access to any point is instantaneous. DYNACALC is 100% 6809 machine code for blistering speed.

8. Is there a version of DYNACALC for MY system?
Probably. You need a 6809 computer (32k minimum) with FLEX™, UniFLEX™, or OS-9™ operating system. You also need a decent crt terminal, one with at least 80 characters per line, and direct cursor addressing. If your terminal isn't smart enough for DYNACALC, you probably need a new one anyway. The UniFLEX and OS-9 versions of DYNACALC allow you to mix different brands of terminal on the same system. There's also a special version of DYNACALC for Color Computers equipped with FLEX (Frank Hogg or Data-Comp versions).

9. How much does DYNACALC cost?
The FLEX versions are just $200 per copy; UniFLEX version $395; OS-9 version (works with LEVEL ONE or LEVEL TWO) $250. Orders outside North America add $7 per copy for postage. We encourage dealers to handle DYNACALC, since it's a product that sells instantly upon demonstration. Call or write on your company letterhead for more information.

10. Where do I order DYNACALC?
See your local DYNACALC dealer, or order directly from CSC at the address below. We accept telephone orders from 10 am to 6 pm, Monday through Friday. Call us at 314-576-5020. Your VISA or MasterCard is welcome. Please specify diskette size for FLEX or OS-9 versions. Software serial number is required for the UniFLEX version.

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Fully enclosed pod with 3' of flat ribbon cable for connection to the host computer MC6821 PIA interface board.

MC6809 software for FLEX and OS9 (Level 1 or 2, Version 1.2).

BINARY DISK FILE offset loader supplied with FLEX, MDOS and OS9.

Menu driven software provides the following facilities:

a. FILL ..... a selected area of the buffer with a HEX char.
b. MOVE ..... blocks of data.
c. DUMP ..... the buffer in HEX and ASCII.
d. FIND ..... a string of bytes in the buffer.
e. EXAMINE/CHANGE . the contents of the buffer.
f. CRC ..... checksum a selected area of the buffer.
g. COPY ..... a selected area of an EPROM into the buffer.
h. VERIFY ..... a selected area of an EPROM against the buffer.
i. PROGRAM ..... a selected area of an EPROM with data in the buffer.
j. SELECT ..... a new EPROM type (return to types menu).
k. ENTER ..... the system monitor.
l RETURN ..... to the operating system.
m. EXECUTE ..... any DOS utility (only in FLEX and OS9 versions).

FLEX AND OS9 VERSIONS AVAILABLE FROM GIMIX. SSB/MDOS CONTACT US DIRECT.

PL/9

- Friendly inter-active environment where you have INSTANT access to the Editor, the Compiler, and the Trace-Debugger, which, amongst other things, can single step the program a SOURCE line at a time. You also have direct access to any FLEX utility and your system monitor.
- 375+ page manual organized as a tutorial with plenty of examples.
- Fast SINGLE PASS compiler produces 6K of COMPACT and FAST 6809 machine code output per minute with no run-time overheads or license fees.
- Fully compatible with TSC text editor format disk files.
- Signed and unsigned BYTES and INTEGERS, 32-bit floating point REALs.
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- Logical operators: (.AND), (.OR), (.EOR/XOR)
- Control statements: IF..THEN..ELSE, IF..CASE1..CASE2..ELSE, BEGIN..END, WHILE.., REPEAT..UNTIL, REPEAT..FOREVER, CALL, JUMP, RETURN, BREAK, GOTO.
- Direct access to (ACCA), (ACCB), (ACCD), (XREG), (CCR) and (STACK).
- FULLY supports the MC6809 RESET, NMI, FIRQ, IRQ, SWI, SWI2, and SWI3 vectors. Writing a self-starting (from Power-up) program that uses ANY, or ALL, of the MC6809 interrupts is an absolute DOD!
- Machine code may be embedded in the program via the 'GEN' statement. This enables you to code critical routines in assembly language and embed them in the PL/9 program (see 'MACE' for details).
- Procedures may be passed and may return variables. This makes them functions which behave as though they were an integral part of PL/9.
- Several fully documented library procedure modules are supplied: IOSUBS, BITIO, HARDIO, MEMIO, FLEXIO, SCIPACK, STRSUBS, BASTRING, and REALCON.

"... THIS IS THE MOST EFFICIENT COMPILER I HAVE FOUND TO DATE."

Quoted from Ron Anderson's FLEX User Notes column in '68. Need we say more?

MACE/XMACE/ASM05

All of these products feature a highly productive environment where the editor and the assembler reside in memory together. Gone are the days of tedious disk load and save operations while you are debugging your code.

- Friendly inter-active environment where you have instant access to the Editor and the Assembler, FLEX utilities and your system monitor.
- MACE can also produce ASMPROCs (GEN statements) for PL/9 with the assembly language source passed to the output as comments.
- XMACE is a cross assembler for the 6800/1/2/3/8 and supports the extended mnemonics of the 6303.
- ASM05 is a cross assembler for the 6805.

D-BUG

LOOKING for a single step tracer and mini in-line disassembler that is easy to use?? Look no further, you have found it. This package is ideal for those small assembly language program debugging sessions. D-BUG occupies less than 6K (including its stack and variables) and may be loaded anywhere in memory. All you do is LOAD IT, AIM IT and GO! (80 col VDUs only).

McCOSH 'C'

This is a complete a 'C' compiler as you will find on any operating system for the 6809. It is completely compatible with UNIX V7 and only lacks 'bit-fields' (which are of little practical use in an 8-bit world!).

- Produces very efficent assembly language source output with the 'C' source optionally interleaved as comments.
- Built-in optimizer will shorten object code by about 11%.
- Supports interleaved assembly language programs.
- INCLUDES its own assembler. The TSC relocating assembler is only required if you want to generate your own libraries.
- The pre-processor, compiler, optimizer, assembler and loader all run independantly or under the 'CC' executive. 'CC' makes compiling a program to executable object as simple as typing in 'CC,HELLO.C <RETURN>'.

IEEE-488

- SUPPORTS ALL PRINCIPAL MODES OF THE IEEE-488 (1975/8) BUS SPECIFICATION:
  - Talker - Serial Poll - Single or Dual Primary Address
  - Listener - Parallel Poll - Secondary Address
  - System Controller - Group Trigger - Talk only ... Listen only
- Fully documented with a complete reprint of the KILOBAUD article on the IEEE bus and the Motorola publication 'Getting aboard the IEEE Bus'.
- Low level assembly language drivers suitable for 6800, 6801, 6802, 6803, 6808 and 6809 are supplied in the form of listings. A complete back to back test program is also supplied in the form of a listing. These drivers have been extensively tested and are GUARANTEED to work.
- Single S-100 board (4, 8 or 16 addresses per port), fully socketed, gold plated bus connectors and IEEE interface cable assembly.

PRICES

D-BUG	(6809 FLEX only)	$ 75.00
MACE	(6809 FLEX only)	$ 75.00
XMACE	(6809 FLEX only)	$ 98.00
ASM05	(6809 FLEX only)	$ 98.00
PL/9	(6809 FLEX only)	$195.00
'C'	(6809 FLEX only)	$295.00
IEEE-488	with IEEE-488 cable assembly	$298.00
UPROM-II/U	with one version of software (no cable or interface)	$395.00
UPROM-II/C	as above but complete with cable and S-50 interface	$545.00
CABLE	5' twist-n-flat 50 way cable with IDC connectors	$ 35.00
S-50 INT	S5-50 interface for UPROM-II	$130.00
EXOR INT	Motorola EXORbus (EXORciser) interface for UPROM-II	$195.00
UPROM SFT	Software drivers for 2nd operating system. Specify FLEX or OS9 AND disk size!	$ 35.00
UPROM SRC	Assembly language source (contact us direct)	

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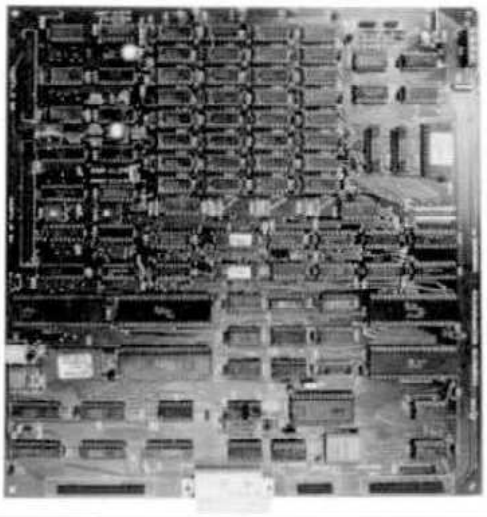

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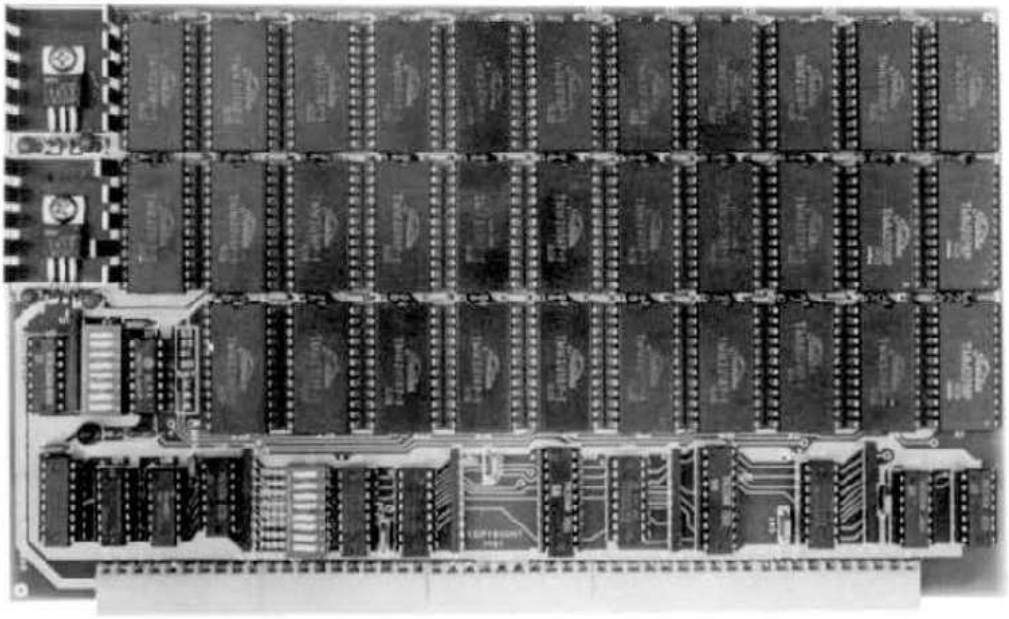

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Color Micro Journal

The Color Computer Monthly Magazine $1.95 per issue Vol. 1, Issue 2 October, 1983

THIS 'N THAT

The BIG NEWS this month is that OS-9 has finally arrived for the Color Computer. The ASTOUNDING part of the Radio Shack OS-9 Package, besides the price, is the DOCUMENTATION. You 'Old Time Radio Shack Followers' will not believe what you see. Jon Shirley has been telling us that the main reason for the "lack" of documentation with a lot of their products was the restrictions placed on releasing that information by Microsoft; I

OS-9 on the COLOR COMPUTER

One of the 'Operating Systems of the Future" is now available for the "little old Color Computer": OS-9. Freely translated, OS-9 means "Operating System for the 6809" (OS-9 is now being written for the 68000, also). Since it is fairly obvious that UNIX and "UNIX-Type" Operating Systems will be running on just about every computer to come out in the next few years, a whole new language is beginning to appear on the horizon.

Color Computer OS-9; the Package

We had been running a preliminary release of OS-9 on the Color Computer for a few weeks, and received the "Official Radio Shack" version for Review a couple of days ago. To put it mildly, this package is IMPRESSIVE! For $69.95 (Radio Shack Catalog Number 26-3039), you receive a 9 1/2" x 7 5/8" x 2" package containing 4

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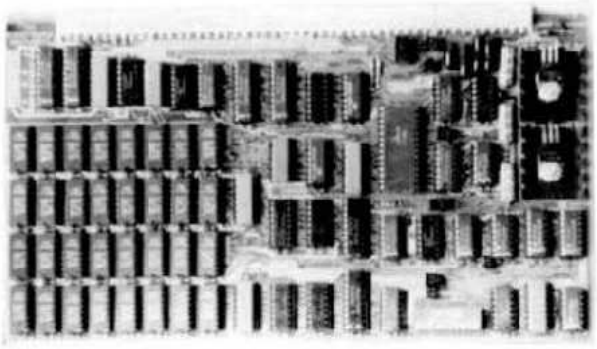

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PROGRAMS							
2704*			●				●
2508	●		●	●	●	●	●
2708*			●		●		●
2758	●	●	●	●		●	
2516	●	●	●	●	●	●	
2716	●	●	●	●		●	●
2716*			●		●		●
2532	●		●	●	●	●	●
2732	●		●	●	●	●	●
2732A	●		●	●	●	●	●
2564	●		●	●	●	●	●
2764	●		●	●	●	●	●
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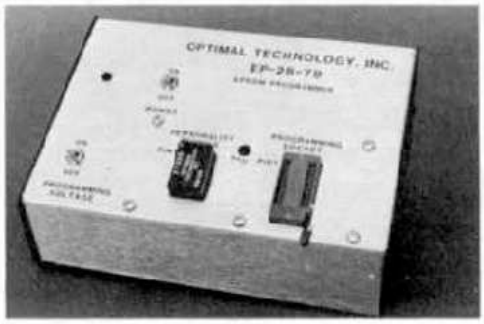

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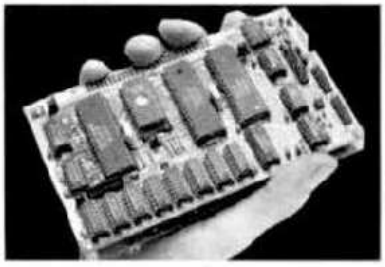

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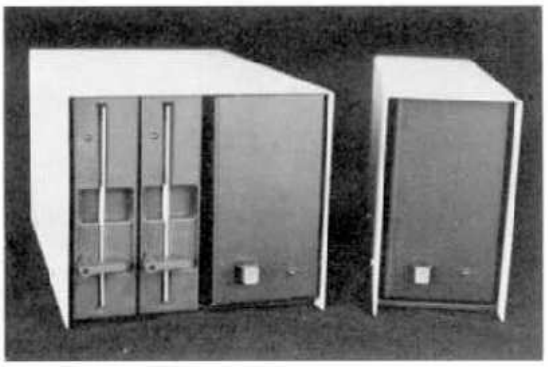

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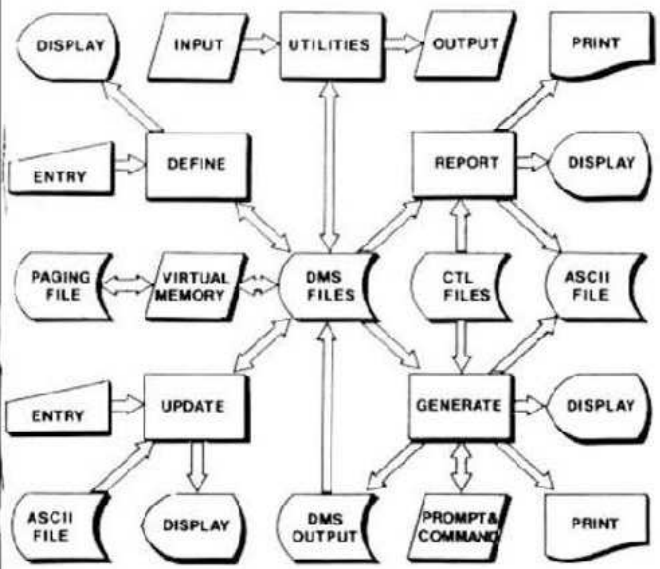

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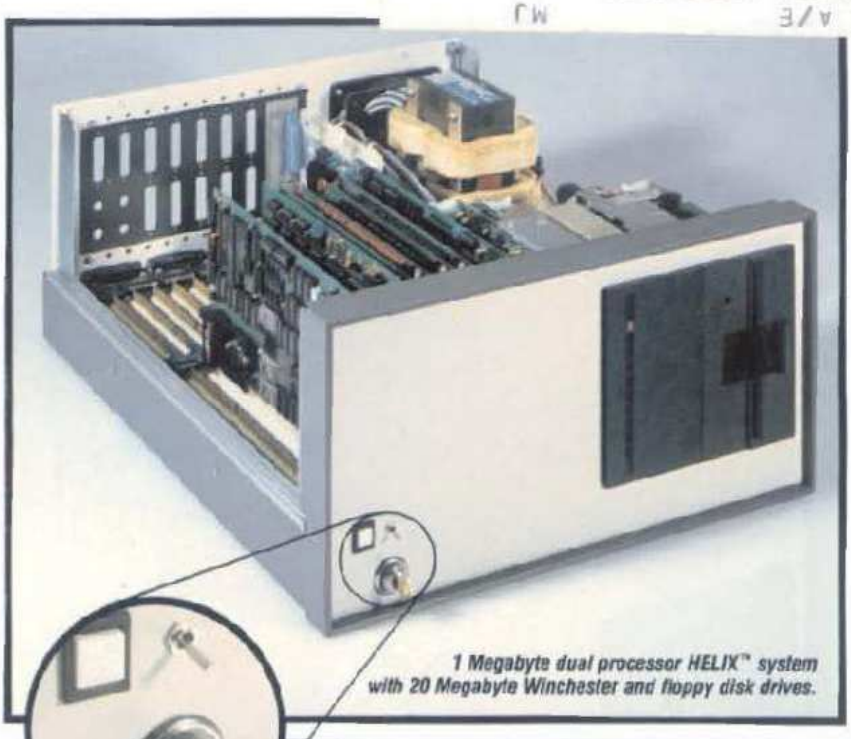

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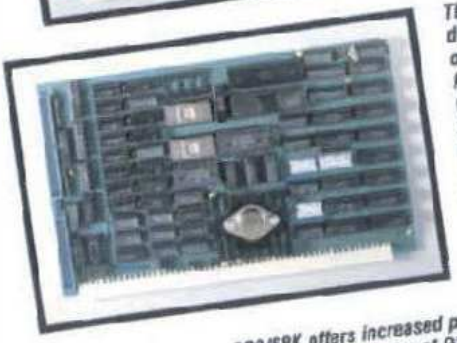

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