

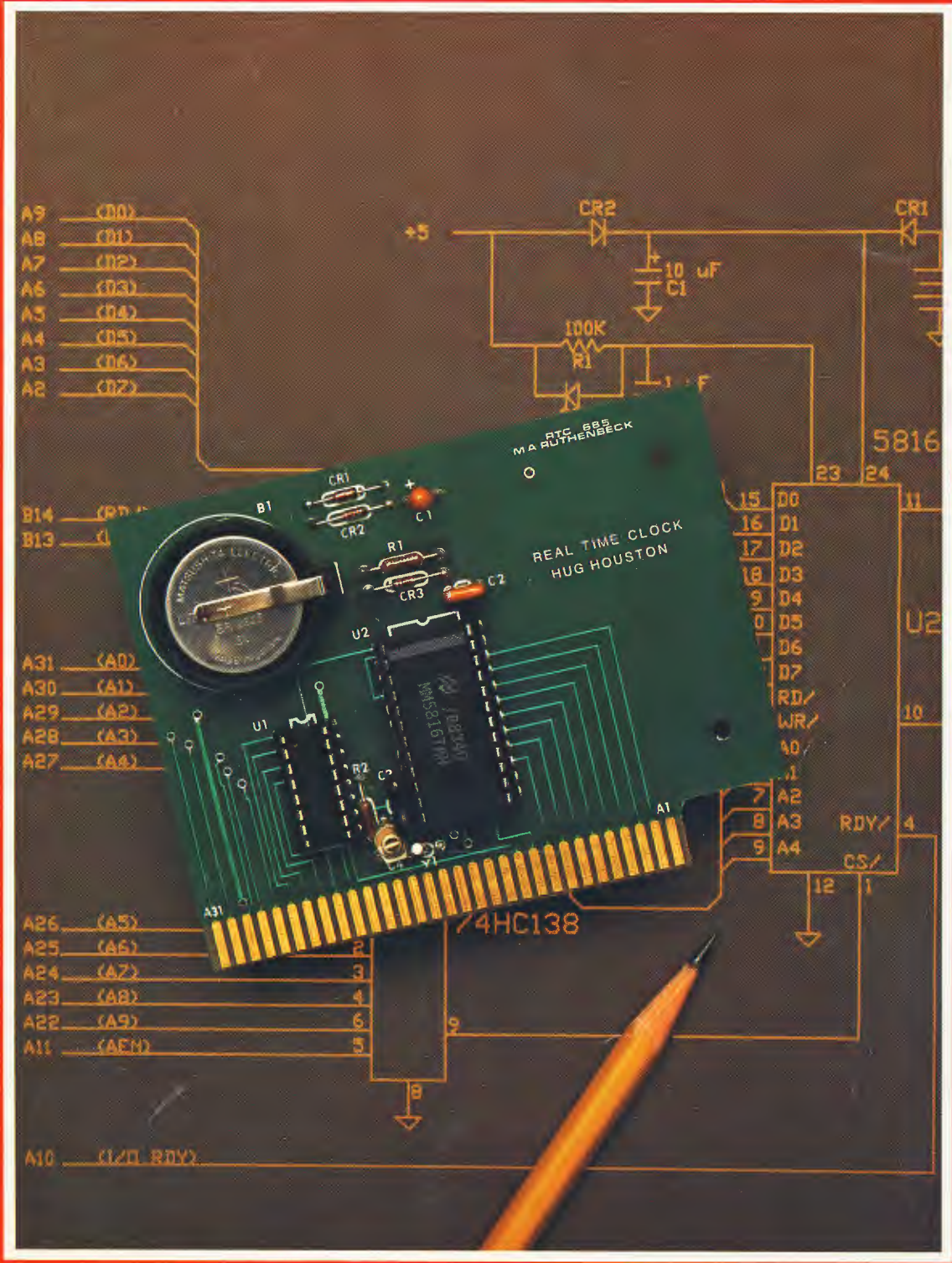
# REMark®

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**Buggin' HUG**

..... 7

**Upgrade Your CP/M 2.2 With ZCPR3  
 A Z80-Based Command Processor**

*Rick Swenton* ..... 9

**Installation Of ZCPR3  
 For Heath Computers**

*Richard P. Allen* ..... 15

**Using The H-100 As A Time Machine (I)**

*Arnold W. Seibel* ..... 21

**MUVIT**

**A BASIC Boost For Spreadsheets**

*Louis M. St. Martin* ..... 27

**An Update Of CONDOR 3  
 Relational Database  
 Management System (rDBMS)**

*Richard L. Mueller, Ph.D.* ..... 35

**ZPC Update #1**

*Pat Swayne* ..... 39

**8 MHz 256K Update #2**

*Pat Swayne* ..... 40

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# Upgrade Your CP/M 2.2 With ZCPR3 A Z80-Based Command Processor

**Rick Swenton**

19 Allen Street  
Bristol, CT 06010

## Introduction

What is ZCPR3? Technically, ZCPR3 stands for Z-80 Command Processor Replacement version 3. More specifically, it is an enhanced replacement Console Command Processor (CCP) for CP/M 2.2. It is written in Z-80 code so it can pack more features into the same restricted space of 2K bytes than the original CCP occupied. Because it is written in Z-80 code, it will not run on the H-100 which uses the 8085 CPU, nor will it run on the H-8 unless it has the Z-80 upgrade CPU board installed. Included in the ZCPR3 package is a collection of programs and system files which have been integrated tightly together to form a powerful "unified" operating system. ZCPR3 comes on fourteen eight-inch disks and the source code is included! There are over seventy COM files and over one hundred available commands with more added each day by the dedicated and enthusiastic ZCPR3 users who contribute new and updated programs into the distribution network. More on this later. ZCPR3 and the majority of its programs and documentation are copyright by Echelon, Inc., but may be obtained and used free of charge for non-commercial purposes. Further on in this article, I will explain the various ways to obtain ZCPR3. ZCPR3 and its utilities were written by a very brilliant man: Richard Conn. Many of you are familiar with ZCPR3's predecessor, ZCPR. ZCPR is a good enhancement to Digital Research's standard CCP. But ZCPR is "kid's stuff" compared with ZCPR3! If you have implemented Ray Livingston's BIOS-80 to run high capacity disk drives with the H17 controller, you were given the option to include ZCPR with your installation. Once you did, you could never go back to the stone ages. This is how ZCPR3 is to ZCPR1. Once you use it, you can never go back to plain old ZCPR. ZCPR3 gives your CP/M compatible system many of the advanced features found in UNIX and MS-DOS.

## Overview Of Features

To the casual user, ZCPR3 will look and operate just like CP/M

2.2. It is downward compatible with CP/M 2.2 and 99% of all programs, which ran on your old CP/M system, will run under ZCPR3. Some highly specialized programs which poke directly into the CCP like SYNONYM.COM will not run and may crash the system. I have experienced problems running a .COM file from Wordstar and not being able to return to Wordstar automatically. I haven't looked into this yet. Most of the ZCPR3 utilities can not run under plain CP/M 2.2, because of the special memory setup required by ZCPR3.

Here are some of the features added to your system by ZCPR3:

1. Multiple commands are allowed on a single line.
2. Enhancement of the directory.
3. Enhanced command processing.
4. Enhanced command search and directory search path.
5. Resident commands.
6. Flow commands.
7. Shells.
8. Environment Descriptor.
9. Over 100 commands are available.
10. There are over 200K of on-line HELP files available which, along with over 70 .COM files are included in the 14 disk set!

I'll try to explain each of these as simply as I can, and I'm sure that because of the vastness of ZCPR3 I will omit something. I learn something new about ZCPR3 each day that I use it and it's fun!

## Installation

In order to understand the ZCPR3 system, you must first understand a little about how it is installed. There are two ways to install ZCPR3: One is the manual method, which requires a good understanding of assembly language. You must downsize your

existing CP/M to reserve about 4k at the top of your memory. You must modify the BIOS to initialize this memory when you boot your system, and you must integrate the new ZCPR3 command processor with the existing CP/M. As you can see, this is no job for a novice. Even the experienced CP/M systems programmer will have to spend many frustrating hours pondering over the supplied documentation. The second method is to purchase an auto-install version from Echelon, Inc. This company is the official commercial source of ZCPR3 products and software support. The auto-install version is pre-configured to take advantage of all but one of the ZCPR3 features. This version costs about \$150, but is worth every penny and more.

You may ask "What if I know a little about assembly language programming and a little about CP/M. Would I be able to install the manually installed version of ZCPR3?" Probably not. You need to be comfortable working in the BIOS. You also need to fully understand MOVCPM, SYSGEN, MAKEBIOS and DDT. In addition, you will need Digital Research's Macro Assembler MAC and Debugger ZSID, and a text editor. A public domain program called RELS.UTL by Robert Van Valzah may be required depending on the revision level of some of the files. Installation is quite a task, but it's well worth the effort. So, as you can see, there's no "in between". Either you are really proficient in assembly language or you purchase the auto-install version. The clear advantage of the auto-install version is that all the work is done for you and you may obtain professional consultation and assistance from Echelon. They have experience installing ZCPR3 on many systems, including the H-8 and H-89.

Figure 1 shows a comparison of my system memory map before and after I installed ZCPR3. The memory sizes shown can vary depending on how many options were selected.

64K	Standard CP/M 2.2	ZCPR3 System
TOP-->		
5K	Standard H/Z BIOS	ZCPR3 Resident Packages   4K
3.5K	CP/M 2.2 BDOS	User Modified H/Z BIOS   5K
2K	CP/M 2.2 CCP	CP/M 2.2 BDOS   3.5K
	Transient Program Area	ZCPR3 Command Processor   2K
		Transient Program Area
		(4K smaller in my system)
~54K		~50K
100H-->	CP/M Buffers	CP/M and ZCPR3 Buffers
0H-->		

**Figure 1. Comparison of standard CP/M 2.2 and ZCPR3 Memory Maps**

Now, let's talk about specific memory locations. I will define how I organized my memory, and later I will explain what each area was used for. Figure 2 shows my ZCPR3 memory map in more detail. The most detailed locations are those shown above the BIOS. They are located in that 4K area which was reserved above the BIOS by running the command MOVCPMxx 60 where xx is either 17,37 or 47 depending on the type of Heath disk system you are using. This will create a 60K CP/M system. The new CP/M

will never attempt to load programs in the upper 4K of memory in your system. The ZCPR3 utilities will take care of utilizing the reserved memory.

Address		
FFFF	-----	
	External Search Path Buffer	64 bytes
FFC0	-----	
	ZCPR3 External Stack	
FF90	-----	
	ZCPR3 Multiple Command Line Buffer	
FEC0	-----	
	ZCPR3 Memory-Based Named Directory (S)	
FDC0	-----	
	ZCPR3 External File Control Block	
FD90	-----	
	ZCPR3 Message Buffers	1K
FD40	-----	
	ZCPR3 Shell Stack	
FCC0	-----	
	ZCPR3 Environment   Z3TCAP (S)	
FC40	-----	
	Descriptor (S)	
FBC0	-----	
	ZCPR3 Flow Command Package (S)	0.5K
F9C0	-----	
	ZCPR3 Input/Output Package (S)	1.5K
	(I/O Package not implemented in my system) (Shown here for reference only)	
F9C0	-----	
	ZCPR3 Resident Command Package (S)	2K
F1C0	-----	
	ZCPR3 BIOS with Modified Cold Boot Routine to Initialize All Elements of the ZCPR3 System Above (3)	5K
DC00	-----	
	CP/M BDOS	3.5K
CE00	-----	
	ZCPR3 Command Processor	2K
C600	-----	
	Transient Program Area	~50K
100	-----	
	CP/M and ZCPR3 Buffers	256 bytes
0	-----	

**Figure 2: ZCPR3 System Memory Image used in the author's H89**

**Notes:**

1. All Areas Above F1C0H are initialized by the Cold Boot Routine in the BIOS
2. Those Areas marked with (S) are ZCPR3 System Segments
3. The file BIOS.SYS occupies 7K on my disk. It only occupies about 5K in memory because some of the Cold Boot code is overlaid after it is used.

Now, we will break down the memory map into even more detail. Figure 3 shows the greatest detail of the way the ZCPR3 memory is configured in my system. Using Figures 2 and 3 as a reference, we can begin the discussion of all of the features of the ZCPR3 environment. Because installation is complex, I will not cover the details. Experienced assembly language programmers can follow the installation documentation, which is included on the disks. Others will not have to worry about installation if the auto-install version is purchased.

## The ZCPR3 Replacement Command Processor (CP)

The ZCPR3.ASM file is assembled after options are selected and the running address is determined. The running address is the same address where the standard CP/M CCP would be located in your 60K CP/M system. The CP/M CCP is then overlaid by the ZCPR3 Command Processor using SYSGEN and DDT. The new CP/M system would be SYSGENed back to the disk and further bootable disks would be made from this master using SYSGEN.

There are many ways of configuring the new Command Processor. You can have all the standard commands like DIR built into the CP, or you can place these commands in a Resident Command Package, which will free the CP to do more sophisticated tasks. This is the best way to go. In my system, the only commands built into my Command Processor are SAVE and GO. A third method would be to have most of your commands available as COM files. There are enough programs on the disk set to drive you crazy while you try to make your decisions.

Let's discuss some of the features of ZCPR3 which lie outside of the Command Processor.

### Multiple Commands

ZCPR3 supports multiple commands on the same line, usually separated by semicolons. Thus, the following would be a valid command line:

```
ASM MYFILE.AAZ;LOAD MYFILE;MYFILE
```

In this single command line, the system would assemble MYFILE, load the resulting HEX file into a COM file, and then run it. Up to 200 characters can be placed on one command line. The standard BDOS line editor remains in effect so that Control-E can be used to cause a carriage return/line feed on the screen to allow a long command to be printed on a new line without pressing the return key. The buffer for the Multiple Command Line is defined in the memory maps in Figures 2 and 3. This buffer must be initialized by the BIOS upon Cold Boot before it can be used.

Address Range	Size	Function
0 - FF	256 b	Standard CP/M Buffers except
3B	1 b	Wheel Byte
100 - C5FF	~50 K	TPA
C600 - CDFF	2 K	ZCPR3 Command Processor
CE00 - DBFF	3.5K	BDOS
DC00 - EFFF	5 K	Modified BIOS with Buffers
F1C0 - F9BF	2 K	Resident Command Package
F9C0 - FBBF	0.5K	Flow Command Package
FBC0 - FCBF	256 b	Environment Descriptors
		Bytes 00H-7FH: Z3 Parameters
		Bytes 80H-FFH: Z3 Terminal Cap
FCC0 - FD3F	128 b	ZCPR3 Shell Stack
FD40 - FD8F	80 b	ZCPR3 Message Buffers
		Byte 0: Error Flag (Z/NZ)
		Byte 1: IF (8 Levels)
		Byte 2: IF Active (8 Levels)
		Byte 3: Z3 Cmd Status
		00B - Normal
		01B - Shell
		10B - Error
		Bytes 4&5: Error Address if 10B
		Byte 6: Program Error Code
		Byte 7: ZEX Message Byte
		00B - Normal
		01B - Z3 Prompt
		10B - Suspend Intercept
		Byte 8: ZEX Running Flag (0=No)
		Bytes 9-10: Address of Next

			Char for ZEX to Return
		Bytes 11-12:	Address of First Char in ZEX Memory-Based File Buffer
		Byte 13:	SH Control Byte
		Bit 0:	Enable SHCMT
		Bit 1:	Enable SHECHO
		Bit 7:	Enable Shell Entry Wait
		Bytes 14-15:	Shell Scratch
		Bytes 10H-2FH:	Error Cmd
		Bytes 30H-39H:	Registers
		Bytes 3AH-3FH:	Reserved
		Bytes 40H-4FH:	User-Defined
FD90 - FDBF	48 b	ZCPR3 External FCB	
FDC0 - FEBF	256 b	Memory-Based Named Directory	
FEC0 - FF8F	208 b	Multiple Command Line Buffer	
FF90 - FBF	48 b	ZCPR3 External Stack	
FFC0 - FFFF	64 b	External Search Path Buffer	

Figure 3: Detailed ZCPR3 Memory Map for the author's system

### Directory Enhancement

There are two methods of specifying a directory under ZCPR3. They are symbolically called DU: and DIR: which stand for Disk/User and Named Directory. Under ZCPR3, the USER command is no longer used. If you wish to log into drive B user 3, you would simply type 'B3:'. The system prompt would return with a 'B3>'. Using the DU: form, any of the following commands are valid:

```
A: (logs you into drive A, current user number)
C5: (logs you into drive C user 5)
8: (Logs you into user 8 of the current drive)
```

The second method of specifying a directory is called a Named Directory. Under ZCPR3, you can assign a name to a Disk/User area. Let's say that you have three drives and that you have your CP/M system disk in drive A, your Wordstar disk in drive B:, and your dBASE disk in drive C:. Using the file MKDIR.COM, you can create a named directory of your disk environment so that when you are logged into A0:, you would see the following prompt:

```
A0:SYSTEM>
```

You can now log into your Wordstar disk with either of the following two commands:

```
B0: or WORDSTAR:
```

The system prompt will now show:

```
B0:WORDSTAR>
```

In the same manner, you could log into your dBASE disk with the command:

```
C0: or DBASE:
```

The system prompt will show:

```
C0:DBASE>
```

As you can see, this feature is most desirable with a hard disk where you have files in many user areas. Named directories can be created with meaningful names assigned to the Disk/User areas.

### Resident Commands (RCP)

There are two places where resident commands can be located: One is the ZCPR3 Command Processor, the other is a Resident Command Package (RCP). It is better to have resident commands

CP	-	Copy a File
ECHO	-	Send a message to the console from a multiple command line or a SUB or ZEX file
ERA	-	Erase a file
H	-	Display list of available cmds.
LIST	-	Print a file on the printer
NOTE	-	A comment which is not interpreted as a command
PEEK	-	Display memory
POKE	-	Alter memory
PROT	-	Protect files (R/O,R/W,DIR,SYS)
REN	-	Rename a file
TYPE	-	Type a file on the CRT

**Figure 4: A List of Commands available in the author's Resident Command Package (RCP)**

in the RCP rather than the CP, because this will allow the CP to control more sophisticated system functions. The RCP is loaded into its place in upper memory (see Figures 2 and 3) by the loader utility LDR.COM. It occupies 2K of memory and once loaded is always present. Commands are available immediately on demand. CP/M does not have to do any disk access to find the command, like it would if the command was a COM file. Another advantage of Resident Command Packages is that you may have as many as you wish, each with its own set of standard or custom commands, and each loaded into the RCP memory location when required. The memory resident commands I have available on my system are listed in Figure 4. The only commands I have built into the Command Processor are SAVE, which operates the same as CP/M, except you can specify the number of pages to save in decimal or hex, and GO which allows you to re-execute a COM file which is already in the TPA. This is the same as jumping to address 100H and executing the program there.

### Paths

ZCPR3 allows you to specify the search path for the execution of a COM file. Using the PATH command, you may set-up a search path so that if the file you wish to execute is not on the currently logged disk or user area, the ZCPR3 CP will search your other drives for the file in the order you specify in the PATH command. For example, you are currently logged into A7:. Then you issue the command:

```
PATH C0 B3 A4
```

Then, when you attempt to run a COM file, ZCPR3 will first search A7:, then C0:, then B3, then A4:, then finally A0:, the default. Of course, the search will abort as soon as it finds your file. This feature is great for hard disk users. You could set-up a path so that commonly used system programs could reside in a known Drive/User area and be accessible from all other Drive/User areas you happen to be working in.

When using the Named Directory feature previously described, you can also specify the search path in Named Directory form, such as:

```
PATH WORDSTAR DBASE SYSTEM
```

### Extended Command Processing And Error Handling

Your ZCPR3 system can be set-up with extended command processing. If a command is issued and ZCPR3 cannot find the COM file along the search path, a default COM file called

CMDRUN.COM will be executed. This opens up many diverse possibilities. In my system, I renamed the LRUNZ.COM utility to CMDRUN.COM. I also have a large file of infrequently used commands packed into a library to conserve disk and directory space. LRUNZ.COM can load and execute a COM file from the library. The default library name is COMMAND.LBR. Since I renamed LRUNZ.COM to CMDRUN.COM, it will always be invoked if the requested COM file cannot be found along the search path. ZCPR3 will then pass the command to the CMDRUN program and CMDRUN (LRUNZ in disguise) will try to find the requested COM file in the default library, COMMAND.LBR. Your options here are limited only to your own imagination!

You may choose to implement Error Handling instead of the LRUNZ scheme. There are four different error handlers provided with the ZCPR3 disk set. The fanciest one uses full-screen video features. If you issue a bad command to ZCPR3 from any of the command input sources (multiple command line, SUB, ZEX), the error handler will bring up a full-screen display of what part of your command line is bad and allow you to select options, such as replacing the bad command with a new one, going on to the next command in the sequence, or terminating the balance of the command line and returning to the system. Once you see the powerful features of ZCPR3, you will never go back to plain CP/M again!

### Batch Processing

Two very versatile batch processing programs are included with the ZCPR3 package. They are SUB and ZEX. SUB is an enhanced version of SUBMIT.COM which comes with CP/M. SUB is a disk-based batch processor. This means that it uses a temporary disk file to store the sequence of commands it's working on. SUB can accept input from a disk file. It can also accept input interactively from the console without the operator having to edit a submit file. ZEX is a memory-based batch processor. It too can accept input from a disk file or from the console interactively, but it doesn't use a temporary disk file to store its sequence of commands. They reside in memory so execution is very fast. The trade-off is that ZEX uses more system memory than SUB. A tremendous amount of versatility has been built into the ZCPR3 system.

### Flow Commands (FCP)

Flow commands reside in the Flow Command Package (FCP) and are loaded into memory with the LDR loader utility. These commands control the flow state of the ZCPR3 system. Commands, such as IF and ELSE, are used to test the TRUE/FALSE flow state. The Command Processor is aware of the flow state. It will allow requested commands to execute if the flow state is TRUE, but will flush requested commands without error if the flow state is false. Here is an example of the use of flow commands:

```
IF EXIST DIR.COM;REN FILES.COM=DIR.COM;ELSE;FILES;FI
```

If I were to explain the above command line in English, I would say "If the file DIR.COM exists in the current directory, then rename it to FILES.COM. Otherwise, run the file FILES.COM". The command FI at the end of the command line means the same as "endif". It is used to tell the Command Processor that it has reached the end of the current IF level. Up to eight IF levels and up to nine flow states can be nested at one time. Figure 5 shows the Flow Commands available in my system.

### Shells

The best way to describe a Shell is to talk about that part of the

Command Processor which interprets the command line. This is called the Command Line Interpreter. This is the code which tries to analyze the user's input to the system and decide what to do with it. The ZCPR3 CP does this function the same way that the CP/M CCP does, except that the ZCPR3 CP always checks to see if a Shell has been specified and will run the Shell instead of the Command Line Interpreter. In this manner, ZCPR3 will accept input and run commands from the Shell rather than from user input from the console. A shell can be something as simple as a named variable to something as complex as complete and powerful utilities. For example, suppose you define the named variable "MYFILE" to mean the same as "LETTER.TXT". Now, if you wish to edit this text file, you would usually type "EDIT LETTER.TXT". Because the MYFILE Shell is defined, the command "EDIT %MYFILE" would do the same thing. One obvious advantage of this feature is that you can create a long batch file using named variables, like %MYFILE, and you would not have to change the batch file if you used it to process other files whose names would not always be the same every time the batch file was processed. You would simply use the Shell feature to redefine the names of the named variables. There are two very powerful utilities provided which run as Shells: MENU/VMENU and VFILER. Their operation is impressive.

```

IF - Tests a condition for True/False
ELSE - Toggles the current condition
      to its opposite condition
FI - Terminates the current IF level
XIF - Terminates all pending IFs

These are arguments to IF and ELSE:

ERROR - If the ZCPR3 ERROR FLAG is set
        then the Flow State is True
EXIST - If all the files that follow
        this argument exist then the
        Flow state is True
INPUT - If the user strikes a T,Y,<cr>, or <sp>
        then the Flow State is True
NULL - If the field following this argument
        is blank then the Flow State is True

```

**Figure 5: A list of Commands available in the author's Flow Command Package (FCP)**

### Environment Descriptor

The ZCPR3 Environment Descriptor is a very small area in reserved memory (see Figures 2 and 3) in which is stored some data particular to the user's system. In here is stored particulars about the user's CRT terminal, such as the size of the display and the control codes to perform direct cursor positioning and highlighting. Similar information is stored about the user's list printer, such as page size and the ability to accept form feeds. In addition, the Environment Descriptor contains the addresses of ZCPR3 specific buffers, such as the locations of the RCP, FCP, Named Directory buffer, ZEX registers and others. With all of this information present in the Environment Descriptor, it does not have to be duplicated and be present within every program or utility which needs to know this information. For example, there is a utility called VFILER. This is a full-screen file handling program which is used for copying files between disks. It does direct cursor positioning, reverse video or highlighting and clear screen CRT functions, as well as accessing the correct lines per page on

the list printer. It does all this by knowing where the ZCPR3 Environment Descriptor is located in memory and reading the data from it as required.

To permit VFILER to run on ANY ZCPR3 system, the only change that you will have to make is to tell VFILER where the system's Environment Descriptor is located. Once it knows this, it knows where everything else is. This is called "installing". When you "install" a ZCPR3 utility, you merely update the address of the Environment Descriptor within the utility. Now, if you buy a new CRT terminal which uses different control codes than your old one, all you have to do is put the new code in the Environment Descriptor and all of your ZCPR3 utilities will access the new codes! You can even use the old terminal again by loading in the old codes at will. The terminal codes are contained in a separate area of the Environment Descriptor called the Terminal Capabilities (TCAP). Included in the disk set is a menu driven TCAP selection covering over 44 different terminals, as well as a utility to create a new TCAP not on the menu.

### Redirectable Input/Output

ZCPR3 allows for custom I/O modules to be dynamically loaded into memory to reconfigure or extend the system I/O capabilities. For example, you may desire to have all of your dialog with the console saved to a disk file for future reference. You may want to have two consoles which operate in parallel. Any number of I/O environments can be created and dynamically loaded.

I have not implemented the I/O Package in my ZCPR3 system. It is shown in Figures 2 and 3 for reference.

### Utilities

Over 100 COM files are included on disk. They range from super directory displays to memory dumps, and disk editor to a very fancy full-screen system status display which tells you what's available in your system in a menu-driven screen-by-screen format.

Many of the COM files are enhanced versions of the features available within the Resident Command and Flow Control packages. There is tremendous versatility in setting-up your system. You can choose moderately powerful, but fast commands to be memory-resident, or you could use the more powerful COM files which will take time to load and consume disk space.

### Help Feature

Over 200K of online Help Files are present on the disks. If you have the room on your working disks, all the ZCPR3 command instructions and descriptions would be available to be typed on the console by your command. Since disk space is at a premium on my system, I printed the Help Files and placed them in a notebook. There is even an included utility which will reformat the CRT-oriented displays and list them on your printer. If you want, you could learn the complete ZCPR3 system without ever opening a book!

### SYSLIB3

For all you people devoted to assembly language programming, Richard Conn has made available a library of integrated assembly language modules called SYSLIB3. In this library are hundreds of routines used by the ZCPR3 utilities. If you are interested in "rolling your own" programs, SYSLIB3 will be invaluable.

## Echelon

Echelon, Inc. is the commercial source of ZCPR3. This is the only source of the auto-install version of ZCPR3.

Even though ZCPR3 is available from sources which distribute public domain software, ZCPR3 and its utilities are copyright by Echelon, Inc. You may freely use them as long as your use is non-commercial and you make no money. This is where Echelon comes in. If you are manufacturing a new computer and you wish to sell it with ZCPR3 included, Echelon is where you get the license. For us personal users, Echelon provides its customers with expert software consultation and support. They publish a newsletter and operate a bulletin board which contains the latest news and upgraded programs. They are also expecting to release very soon "ZCPR3: The Manual", a 200 page book by Richard Conn.

In addition to ZCPR3, Echelon is the only source of a replacement BDOS called ZRDOS (Z-80 Replacement Disk Operating System). ZRDOS in conjunction with ZCPR3 forms the coveted "Z-SYSTEM". ZRDOS was written to be downward compatible with the standard CP/M BDOS. In addition, it takes into account all the features of ZCPR3. The "Z-SYSTEM" makes you completely independent of Digital Research! You replace their CCP with ZCPR3 and you replace their BDOS with ZRDOS. All that's left is the BIOS and Heath/Zenith wrote that! Echelon will now be your total support.

There is a movement underway right now to promote ZCPR3 and ZRDOS. Echelon is, of course, a major influence. However, a large number of people contribute regularly to the continued enhancement of ZCPR3 and ZRDOS. At least once a week, an improved version of a ZCPR3 utility appears on the Echelon bulletin board. Somebody just had to add those three commands to his favorite program. Fortunately, Echelon is coordinating the work on the official upgrades, so that there won't be more than one upgrade with the same revision number!

One more thing before I stop blowing the horn for Echelon: If you did not obtain ZCPR3 from them, don't ask them for help. It's only fair that you don't get something for nothing. ZCPR3 is among their "bread and butter". Please help by not releasing licensed software like ZRDOS and the auto-install ZCPR3 to public bulletin boards.

### Sources For ZCPR3

SIG/M, the Special Interest Group for Microcomputers, a user group of the Amateur Computer Group of New Jersey is a non-

profit organization which distributes public domain CP/M software. ZCPR3 and its utilities are available on SIG/M volumes 184 through 192 and Volumes 200 through 202 (twelve eight-inch disks). The cost is \$6 per volume, plus shipping. Contact SIG/M at Box 97, Iselin, NJ 08830.

Echelon, Inc. is the official source of ZCPR3 and its utilities, including software support and consultation. A sampler kit with 20 utilities and a manual install ZCPR3 with documentation is available for \$39.

If you want more, you can get all of the above in a package containing 70 programs (source code included) in a complete subsystem including the online Help facility for \$89.

The ZCPR3 auto-install version, which contains the full-blown complete system and installs in four minutes or less, is available for \$149.

Contact Echelon, Inc., 101 First Street, Los Altos, CA 94022. Telephone: (415) 948-3820. The Echelon BBS number is (415) 489-9005.

### Summary

Well, what do you think? I have been using ZCPR3 for almost a year now, and I have not even come close to depleting the massive power at my fingertips. ZCPR3 transformed my H-89 into a new and versatile system limited only to my own imagination. Every day I learn something new; every day I have fun using ZCPR3. You could too!

My next step . . . ZRDOS.



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Ask your Heath/Zenith dealer or contact:

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