

FHL

**Color**

FLEX

## READ THIS FIRST

5.0:4 Color FLEX has several new features. First put the supplied disk in drive 0 and type RUN"FLEX . After about 30 seconds the screen will switch to Hi-Resolution and the FHL Color FLEX logo with a date prompt will be displayed. Answer the date prompt with today's date. In a few moments the screen will clear and a status line will appear on the bottom of the screen with the FHL logo and the date in it, then an example of the character set will be displayed on the screen. Finally the three plus sign prompt will appear.

Everything that happens from the time you entered the date until the three plus sign prompt is because of the "STARTUP" file being executed as per the documentation. If you list the startup file, i.e. LIST STARTUP, you will see PUTSTAT:LIST ALPHA. PUTSTAT is a trivial program that sets a status line at the bottom of the screen and then puts the logo and the date in it. LIST ALPHA is just that, LIST being a program that lists a file, and ALPHA being a text file that contains just exactly what you see displayed.

New features of version 5.0:4 include the DISPLAY command and an extensive revision of the EXT command bringing with it true hardware handshaking! Along with this, the INT command has been modified. Smooth scrolling and variable scroll rates along with a new SETUP command to change your screen from a white background to green (eliminating the need to change it by manually adjusting the VDG mode as in previous versions) are also included and explained in the "Features of FHL Color FLEX" section of this manual. Control-W is now used to generate Status lines instead of the Control-C used previously.

These are just some of the features of this new version. Read in the manual about how to create your own STARTUP file and the use of commands in it.

### A NOTE ABOUT STATUS LINES

When you use status lines you are changing the configuration of the terminal. This means that if you were to run a program like our 'ED' which uses cursor addressing and depends on the configuration of the terminal for proper running, then you have to reconfigure those programs. Or, before running any of these programs, just type a CTRL D which will remove any status lines. The same can be said for protected lines on the screen. It's no big problem, as a matter of fact it can be rather entertaining to see what happens when you do this. At any rate, have fun with the new features of FLEX.

This version of FLEX for the Color Computer is the most powerful available, with more features than any other currently available. Just wait 'till you see what we're working on next.

FHL

## PREFACE

The purpose of this User's Guide is to provide the user of the FLEX Operating System with the information required to make effective use of the available system commands and utilities. This manual applies to **PHL Color FLEX** for the Radio Shack Color Computer. The user should keep this manual close at hand while becoming familiar with the system. It is organized to make it convenient as a quick reference guide, as well as a thorough reference manual.

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**FRANK HOGG LABORATORY, Inc.**  
770 James Street  
The Regency Towers  
Syracuse, NY 13203  
315-474-7856

## MANUAL REVISION HISTORY

Revision	Date	Change
A	5/27/82	Original Release, V5.0
B	7/14/82	Correct typos, add INCHNE to Appendix E, Prog. Guide page 53 addition.
C	11/24/82	Rewrite and update to Version 5.0:2
D	3/18/83	Addition of ISM and TED.
E	6/13/83	Rewrite and update to Version 5.0:4
F	9/9/83	Include omissions to previous rewrite. Correct typos.

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(\* ) These commands are provided by Frank Hogg Laboratory, Inc., not TSC. Contact FHL if you have any problems with them.

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**NOTE:** IF THERE IS A 'READ-ME.TXT' FILE ON THE SUPPLIED DISK THEN LIST IT OUT USING:

LIST 0.READ-ME

(\* These commands are provided by Frank Hogg Laboratory, Inc. - not TSC. Contact FHL if you have any problems with them.

## Introduction to FHL Color FLEX

### 1. Introduction

FHL Color FLEX, licensed from Technical Systems Consultants, Inc. by Frank Hogg Laboratory, Inc., is an enhanced version of their FLEX Disk Operating System, for the Radio Shack TRS-80 Color Computer. FHL Color FLEX allows the Color Computer to be used with a wide array of hardware and software products, far beyond the capabilities of the basic system as supplied by Radio Shack. For a list of some of the software products available for FLEX, see Appendix D.

The rest of Section 1 details the minimum hardware configuration required to run FHL Color FLEX. Section 2 of this document describes some of the features of FHL Color FLEX. Features of FLEX as supplied by TSC are not described here; some articles are referenced in Appendix A. Section 3 provides a tutorial on the use of some of the commands provided with FHL Color FLEX.

#### Minimum Hardware Configuration.

To run FHL Color FLEX you must have a TRS80 Color Computer with Disk Extended Color Basic and at least one disk drive. This implies that the Extended Color Basic ROM is installed in the Color Computer. In addition, 64K dynamic RAMs must be installed in the Color Computer, which must be configured as a 32K Color Computer. Finally, a small hardware modification (Revision F boards do not require modification), is required inside the case of the Color Computer to allow the ROMs to be disabled under software control, allowing the full 64K of RAM (minus the top 256 bytes) to be accessed.

If you do not have a Color Computer, you may purchase one already modified and ready to run FHL Color FLEX. Some vendors are listed in Appendix B. If you have a Color Computer that does not have 32K, Radio Shack will upgrade it for you. The RAM chips used by Radio Shack will probably be full 64K RAMs, but they must be tested after performing the modification, and one or two may need to be replaced. Alternatively, if your computer is a recent revision (D,E or F), a 64K upgrade kit is available.

If you have a 32K Color Computer, Appendix C tells you how to perform the modification to use the full 64K.

Running FHL Color FLEX on the modified 64K Color Computer with the Radio Shack disk system and Disk Extended Color Basic is accomplished by inserting the system disk in drive zero and entering:

```
RUN "FLEX"
```

The disk motors should start and after about 10 seconds, the following should appear on the terminal.

```
FHL COLOR FLEX Vx.x:x  
DATE (MM,DD,YY)?
```

```
+++
```

The name FLEX identifies the operating system and the x.x:x will be the version number of the operating system. At this time the current date should be

## Features of FHL Color FLEX

entered, such as 5,26,82 or 5 26 82 or 5/26/82. The FLEX prompt is the three plus signs (+++), and will always be present when the system is ready to accept an operator command. The '+++' should become a familiar sight and signify that FLEX is ready to work for you!

### 2. Features of FHL Color FLEX

#### Disk Drive Support

The disk drive supplied with the Color Computer disk system by Radio Shack is a 35-track, single-sided, double-density drive with a stepping rate of 30 milliseconds. It is possible to purchase an 80-track, double-sided, double-density drive with a stepping rate of 6ms. This disk will store more than four times as much information as the Radio Shack disk, and will perform track seeking operations five times faster. FHL Color FLEX allows these high-performance drives to be used with the Color Computer.

A section of memory in the FLEX operating system is reserved for a Drive Configuration Table. This table contains information about each drive in the system, up to a total of four drives. (Only three drives may be used if double-sided drives are included.) The information about each drive in the table includes whether or not the drive exists, whether or not it is double-sided or double-density, how many tracks it has, and what its stepping rate is. This means that not only may you use high-performance drives in the system, but also you may mix high-performance drives with standard Radio Shack drives in any combination. Another feature of the Drive Configuration Table allows the drive number used by FLEX (the logical drive number) to be different from the drive number according to the wiring (the physical drive number). Care must be exercised using this feature, because the number switching is not in effect during boot-up, and because different logical drives may be assigned to the same physical drive and vice-versa, possibly confusing the FLEX file management system.

FHL Color FLEX contains another feature rarely found in FLEX systems for five-inch disks. A five-inch drive has no provision for telling the computer that there is no disk in the drive, or that the door is open. This means that on most five-inch FLEX systems the software will hang up if you accidentally access a drive which does not exist, or which exists but does not contain a disk. In FHL Color FLEX, an access to a nonexistent drive will immediately return an error (because the Drive Configuration Table indicates that the drive doesn't exist.) A time limit is imposed on accesses to existing drives so that if the drive is not ready, an error will occur.

Another feature of the disk package in FHL Color FLEX is that the time delay before motor shutoff occurs is adjustable.

#### Keyboard Features.

Every ASCII code may be generated from the Color Computer keyboard under FHL Color FLEX. To allow for this, some of the keys must serve dual functions. Keycodes commonly used in FLEX have been assigned so that they may be easily generated.



## Features of FHL Color FLEX

If the up-arrow is struck alone, the cursor is moved up one line. However, if the shift key is held down, the up-arrow key serves as the CTRL key. In the unshifted mode, the break key generates an escape code. In control mode however, the break key is another case-shifting key, called super-shift. The super-shift feature and the CTRL feature allow all codes to be generated. Appendix E contains a list of the codes generated by each of the keys, in each mode.

Some special function keys are worthy of note. A shift-zero toggles the alpha-lock function: If alpha-lock is on, only upper-case letters are generated.

The number of times that the keyboard is scanned for debouncing purposes is adjustable, using the SETUP command. This feature allows the debouncing operation to be optimized for faster typists or, on the other hand, for bouncier keyboards.

### Display Features

The display package included in FHL Color FLEX contains many features and adjustable parameters to enhance the capabilities of the Color Computer display. The user may select either a blinking block or steady underline cursor. This is done by typing SETUP TCC. The cursor may also be disabled. Screen color may be changed from a white background to green by using SETUP TG. Switch back to white by SETUP TW. See SETUP TERMINAL for more info on these and other options.

Other features of the display package include direct cursor addressing, clear end-of-line and end-of-screen, home, cancel line, and variable scroll rates. See Appendix E page 3.

The control-G bell is adjustable in pitch and duration. For information on the control codes for various screen operations, see Appendix E.

### A Note about Motor Shutoff

There is no means to automatically shut off the drive motors in the Color Computer while running FLEX. Automatic motor shutoff is provided only while a program is waiting for keyboard input. If no key is pressed for a certain time, the motors are shut off. This time is adjustable using the SETUP command. The shutoff occurs after the cursor has blinked a certain number of times, thus the delay is also changed by changing the blink frequency. Note that virtual cursor blinks occur even if a non-blinking cursor is selected.

### Printer Support

The P command (used to redirect output from a program to the printer) has been included as a memory-resident command. It redirects output to the Color Computer RS-232 port. Several options, adjustable using the SETUP command, allows almost any ASCII printer to be used. The baud rate is adjustable from 110 to 9600. The number of stop bits may be changed from 1 to 255. The printer may be either an auto-linefeed printer or a normal CR-LF printer.

## Features of PHL Color FLEX

### Other FLEX Features

You may like to make some of these options permanent installations in your FLEX system. Of course, you could put the required SETUP command in your STARTUP file, but this uses up some time during bootup. A better way is to include the options right in the FLEX.SYS file. To do this you must create a temporary file called OPTIONS.BIN perhaps, to contain the options. To do this, type "SETUP FOPTIONS" followed by your options. Instead of affecting the options in memory, SETUP places them in the file. Now append FLEX.SYS to OPTIONS, creating a new file which will become your new FLEX.SYS file once renamed. On a single-drive system:

```
"APPEND FLEX.SYS OPTIONS.BIN NEWFLEX.SYS"  
"DELETE FLEX.SYS"  
"RENAME NEWFLEX.SYS FLEX.SYS"  
"LINK FLEX.SYS"
```

On a two-drive system:

```
"SETUP F1.OPTIONS ..."  
"APPEND 0.FLEX.SYS 1.OPTIONS.BIN 1.FLEX.SYS"  
"LINK 1.FLEX.SYS"
```

### Hooking up a Printer

You can attach a printer to your Color Computer and run it under FLEX very easily. The hookup is the same as it is for using the printer under COLOR BASIC. Serial data will come out the RS-232 Data Out pin, as long as the Data In pin is held high.

Use the SETUP command to tell FLEX what kind of printer you have. Set the baud rate by typing "SETUP PB1200" for a 1200 baud printer as an example. If the printer does not perform automatic linefeeds for each carriage return, type "SETUP PN". You may want to add more stop-bits. Typing "SETUP PS3" will give you 3. These three commands may be combined by typing "SETUP PNS3,B1200".

On some printers it may be necessary to adjust the baud rate count by +/- six percent to achieve reliable transmission. FLEX generates the best approximation of the baud rate you type that it can.

You may use the printer in two different ways. If you type a CTRL-P, everything that goes to the screen will also go to the printer until another CTRL-P is sent. Also, you may use the P command. This will redirect the output from a command to the printer. Try "P CAT".

### FLEX Tutorial

What follows is a step by step tutorial which should help those new to the FLEX operating system with making backup copies of their FLEX disk and in understanding FLEX in general. Once through the Tutorial, read on to the more detailed information about FLEX features and commands, and see what applications you can come up with. Good luck and have fun!

**FHL**

**Color**

**FLEX**

**Tutorial**

First you "Got Started with Color BASIC"  
Then you "Went Ahead With Extended Color BASIC"  
Now, "Keep On Going With FLEX!"

What exactly is "FLEX" and what will it let me do?

FLEX is a Disk Operating System (DOS) which allows your software to interact with your hardware. You may have a computer, and you may have a program written on a disk, but without a disk operating system you can put your disk in the drive and wait forever—the computer won't know the difference!! FLEX is like a bridge between the two which lets your program be read from its disk and be loaded into the computer's memory. NOW you can use it.

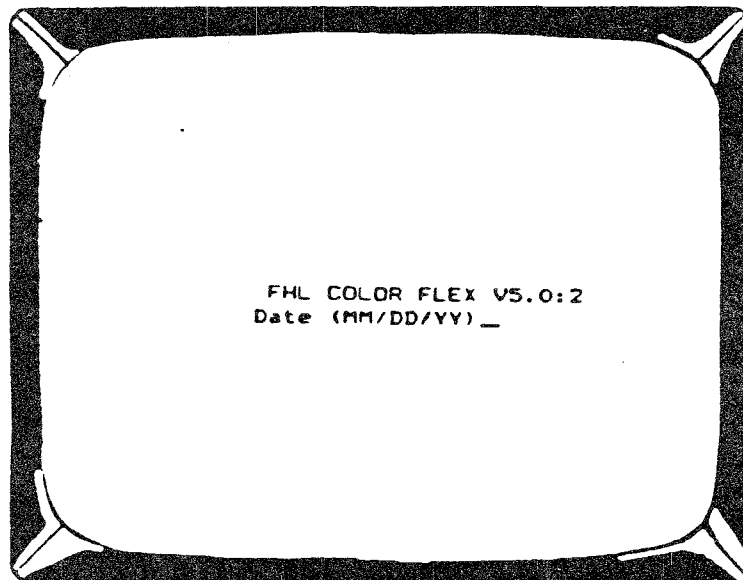
Now that I have my FLEX disk, what should I do with it?

How about trying to use it? Put it in the drive with the little white "write protect" sticker on top. Close the drive door and type:

**RUN\*FLEX** **ENTER**

(When you see this symbol: **ENTER** That means you are to hit the enter key on your computer. Also, for simplicities sake, all information which you are to actually type in will appear in **BOLDFACE** type.)

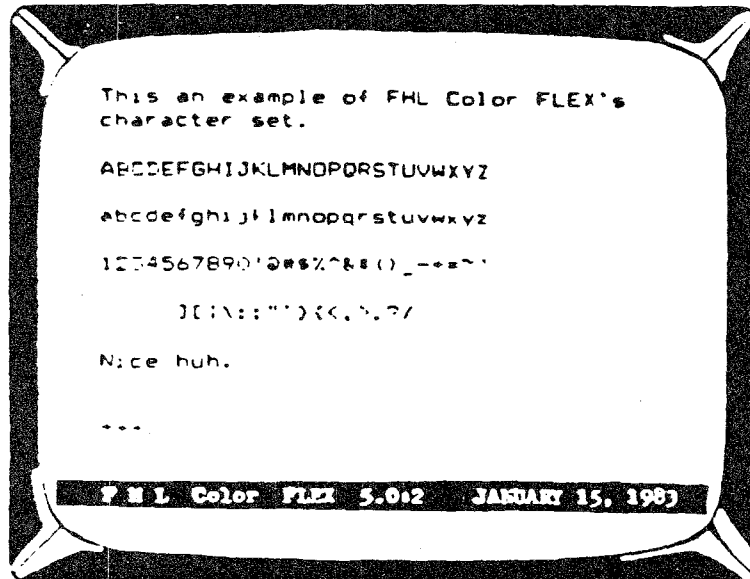
Your drive motor should start to hum, in about six seconds the screen will appear like this:



This is asking you for the date. Type in the numbers of the date in the same form. (MM/DD/YY)—don't include the parentheses!! For example:

2/15/83 **(ENTER)**

Not too tough right? Now FLEX will come back with:

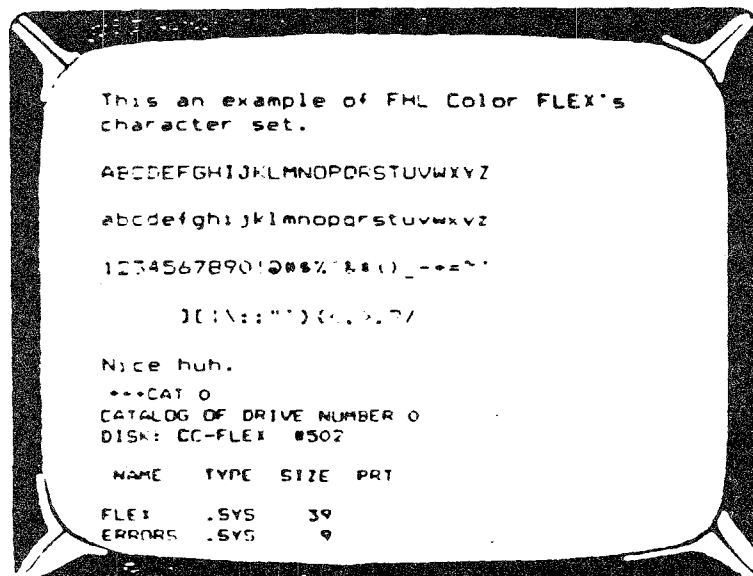


+++\_ means it's ready and waiting for you to tell it what to do. Well, let's find out what is on the disk. Type in:

CAT 0 **(ENTER)**

(this is the number zero, not the letter O).

You have just "commanded" FLEX to give you a catalog of all the files that reside on the disk in drive #0 (which is the FLEX disk of course!). So now, what you should see on your screen is this:



```

PRINT .SYS 1
STARTUP .TXT 1
ALPHA .TXT 1
PUTSTAT .CMD 3
MON .LOW 7
MON .CMD 7
R5124BW .CMD 9
R5124WB .CMD 9
R6424BW .CMD 8
R6424WB .CMD 8
R6432BW .CMD 7
R3216BW .CMD 9
IDUT .CMD 2
LIST .CMD 3
COPY .CMD 5
SDC .CMD 2
SETUP .CMD 5
MOVEROM .CMD 1
CRASIC .CMD 1
BASIC .CMD 1
EXIT .CMD 4
INT .CMD 1
HELP .CMD 3

```

```

PI .CMD 1
NEWDISK .CMD 7
NEWDISKA .CMD 7
CAT .CMD 3
ASH .CMD 1
PUTBOOT .LDR 5
DELETE .CMD 2
RENAME .CMD 1
TTYSET .CMD 2
SAVE .CMD 2
APPEND .CMD 3
BUILD .CMD 1
EXEC .CMD 1
JUMP .CMD 1
DATE .CMD 2
O .CMD 2
VERSION .CMD 1
PROT .CMD 1
VERIFY .CMD 1
I .CMD 1
LINK .CMD 1
SAVE .LOW 2

```

```

HELPCOCO.DIR 56
READ-HE .TXT 2
MEMPATCH.TXT 5
MEMPATCH.BIN 1
DIAPATCH1.TXT 3
DIAPATCH0.TXT 3
DIAPATCH0.BIN 1
DIAPATCH1.BIN 1

```

```

SECTORS LEFT = 321
***

```

Very Good!! You have now used FLEX.

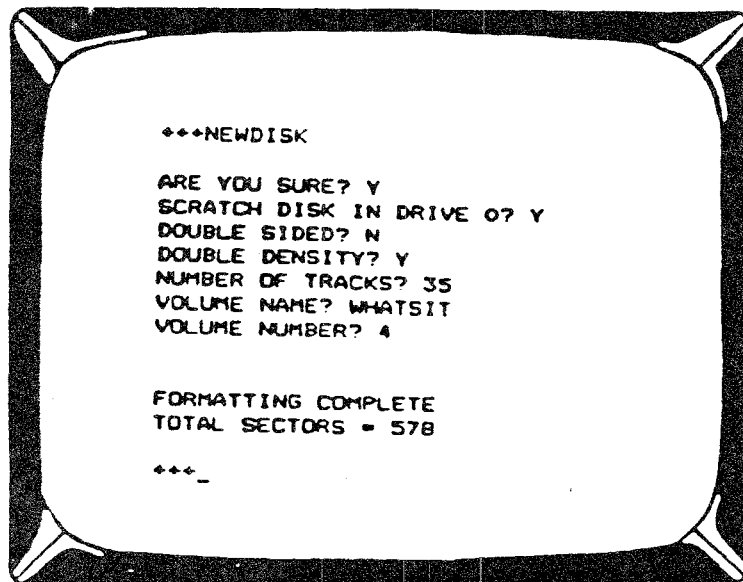
At this point, there are three items that should be clarified. First of all, what is a "write protect" sticker you may be wondering. Well, the name is relatively self explanatory. It "protects" the disk from being "written" on. Therefore, if you want to change anything already written on the disk, or if you want to save some information (write on the disk) you must "unprotect" it—in other words, take the little sticker off! Secondly, anytime you see a 0 used in a command, or to designate a drive, it is the number zero, not the letter O. Last, but not least, What's a drive #0 (or 1, 2, or 3 for that matter)? Well, your drives are numbered, which makes a very convenient way to tell FLEX which drive you want it to look in. If you only have one drive, then that's your drive #0 and FLEX will automatically look there for any information. With more than one drive, you have to tell FLEX which drive contains the information you want it to use. What's nice about two drives is that you can assign one to be your "system" drive, and the other to be your "working" drive. Your system drive contains your system disk—FLEX. Once you type RUN"FLEX" part of the information on your FLEX disk is loaded right into your computer's memory. This is the information that gets the whole system running. The rest of the information on your FLEX disk can be thought of as a "Dictionary" of sorts. When you tell FLEX to do something (i.e. type a command in) it will go to the system drive and "look up" on the disk what that particular command means it's supposed to do. The "work" drive contains the files of information that FLEX is supposed to "do something" to.

With a one drive system, your system and work drive are one in the same--called drive #0. This can be a bit of a pain in the neck at times if you want to command FLEX to do something to a file on a different disk.

Okay, now that you're just about a Pro, the next thing you'll probably want to do is to make a back-up copy of your FLEX disk.

There are five steps to this procedure. Again, there are FIVE steps to this procedure, so count them as you go. For simplicity's sake, we'll be assuming this is being done on a single drive system.

1. Prepare a new disk to have information put on it. This is called formatting, and is done using the NEWDISK command (if you have a double sided drive, you'll be using NEWDISKA instead). Here's an example of what the screen would look like during a typical formatting procedure:



And here's how to get your screen to look that way.

Put your FLEX disk in the drive and after "booting up FLEX" (in other words after typing RUN"FLEX" etc.) type:

NEWDISK ENTER

FLEX will then come back with:

ARE YOU SURE?

Yes you are, so type: Y

Then FLEX will ask you if you want to:

SCRATCH DISK IN DRIVE 0?

BEFORE typing Y, remove your FLEX system disk and put in a new disk with no write protect sticker on it.

Now type: Y

FLEX will then ask the following questions:

DOUBLE-SIDED? Do you have a double sided drive? If not, type N. (If you do then you figure it out.)



DOUBLE DENSITY? You have a double density drive or you wouldn't have gotten this far, so type Y.

NUMBER OF TRACKS? That depends on the number of tracks your drive will support--on one side. Therefore, if you have a double sided drive, DO NOT multiply the number of tracks your drive has by two. Also realize that even though a 35 track disk may be read in a 40 track drive, a 40 track disk cannot be read in a 35 track (for example a Radio Shack) drive. So if you are formatting a disk that may be used in assorted drives, keep this fact in mind. One last note, neither 35 or 40 track disks may be read in an 80 track drive. (ENTER)

VOLUME NAME? Be original, why not call it DISK? (ENTER)

VOLUME NUMBER? This ones up to you.

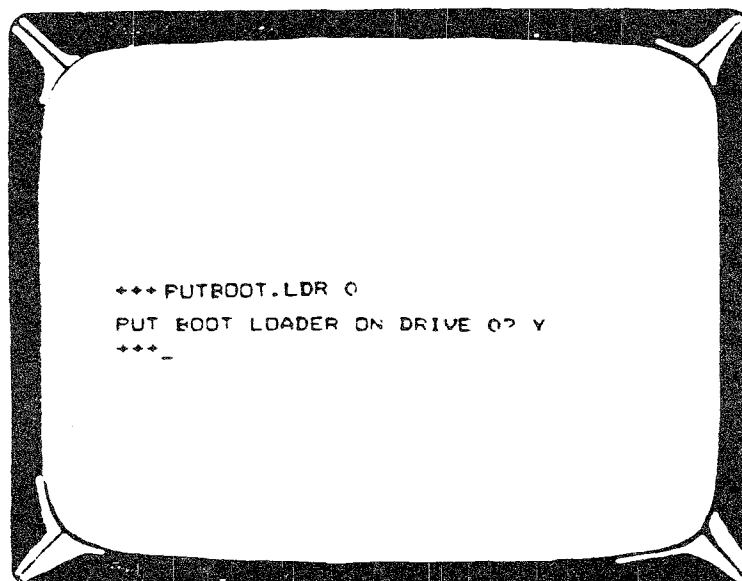
Now hit return and wait. The drive motor will begin running. This is an indication to you that formatting is taking place.

NOTE: Prior to the "FORMATTING COMPLETE" statement, you may see the message:

TRIMMING TRACK SIZE DOUBLE D.

This is not a problem--for more information on this, refer to the NEWDISK section of the FLEX manual.

2. The next step is to use PUTBOOT.LDR on your newly formatted disk. Here's what you'll see on your screen after performing this procedure:



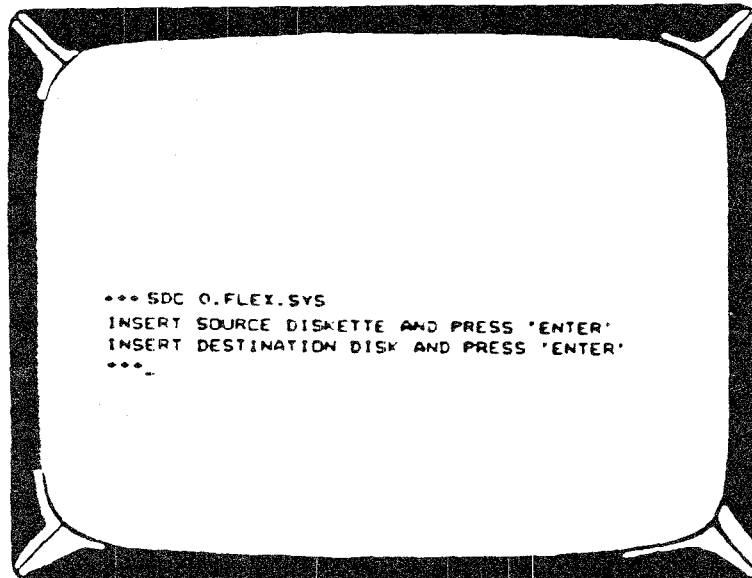
Now here's how you do it:

Put your FLEX disk back in the drive and type:

PUTBOOT.LDR 0 (the 0 tells FLEX which drive to go to). **(ENTER)**

PUT BOOT LOADER ON DRIVE 0? Now, you want to put the boot loader on your new disk, so this is your chance to switch disks—then type: Y

3. When you previously did a catalog (CAT 0) of your system disk, FLEX should have come back with a list of all the files it contained. In this step you're going to copy one of those files; the FLEX.SYS file. Here's the screen:



And here's what you do:

Put your FLEX disk back in and type:

SDC 0.FLEX.SYS **(ENTER)**

Then when FLEX asks you to:

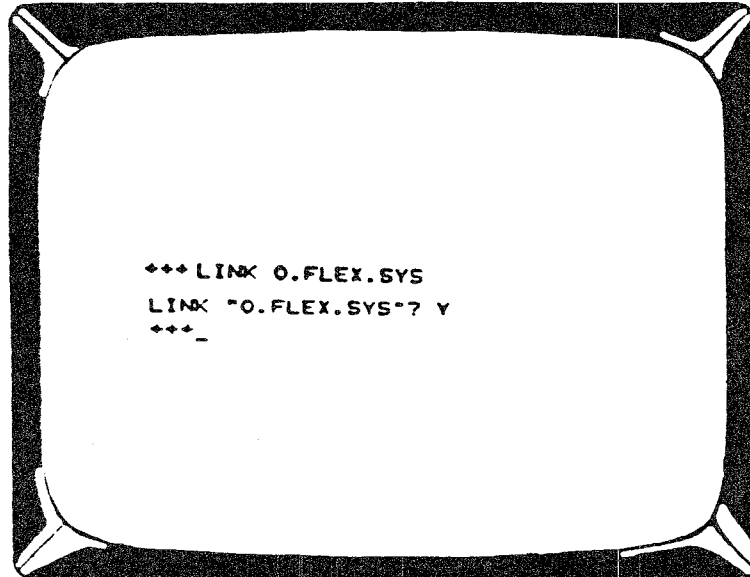
INSERT THE SOURCE DISKETTE AND PRESS 'ENTER'

Just hit enter, since the disk which contains the file you want to copy on it (your system disk) is already there. The destination disk is where you want the file to be copied to, so when FLEX asks you to:

INSERT DESTINATION DISK AND PRESS 'ENTER'

Put your new disk in and hit enter.

4. Three steps down, two to go. Now you've got to LINK the boot loader to the FLEX.SYS. Guess what command you're going to use? That's right, none other than the LINK command. Here's what to look forward to from your screen:



And this is how it's done:

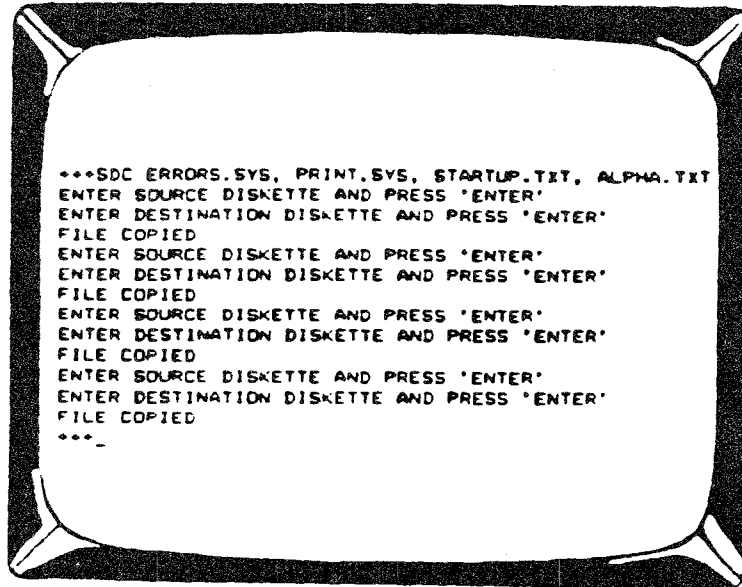
Put your FLEX disk in and type:

**LINK 0.FLEX.SYS** **(ENTER)**

When FLEX asks for confirmation, that's your cue to switch disks. Then type: **Y**

5. The only thing left for you to do at this point is to copy the individual files (remember all the ones that were listed out when you did a "CATalog" of your disk?) from your original FLEX disk to your new disk. This is done with the SDC command for a single drive system, and with the COPY command if you have more than one drive. With SDC you must write out each individual command file name that you are copying, although you may list more than one file in the same command line.

Here's an example of what you should see when you try to copy the first four files from your original FLEX system disk using SDC:



And here's the necessary steps:

While your original FLEX disk is in the drive, type:

**SDC ERRORS.SYS, PRINT.SYS, STARTUP.TXT, ALPHA.TXT** **ENTER**

Now FLEX will come back with:

**ENTER SOURCE DISKETTE AND PRESS 'ENTER'**

Hit enter.

**ENTER DESTINATION DISKETTE AND PRESS 'ENTER'**

Switch disks and hit enter.

**FILE COPIED**

Then continue to switch the disks back and forth as FLEX repeats the above procedure for the next file, and the next file and finally the last file. Now look for that friendly little prompt;

+++\_

O.EBCC	.CMD	TO DRIVE 01	COPIED
O.JUMP	.CMD	TO DRIVE 01	COPIED
O.DATE	.CMD	TO DRIVE 01	COPIED
O.D	.CMD	TO DRIVE 01	COPIED
O.VERSION	.CMD	TO DRIVE 01	COPIED
O.PROT	.CMD	TO DRIVE 01	COPIED
O.VERIFY	.CMD	TO DRIVE 01	COPIED
O.I	.CMD	TO DRIVE 01	COPIED
O.LINK	.CMD	TO DRIVE 01	COPIED
O.SAVE	.LOW	TO DRIVE 01	COPIED
O.HELPCCO	.DIR	TO DRIVE 01	COPIED
O.READ-ME	.TXT	TO DRIVE 01	COPIED
O.MEMPATCH	.TXT	TO DRIVE 01	COPIED
O.MEMPATCH	.BIN	TO DRIVE 01	COPIED
O.DIAPATCH	.TXT	TO DRIVE 01	COPIED
O.DIAPATCH	.TXT	TO DRIVE 01	COPIED
O.DIAPATCH	.BIN	TO DRIVE 01	COPIED
O.DIAPATCH	.BIN	TO DRIVE 01	COPIED

This is all you have to do:

Put your FLEX system disk in drive 0 and your new disk in drive 1 and type:

**COPY 0,1 ENTER**

Voila! You're all done! Now, put your master disk away in a safe place, your new disk in the drive, your FLEX manual on your lap, and learn how to use the darn thing!!

Let's say you just bought some new software to run under FLEX (in other words, is "FLEX compatible"). What should you do with it first?

Just to see what you actually got, do a CAT (catalog) of your new disk. Now, realize that CAT is a FLEX command and is only found on your FLEX disk (this is what is meant by "Disk Resident Commands"). So, if you have a single disk drive system and put your new disk in and type CAT, the system will look on the disk to see what CAT means, and guess what? It won't be there, and your computer will come back with the message NOT FOUND. Therefore you must copy the CAT command onto your new disk. This is quite simple and is done by using the FLEX SDC command. Put your FLEX disk in, type SDC CAT.CMD then hit enter. When asked for the source diskette, hit enter. When asked for the destination diskette, take the write protect sticker off the new disk and insert it in the drive. Hit enter. Remove the disk after the copy is complete and put the write protect sticker back on and then just do a catalog of the disk (CAT 0). Now you at least know what it is you spent your money on, and you can then make a copy or find out what the various files do as explained in the documentation that accompanies your new software.

# **APPENDICES**

## Appendix A - FHL Color FLEX References

### Appendix A - references

1. Frank Hogg, "32K RAM FOR FREE!!!" Color Computer News, February 1982 (No. 6) p.23. How to modify the Color Computer for full use and test the memory.
2. Dale Puckett, "FLEX: An Operating System for the 6809," MICRO - The 6502/6809 Journal, April 1982 (No. 47), p.61. Introduction to FLEX.
3. Scott Norman, "FLEX Your Color Computer," '80 Micro, March 1983 (No. 38) p. 101 Review
4. Dr. Laurence Preble, "A Tale of Three Flexes," The RAINBOW, July 1983 Vol.II (No. 12), p.240. Review and comparison to other versions of FLEX.
5. E.M. Pass, Ph.D., "FLEX and OS/9. An Inside View," The Color Computer Magazine October 1983 Vol.1 (No. 8), p.110. Comparison of FLEX and OS9.
6. Frank Hogg, "64K COLUMN," Color Computer News, Ongoing column about the 64K Color Computer. Additional information about 64K and FLEX.

**Appendix B - Hardware Vendors**

**FRANK HOGG LABORATORY, Inc.**

The Regency Tower  
770 James Street  
Syracuse, New York 13203  
(315) 474-7856

64K Color Computer with warranty. Disk systems with high-performance drives.  
Complete packaged systems for:

**SOFTWARE DEVELOPMENT  
BUSINESS  
WORD PROCESSING**

Computer Plus  
245A Great Road  
Littleton, MA 01460  
(617) 486-3193

64K Color Computers. Radio Shack disk systems. 64K RAMS.



## Appendix C. Modifying the 32K Color Computer.

The following steps will transform a 32K Color Computer (containing 64K RAMs, not the piggybacked 16K rams) into a 64K Color Computer capable of running FLEX.

1. Obtain a new 74LS02 and a new 74LS138.
  2. Remove the top of the case from the Color Computer and remove the RF shield.
  3. Locate U29 and U11 (a 74LS02 and a 74LS138) inside the shield, located in the corner of the shielded area near the center of the keyboard.
  4. Remove U29 and U11 and store them in a safe place. If you have trouble with your Color Computer in the future, you can easily remove the modification and replace these chips, and it will be undetectable that the Color Computer was modified.
  5. On you new 74LS02, carefully bend pins 4, 5 and 6 so they point straight up in the air. Do the same for pin 5 on the 74LS138.
  6. Plug the modified 74LS02 in as U29. Plug the modified 74LS138 in as U11.
  7. You must now make three connections using 30-gauge tinned solid copper wire. You will need a wirewrap tool to wrap the ends of the wire around the pins. For maximum reliability, you should solder the wire to the IC leads. However, do not do this unless you are confident that you can do it without shorting the pins or dropping solder onto the circuit board. The following connections must be made:
    - U29 pin 6 to U29 pin 8
    - U29 pin 4 to U11 pin 5
    - U29 pin 5 to TP1.
- TP1 is located in the diagonally opposite corner of the shielded area. DO NOT SOLDER TO TP1! A simple wire wrap should be sufficient here, and can be easily removed so the modification is reversible.
8. Turn on the computer and see if it initializes properly before replacing the shield and case. Color Basic should work as it did before.
  9. Run the following program to test the RAM. The program will take about a minute to set up, then it will say OK if the memory is good. Otherwise it will report the address of the error, what was read, and what was expected. The following table indicates what kind of error corresponds to which RAM. Chances are everything is OK, but if not probably only one or two of the RAMS need to be replaced. Use 4164 64K Dynamic RAMs.

## Appendix C. Modifying the 32K Color Computer.

Error	Culprit
01	U20
02	U21
04	U22
08	U23
10	U24
20	U25
40	U26
80	U27

### Revision 'F' Board

The Revision 'F' board is very simple to upgrade. If you have a Radio Shack 32K Revision 'F' board then all you have to do is run the test program because the 'F' board has the 64K Mod in it from Radio Shack!

Upgrading a 16K Revision 'F' board to 64K:

Remove these capacitors near the memory chips:  
C58, C60, C62, C64, C66, C68, C70, C72  
Add a jumper to the left of PIA 6821  
Move the jumpers labeled 16/64 from 16 to 64  
Install 8 64K chips.

You still need Extended Color Basic to run FLEX unless you have "The Solution"

## Appendix C. Memory Test

This test is from the October 1982 issue of Color Computer News, page 68. It is patterned after a program published by FHL in the February issue of Color Computer News. This program was written by Jim Brown, 31 Richie Drive, Pleasant Hill, CA 94523.

Basic initialization and machine code load require about 3 seconds. Full range test time for good RAM takes less than 3 seconds.

```

10 ' TEST MEMORY IN MODIFIED
20 ' 32K TRS80 COLOR COMPUTER
30 ' FOR FULL 64K ADDRESSING
40 ' RANGE WHEN MAP TYPE=1
50 '
60 CLEAR 50,&H3000
80 B=&H1D00: ' RELOCATION BASE
100 ' MACHINE CODE:
120 ' SETUP & CLR MEM
130 DATA 34011A50B7FFDF4F
140 DATA AE8CEBA780AC8CE8
150 DATA 23F943
160 ' WAIT FOR REFRESH
170 DATA 8E02A0301F26FC
180 DATA 8E02A0301F26FC
190 ' MAIN LOOP
200 DATA AE8CD26384A184
210 DATA 27028D1F6380
220 DATA AC8CC723F11F894D
230 DATA 271A
240 ' MID LOOP
250 DATA AE8CBB4FA1842702
260 DATA 8D096380AC8CB1
270 DATA 23F320C8
280 ' EXIT SEQUENCE
290 DATA E6843540EF8CAC
300 DATA ED8CA7AF8CA2
310 DATA B7FFDE3581
320 ' RESUME SEQUENCE
330 DATA 34011A50B7FFDF
340 DATA EE8C97AE8C90
350 DATA A68C8F6EC4
370 ' DEFINE CONSTANTS
390 H$="&H"
400 SA=B+&H00:'START ADDR
410 EA=B+&H02:'END ADDR
420 XA=B+&H04:'EXIT ADDR
430 DA=B+&H06:'RD/WR DATA
440 E0=B+&H0A:'START ENTRY
450 E1=B+&H67:'RESUME ENTRY
460 LA=B+&H78:'LAST CODE BYTE
470 DEFUSR0=E0:DEFUSR1=E1
490 ' LOAD MACHINE CODE
510 FOR A=E0 TO LA
520 IF HX$="" THEN READ HX$
530 POKE A,VAL(H$+LEFT$(HX$,2))
540 HX$=MID$(HX$,3,255)
550 NEXT A
570 ' INPUT LAST MEM TEST BOUNDARIES
590 PRINT "LOWEST,HIGHEST:";
600 PRINT "3000,FEFF"
610 PRINT "LOWER,UPPER BOUND";
620 INPUT I$,J$
630 BT=VAL(H$+MID$(I$,1,2))
640 POKE SA,BT
650 BT=VAL(H$+MID$(I$,3,2))
660 POKE SA+1,BT
670 BT=VAL(H$+MID$(J$,1,2))
680 POKE EA,BT
690 BT=VAL(H$+MID$(J$,3,2))
700 POKE EA+1,BT
720 ' TEST MEMORY SEGMENT
740 X=USR0(0)
760 ' PRINT TEST RESULTS
780 WD=PEEK(DA):RD=PEEK(DA+1)
790 IF WD=RD THEN 960
800 FA=PEEK(XA)*256+PEEK(XA+1)
810 PRINT"ADDRESS:";HEX$(FA);
820 PRINT"WROTE";HEX$(WD);
830 PRINT"READ";HEX$(RD);
850 ' RESUME TESTING
870 X=USR1(0)
890 ' LOOP BACK FOR REPORTING
910 GOTO 780
930 ' END OF CURRENT TEST
940 ' ALLOW FURTHER TESTING
960 PRINT"TEST COMPLETED"
970 PRINT
980 GOTO 590

For loop testing,
replace 980 with:
980 GOTO 780
Hold <BREAK> key for about 6
seconds to break the test loop.

```

## Appendix D. Software Vendors

1. Computer Systems Center  
13461 Olive Blvd.  
Chesterfield, MO 63017  
\* Dynacalc, an electronic spreadsheet. Dynamite disassembler.
2. Computerware  
4403 Manchester Ave., Suite 103  
Encinitas, CA 92024  
\* Business and Accounting packages.
3. Frank Hogg Laboratory, Inc.  
The Regency Tower  
770 James Street  
Syracuse, NY 13203  
(315) 474-7856  
\* **PHL Color FLEX**, Editor and Assembler (ED/ASM), Dynastar and Stylograph Word Processors, FORTH, Dynasoft PASCAL (p-code system), Dyna-C (C-language subset), CRASMB Cross Assembler for various micros, Super Sleuth and Dynamite+ Disassemblers, Autotask procedure file executor, Programmer's toolkit, Basic toolkit, spelling-checker, Data-Base systems, Business and Accounting packages, Mailing and Correspondence systems, JCP Job Control Program, many more.
4. Introl Corp.  
647 West Virginia St.  
Milwaukee, WI 53204  
\* A full 'C' Compiler.
5. Lucidata Ltd.  
P.O. Box 128  
Cambridge CB2 5EZ ENGLAND  
\* Lucidata PASCAL, a p-code system with floating point.
6. Omegasoft  
P.O. Box 70265  
Sunnyvale, CA 94086  
\* PASCAL native code compiler.
7. Technical Systems Consultants, Inc.  
111 Providence Road  
Chapel Hill, NC 27514  
\* Native code Pascal Compiler, Text Editor, Assembler, 68000 Cross-Assembler, XBASIC Extended Basic, Sort/Merge, Utilities, Debug.
8. Universal Data Research Inc.  
2457 Wehrle Dr.  
Buffalo, NY 14221  
\* Business and Accounting Packages.
9. Washington Computer Service  
3028 Silvern Lane  
Bellingham, WA 98225  
\* RMS Record Management System.

\* **MOST OF THE ABOVE SOFTWARE IS AVAILABLE FROM FRANK HOGG LABS**

## Appendix E - PHL Color FLEX Specifications.

These specifications are in addition to the normal FLEX specifications, as documented in the FLEX User's Manual and FLEX Programmer's Manual.

### 1. Disk System.

#### User Callable Routines

##### \$DE1E (ULH) Unload Heads

This routine causes all of the selected drive to be deselected. It still remains the current drive, and if the motor was running it remains running, but the heads are unloaded. Uses no registers.

##### \$DE21 (MTROFF) Turn Off Drive Motors

This routine causes the currently selected drive to be deselected, and the drive motors to be turned off. The current drive remains the current drive. Uses no registers.

ULH and MTROFF should be called instead of accessing the Drive Register directly. This is because the disk drivers keep a local copy of the Drive Register, which must be kept up to date.

##### \$DE24 (FCTE) Find Configuration Table Entry

This routine returns the address of the Drive Configuration Table Entry for the current drive in X. If the current drive is not 0, 1, 2, or 3, a "Drive Not Ready" error will be returned in B and a Z will be 0. Otherwise, no registers are used.

The following entries are defined for the Drive Configuration Table.

#### Offset Function

- 0 =1 if drive exists
- 1 =1 if double sided
- 2 =1 if double density
- 3 Stepping rate: 0=6ms, 1=12ms, 2=20ms, 3=30ms
- 4 Physical drive 0-3 selection code: 1=0, 2=1, 4=2, 64=3
- 5 Track to start precompensation at
- 6 Sectors/track single density
- 7 Sectors/track double density
- 8 Maximum track number (no. of tracks minus one)
- 9 Seek time limit [(no.tracks\*step rate +1)] \*60
- 10,11 variables (reserved)

The physical drive selection code may be used to cause a drive wired with a certain physical drive number to behave as if it had a different logical drive number. Do not use more than one physical drive number for any logical drive number, or vice versa; also, do not use physical drive number 3 (selection code 64) if the system has any double sided drives.

## Appendix E - PHL Color PLEX Specifications.

### Console I/O specifications

#### User settable options in the Console I/O package

These addresses are vectors which point to the address where the actual option resides.

#### \$D3D1 Debounce count

This is the number of times the keyboard is scanned before a key is registered.

#### \$D3D3 Blink Period

The reciprocal of the cursor blink frequency, on a relative scale.

#### \$D3D5 Motor Off Blink Limit

After this many blinks the motors shut off, whether the blinks are visible are not.

#### \$D3D7 Cursor Type

\$00 = underline cursor

\$FF = blinking block cursor

#### \$D3D9 VDG Mode

The upper five bits of this word set the VDG mode.

\$D3DB Reserved for future system use.

\$D3DD Reserved for future system use.

\$D3DF Reserved for future system use.

#### \$D3E1 Bell Tone Cycle Count.

The length of the Control-G tone, in half-cycles.  
(Frequency dependent.)

#### \$D3E3 Bell Tone Half Period

The reciprocal of the frequency of the Control-G tone on a relative scale.

#### \$D3E5 INCHNE Get a character from the keyboard without echo.

Used in the form JSR [\$D3E5].

## Appendix E - PHL Color FLEX Specifications.

### Output Character Control Functions and Displays

Holding down the shift and up arrow key is the control key. We refer to the control key in this table by the '^'. Therefore, ^B means to hold down the shift, up\_arrow and the 'B' key.

02	^B	Home and Clear screen (including protected areas).
03	^C	NOT USED
04	^D	Remove all status lines.
05	^E	Erase cursor to end of line.
06	^F	Put line cursor is on in reverse video
07	^G	Bell tone
08	^H	Cursor left, non-destructive.
09	^I	Cursor right.
10	^J	Cursor down (LF), initializes beginning of line pointer if in first column.
11	^K	Cursor up.
12	^L #	Used to flag Protected areas.
13	^M	CR
14	^N	Erase all Unprotected areas.
15	^O	Home cursor.
16	^P	Toggle printer on and off.
17	^Q	NOT USED
18	^R	NOT USED
19	^S	Erase cursor to end of screen.
20	^T	Cursor addressing, ^T,row,column. ^T,32,32 = home where 32 refers to the decimal equivalent of the actual character typed.
21	^U	Unprotects all lines.
22	^V	Variable scroll rates. Follow with a ^A - ^F.
23	^W *	Allocate status line(s) at bottom of screen.
24	^X	Cancel line.
25	^Y	Erase entire line.
26	^Z	Toggle cursor between underline and block.

(#) Place the cursor on a line and type ^L then move cursor to another line and type ^L again. The lines between will now be protected. Use cursor addressing to put text into the protected lines.

(\*) Each time the ^W is typed, another status line will be added to the bottom of the screen. The number of status lines is limited to four. Use cursor addressing to put text into the lines.

## Appendix E - PHL Color PLEX Specifications.

### KEY FUNCTIONS

#### 1. Shift functions

shift	'shift'
Shift-^	"ctrl" (abbrev ^)
Shift-^-break	'super-shift'
Shift-^-0	Toggle 'Alpha-lock'

Alpha is on when first booted up.

#### 2. Normal Key Functions

KEY	NORMAL	NORMAL, Alpha-lock	Shift	CTRL	Super-Shift
0	0	same	'	nu1	FS (\$1C)
A-Z	a-z	A-Z	A-Z	^A-^Z	
↑	Cursor Up	same	"CTRL"	n/a	n/a
↓	LF	"	LF	LF	LF
←	BS	"	^X	DEL(7F)	GS(\$1D)
→	TAB (HT)	"	^	nothing	RS (\$1E)
space	space	"	space	space	space
0	0	"		see(1)	same
1	1	"			
2-5	2-5	"	(as shown on keyboard)		
6	6	"	(as shown on keyboard)		
7	7	"	(as shown on keyboard)		
8	8	"	(	[	{
9	9	"	)	]	}
:	:	"	z	z	z
-	-	"	=	_	US(\$1F)
.	.	"	^	>	^
/	/	"	?		
enter	CR	"	CR	CR	CR
BREAK	ESC	"	n/a	super-shift	n/a



## APPENDIX F - System Memory Map

The following is a brief list of the RAM space required by the FHL Color FLEX Operating System. All addresses are in Hex.

0000 - B7FF	User RAM *Note: Some of this space is used by NEWDISK, COPY and other utilities.
B800 - BFFF	Hi-Res Screen Drivers and character tables.
C000 - E5FF	Disk Operating System
E600 - FDFE	Hi-Res Screen Memory
FE00 - FEFF	Misc. routines
C07F	System Stack
C100 - C6FF	Utility Command space
CD00	FLEX cold start entry address
CD03	FLEX warm start entry address

For a more detailed memory map, consult the 'Advanced Programmer's Guide.'