CP/M® VERSION 2.2.04 MANUAL

Volume II

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The CP/M Reference Guide

This Reference Guide contains detailed descriptions of each of the commands accompanying Heath/Zenith CP/M release 2.2.04. The guide deals with all of the resident commands and transient commands, presenting each command in alphabetical order. The text explains the following aspects of commands (where applicable):

- Function
- Invocation
- Options or Parameters
- Common applications
- Error message explanations

The text on each command is divided into numbered sections and subsections concerning specific aspects of the command. Examples are provided where appropriate.

The Reference Guide features several examples of user interaction with the microcomputer. In these examples, displays presented by the microcomputer console will be represented by the following typestyle:

```
THIS TYPESTYLE represents console displays

                (0123456789#$*?:=.A>)
```

User input will be represented by boldface type, as shown:

BOLDFACE TYPE represents the things the user types

(0123456789#$*?:=[.])

Text that instructs you to press a key that is labelled with more than one character (such as the RETURN key of the CTRL key) will specify the label of this key in dark (boldface), slanted (italicized), capitalized characters, as shown:

Press ***RETURN*** Hold down ***CTRL***

An example of user interaction with the terminal might appear as follows:

A>**STAT {drive}:{file name}** ***RETURN***

Where "A>" is a console display (issued by CP/M);

where **STAT** is a command entry typed through the console by the user;

where {**drive**} or any other description enclosed in curved braces is an entry that the user should supply;

where {**file name**} is the primary name of a file within the specified drive; and

where ***RETURN*** is a key label of a key pressed by the user.

The "where" statements that immediately follow a sample screen display or sample entry describe the important components of the display or entry.

These examples appear throughout the Reference Guide to demonstrate how you should communicate with the microcomputer.

ASM

The Utility that Creates an Intel Hexadecimal File and a Printout File from an Assembly Language Program File

> This text on the ASM utility assumes that you are familiar with assembly language programming. If you are not familiar with assembly language programming, we recommend that you read the Heathkit Continuing Education Course in Assembly Language Programming before using the ASM utility. Information on your computer's architecture, opcodes, and other processor features is available in your computer manual.

The ASM utility reads assembly language source files (files with the "ASM" extension) from a disk and translates them into two output files (1):

- An output file with the "HEX" extension, containing 8080 machine code in Intel hexadecimal form (2). This file can be loaded into the computer (using the LOAD utility) and executed under the CP/M Operating System.

- An output file with the "PRN" extension, containing ASCII characters. This file can be printed out, displayed on a console screen, or not produced (1.1). It includes the same mnemonics as the "ASM" file (3, 4, and 5), plus the hexadecimal address of each source line and signal characters for errors that occurred during the assembly (6.2).

1. ASM INVOCATION

The ASM utility is invoked in response to the system prompt by entering a command in the following form:

A>**ASM {file name}.{asm}{hex}{prn}** ***RETURN***

Where {**file name**} is the primary name of an assembly language source file whose extension is assumed to be "ASM". This file will be translated into the two output files by ASM;

where {**asm**} represents a one-letter parameter entered to specify the drive in which the assembly language source file is located;

where {**hex**} represents a one-letter parameter entered to specify the drive to which the "HEX" output file will be written; and

where {**prn**} represents a one-letter parameter entered to specify the drive to which the "PRN" output file will be written.

CP/M assumes that the source file has the extension "ASM". Therefore, the "ASM" extension does not have to be entered in the invocation command.

1.1 Assembler Parameters

Three single-letter parameters can be entered immediately after the period (.) in the invocation command line, as explained below:

A>**ASM PROGRAM.ABC** ***RETURN***

The first parameter letter specifies the drive which contains the "ASM" source file which is to be assembled.

The second parameter letter specifies the drive that will receive the "HEX" file produced by the assembly. If a **Z** is entered in the place of a drive letter, the assembler will not produce a "HEX" file.

The third parameter letter specifies the drive that will receive the "PRN" file produced by the assembly. If a **Z** is entered in place of a drive letter, the assembler will not produce a "PRN" file. If an **X** is entered in place of a drive letter, the listing will be displayed at the console instead of being written to a disk as a "PRN" file.

If you omit all of the parameter letters (as in the command **ASM PROGRAM** ***RETURN***), then ASM will try to read the source file from the default drive and to write both the HEX file and the PRN file to the default drive.

If you omit the the last two parameter letters (as in the command **ASM PROGRAM.A** ***RETURN***), then ASM will try to read the source file from the specified drive, to write the HEX file to the default drive, and to write the PRN file to the default drive.

If you omit only the final parameter letter (as in the command **ASM PROGRAM.AB** ***RETURN***), then ASM will try to read the source file from the specified drive, to write the HEX file to the specified drive, and to write the PRN file to the default drive.

If you leave a space for the first parameter letter and then specify a letter for any remaining parameters, (as in the command **ASM PROGRAM. BC** ***RETURN*** or **ASM PROGRAM. C** ***RETURN***), then ASM will ignore the parameters that follow the space. Thus ASM will try to read the source file from the default drive and to write both the HEX file and the PRN file to the default drive.

1.2 Example ASM Command Lines

The following examples and explanations illustrate the different forms of the ASM command line and the results they produce.

A>**ASM PROGRAM** ***RETURN***

Source file PROGRAM.ASM is read from the default drive and assembled. Hex file PROGRAM.HEX and print file PROGRAM.PRN are written to the default drive.

A>**ASM PROGRAM.ABB** ***RETURN***

Source file PROGRAM.ASM is read from drive A and assembled. Output files PROGRAM.HEX and PROGRAM.PRN are both written to drive B.

A>**ASM PROGRAM.BAX** ***RETURN***

Source file PROGRAM.ASM is read from drive B and assembled. Hex file PROGRAM.HEX is written to disk A, and print file PROGRAM.PRN is displayed on the console.

A>**ASM PROGRAM.BZZ** ***RETURN***

Source file PROGRAM.ASM is read from drive B and assembled. Neither output file is created. Such an entry is used to check for source file errors.

2. ASM EXECUTION

When invoked, ASM identifies itself with the following display:

```
CP/M ASSEMBLER - VER 2.0
```

Where "2.0" indicates the version number of the ASM utility.

If you specified (in a parameter) that the PRN file be displayed rather than stored, then this display will now appear on the console. This display can be suspended by entering a ***CTRL-S***, and resumed by entering another ***CTRL-S*** or any other character. The display can only be aborted by resetting the computer, which would abort the entire assembly operation as well. The HEX file is not assembled until the PRN file has been fully displayed.

After an assembly operation is completed, ASM displays a message in the form of the following example:

```
0FD4
02AH USE FACTOR
END OF ASSEMBLY

A>
```

where "0FD4" (or any number appearing in this position) is the next free address (in hexadecimal) after the end of the HEX file produced by the assembly; and

where "02AH" (or any number appearing in this position) represents the percentage of free system memory used for ASM's symbol table. This percentage is expressed in hexadecimal values, with 000H being 0 percent and 0FFFH being 100 percent.

3. FORM FOR SOURCE FILE STATEMENTS

Assembly language source files must be composed of program statements in the following form:

line# label operator operand ;comment

Where the **line#** field is an optional integer value representing the source program line number. These numbers are only for the convenience of the user and are ignored by the assembler when present;

where the **label** field is optional, except when required by particular statement types. It consists of a maximum of 16 alphanumeric characters (letters and numbers). The first character must be a letter. Labels can be freely used by the programmer to identify elements such as program steps.

A single label should not contain any spaces, because ASM interprets a space as the end of the label field. However, the dollar sign ($) can be used to improve the readability of labels that contain more than one word. ASM will ignore the dollar sign, and consider the other characters in the label as if they were in a continuous string. The label "DATESOFBIRTH" is somewhat easier to read than the label "DATESOFBIRTH". ASM will treat the two labels as being identical.

Labels may also be followed by a colon (:) to maintain compatibility with some other assemblers. The colon will not become part of the label and will be ignored by ASM.

where **operator** is either a pseudo operation, or an assembler directive or an 8080 Machine Opcode (see your microcomputer manual);

where the **operand**, in general, contains an expression formed from constants and labels together with arithmetic and logical operations on these elements; and

where a **comment** consists of any characters following a semicolon (;) until an end-of-line is encountered. An asterisk (*) used as the first character on a line will also indicate a comment. All comments are read and listed in the print file but otherwise ignored by ASM.

Any or all of these fields may be present in a statement. Each assembly language statement is terminated by a carriage return and a line feed (both of which are inserted when the RETURN key is pressed with many text editors), or with the exclamation point character (which is recognized by the ASM utility as an "end-of-line" character). If the exclamation point (!) is used to signify the end of an assembly language statement, other statements can be entered on the same physical line.

4. FORMING THE OPERAND

In order to completely describe the operation codes and pseudo operations, it is first necessary to present the form of the operand since it is used in nearly all statements.

Expressions consist of simple operands (labels, constants, and reserved words) combined in properly formed subexpressions by arithmetic and logical operators. Expression computation is carried out by the assembler as the assembly proceeds. Each expression must produce a 16-bit value during the assembly.

The number of significant digits in the result must not exceed the intended use. If an expression is to be used in a byte move-immediate instruction, then the most significant 8 bits of the expression must be zero. The restrictions on the expression significance are given with the individual instructions.

4.1 Labels

A label is an identifier which occurs on a particular statement. Generally, the label is given a value determined by the type of statement which it precedes.

If the label occurs on a statement which generates machine code or reserves memory space (such as a MOV instruction, or a DS pseudo operation), the label is given the value of the program address that it labels. If the label precedes an EQU or SET instruction, the label is given the value resulting from evaluating the operand. Except for the SET statement, an identifier can only label one statement.

When a label appears in the operand, its value is substituted by the assembler. This value can then be combined with other operands and operators to form an operand for a particular instruction.

4.2 Numeric Constants

A numeric constant is a 16-bit value in one of several bases. The base, or radix, of the constant is denoted by a trailing radix indicator. The radix indicators are:

B	Binary constant (base 2)
O	Octal constant (base 8)
Q	Octal constant (base 8)
D	Decimal constant (base 10)
H	Hexadecimal constant (base 16)

"Q" is an alternate radix indicator for octal numbers since the letter O is easily confused with the digit zero (0).

A numeric constant which does not terminate with a radix indicator is assumed to be a decimal constant.

A constant is composed of a sequence of digits, sometimes followed by a radix indicator. The digits are in the appropriate range for the radix. Binary constants must be composed of 0 and 1 digits, octal constants can contain digits in the range 0–7, while decimal constants contain decimal digits 0–9. Hexadecimal constants contain decimal digits and hexadecimal digits A (10D), B (11D), C (12D), D (13D), E(14D), and F (15D). The leading digit of a hexadecimal constant must be a decimal digit in order to avoid confusing a hexadecimal constant must be a decimal digit in order to avoid confusing a hexadecimal constant with an identifier. If a number begins with a hexadecimal digit (A–F), precede this digit with a zero.

A constant composed in this manner must correspond to a binary number that can be contained within a 16-bit counter, otherwise it is truncated on the right by the assembler. As with a label, dollar signs ($) can be imbedded in a constant to improve readability. Finally, the radix indicator is translated to upper case if a lower case letter is encountered. The following are all valid instances of numeric constants.

```
1234     1234D    1100B     1111$0000$1111$0000B
1234H    0FFEH    33770     33$77$22Q
3377o    0fe3h    1234d     0ffffh
```

4.3 Reserved Words

There are several reserved character sequences with predefined meanings in the operand field of a statement. Names of 8080 registers are given below. When ASM encounters one of these register names, the numeric value shown in the following table is produced:

REGISTER NAME	REGISTER VALUE
A	7
B	0
C	1
D	2
E	3
H	4
L	5
M	6
SP	6
PSW	6

Lower case names have the same value as their upper case equivalents.

When the symbol "$" occurs in the operand field (not imbedded within identifiers and numeric constants) its value becomes the address of the next instruction to generate, not including the instruction contained within the current logical line.

4.4 String Constants

String constants, sequences of ASCII characters, are represented by enclosing the characters within apostrophe symbols ('). All strings must be fully contained within the current physical line (thus allowing "!" symbols within strings) and may not exceed 64 characters in length. The apostrophe character can be included within a string by representing it as a double apostrophe (press the apostrophe key two consecutive times), which ASM interprets as a single apostrophe.

In most cases, the string length is restricted to either one or two characters (the DB pseudo operation is an exception). If the string consists of one character, it becomes an 8-bit value. If the string consists of two characters, it becomes a 16-bit value. Two character strings become a 16-bit constant, with the second character as the low order byte, and the first character as the high order byte.

The value of a character is its corresponding ASCII code. There is no case translation within strings. Therefore, both upper and lower case characters can be represented. Only ASCII characters that print are allowed within strings. Valid strings are:

```
'A'    'AB'    'ab'    'c'
'She said "Hello" to me.'
'I said "Hello" to her.'
```

4.5 Arithmetic and Logical Operators

The operands described previously can be combined in normal algebraic notation using any combination of properly formed operands, operators, and expressions enclosed in parentheses. The operators recognized in the operand field are shown by the following list:

a + b	Unsigned arithmetic sum of a and b
a − b	Unsigned arithmetic difference between a and b
+ b	Unary plus (produces b)
− b)	Unary minus (identical to 0 − b)
a * b	Unsigned magnitude multiplication of a and b
a / b	Unsigned magnitude division of a by b
a MOD b	Remainder after a / b NOT b Logical inverse of b (0's become 1's, 1's become 0's), where b is considered a 16-bit value
a AND b	Bit-by-bit logical and of a and b
a OR b	Bit-by-bit logical or of a and b
a XOR b	Bit-by-bit logical exclusive or of a and b
a SHL b	The value which results from shifting a to the left by an amount b, with zero fill
a SHR b	The value which results from shifting a to the right by an amount b, with zero fill

In each case, a and b represent simple operands (labels, numeric constants, reserved words, and one or two character strings), or subexpressions fully enclosed in parentheses, such as:

```
10+20    10h+37Q    L1/3    (L2+4)    SHR 3
('a' and 5fh) + '0' ('B' +B) OR (PSW+M)
(1+(2+c)) shr (A-(B+1))
```

All computations are performed at assembly time as 16-bit unsigned operations. Thus, −1 is computed as 0-1 which results in the value 0ffffh (i.e., all 1's). The resulting expression must fit the operation code in which it is used. If, the expression is used in an ADI (add immediate) instruction, then the high order eight bits of the expression must be zero. As a result, the operation "ADI −1" produces an error message (−1 becomes 0ffffh, which cannot be represented as an 8-bit value), while "ADI (−1) AND 0FFH" is accepted by the assembler since the "AND" operation zeros the high order bits of the expression.

4.6 Precedence of Operators

ASM assumes that operators have a relative precedence of application which allows the programmer to write expressions without nested levels of parenthesis. The resulting expression has assumed parentheses which are defined by the relative precedence.

The order of application of operators in expressions not enclosed in parentheses is listed below. Operators listed first have highest precedence (they are applied first in an expression), while operators listed last have lowest precedence. Operators listed on the same line have equal precedence, and are applied from left to right as they are encountered in an expression such as the following:

* / MOD SHL SHR
− +
NOT
AND
OR XOR

In the following examples, the expressions shown to the left are interpreted by ASM as the expressions enclosed in parentheses shown to the right:

APPEARANCE IN PROGRAM	AS INTERPRETED BY ASM UTILITY
a * b + c	(a * b) + c
a + b * c	a + (b * c)
a MOD b * c SHL d	((a MOD b) * c) SHL d
a OR b AND NOT c + d SHL e	a OR (b AND (NOT(c + (d SHL e))))

Balanced subexpressions enclosed in parentheses can always be used to override the assumed parentheses. The last expression in the preceding example could be rewritten to force application of operators in a different order, as shown:

(a OR b) AND (NOT c) + d SHL e

This expression is interpreted by ASM as the following expression with assumed parentheses:

(a OR b) AND ((NOT c) + (d SHL e))

An expression not enclosed in parentheses is only correct if the expression resulting from inserting the assumed parentheses is correctly formed.

5. ASSEMBLER DIRECTIVES

Assembler directives are used to set labels to specific values during the assembly, perform conditional assembly, define storage areas, and specify starting addresses in the program. Each assembler directive is denoted by a "pseudo operation" that appears in the operation field of the line. These pseudo operations are acceptable to ASM:

Pseudo Operation	Function	Text Subsection
ORG	Set the program or data origin	(5.1)
END	End program, optional start address	(5.2)
EQU	Numeric "equate"	(5.3)
SET	Numeric "set"	(5.4)
IF	Begin conditional assembly	(5.5)
ENDIF	End of conditional assembly	(5.6)
DB	Define data bytes	(5.7)
DW	Define data words	(5.8)
DS	Define data storage area	(5.9)

5.1 The ORG Directive

The ORG Directive takes the following form:

Label ORG expression

Where "label" is an optional program label; and

where "expression" is a 16-bit expression, consisting of operands which are defined previous to the ORG statement.

The assembler begins machine code generation at the location specified in the expression. There can be any number of ORG statements within a particular program. There are no checks to ensure that the programmer is not defining overlapping memory areas. Most programs written for the CP/M operating system begin with an ORG statement of:

ORG 100H

Machine code generation begins at the base of the CP/M transient program area (hexadecimal address 100H). If a label is specified in the ORG statement, then the label is given the value of the expression. (This label can then be used in the operand field of other statements to represent this expression.)

5.2 The END Directive

The END Directive is optional in an assembly language program. If it is present, it should be the last statement. All subsequent statements will be ignored by ASM.

The two forms of the END directive are:

label END

Label END expression

Where the "label" field is optional; and

where the "expression" field is the program starting address.

If the first form is used, the assembly process stops, and the default starting address of the program is taken as 0000.

If the second form is used, the expression in the statement becomes the program starting address. (This starting address is included in the last record of the Intel formatted machine code "HEX" file that results from the assembly.)

Most CP/M assembly language programs should end with the statement:

END 100H

resulting in the default starting address of 100H (which is the beginning of the Transient Program Area).

NOTE: When an assembled .HEX file is loaded using the CP/M LOAD utility (included with your CP/M distribution software), you do not need to use the expression "100H" with the END directive. LOAD produces .COM files that automatically execute from address 100H regardless of the expression used in an END directive that might exist at the end of a program.

5.3 The EQU Directive

The EQU Directive is used to set up synonyms for particular numeric values. It takes the following form:

label EQU expression

Where the "label" field must be present, and must not label any other statement; and

where the "expression" field is assigned to an identifier given in the label field. The identifier is usually a name which describes the value in a more human-oriented manner. This name is used throughout the program to add parameters to certain functions.

Suppose, for example, that data received from a Teletype appears at a particular input port, and data is sent to the Teletype through the next output port in sequence. The following series of equate statements could be used to define these ports for a particular hardware environment:

```
TTYBASE  EQU  10H          ;BASE PORT NUMBER FOR TTY
TTYIN    EQU  TTYBASE      ;TTY DATA IN
TTYOUT   EQU  TTYBASE+1    ;TTY DATA OUT
```

At a later point in the program, the statements which access the Teletype could appear as shown:

```
IN       TTYIN     ;READ TTY DATA TO REG-A
...
OUT      TTYOUT    ;WRITE DATA TO TTY FROM REG-A
```

This directive makes the program more readable than if the absolute I/O ports had been used.

If the hardware environment is redefined to start the Teletype communications ports at 7FH instead of 10H, the first statement need only be changed to:

```
TTYBASE  EQU  7FH    ;BASE PORT NUMBER FOR TTY
```

Then the program can be reassembled without changing any other statements.

5.4 The SET Directive

The SET Directive takes the following form:

label SET expression

Where the "label" field must be present, and may appear in other SET statements throughout the program; and

where the "expression" field is evaluated by ASM, and becomes the current value associated with the label.

The EQU Directive defines a label with a single value while the SET Directive defines a value which is valid from the current SET statement to the point where the label appears in the next SET statement. The use of the SET is similar to the EQU statement, but SET is most often used in controlling conditional assembly.

5.5 The IF and 5.6 ENDIF Directives

The IF and ENDIF Directives define a range of assembly language statements which are included or excluded during the assembly process. The form is:

```
IF expression
statement#1
statement#2
...
statement#n
ENDIF
```

When ASM encounters the IF statement, it evaluates the expression following the IF. (All operands in the expression must be defined ahead of the IF statement.) If the expression evaluates to a value where the low order bit (bit 0) is one, then statement #1 through statement #n are assembled. If the expression evaluates to a value where the low order bit (bit 0) of the expression is zero, then the statements are listed but not assembled.

Conditional assembly is often used to write a single "generic" program that includes a number of possible run-time environments, with only a few specific portions of the program selected for any particular assembly. The following program segments, might be part of a program that communicates with either a Teletype console or a CRT console by selecting a particular value for TTY before the assembly begins:

```
TRUE     EQU 0FFFFH          ;DEFINE VALUE OF TRUE
FALSE    EQU NOT TRUE        ;DEFINE VALUE OF FALSE
;
TTY      EQU TRUE            ;TRUE IF TTY, FALSE IF CRT
;
TTYBASE  EQU 10H             ;BASE OF TTY I/O PORTS
CRTBASE  EQU 20H             ;BASE OF CRT I/O PORTS
         IF TTY              ;ASSEMBLE RELATIVE TO TTYBASE
CONTIN   EQU TTYBASE         ;CONSOLE INPUT
CONOUT   EQU TTYBASE+1       ;CONSOLE OUTPUT
         ENDIF
;
         IF NOT TTY          ;ASSEMBLE RELATIVE TO CRTBASE
CONTIN   EQU CRTBASE         ;CONSOLE INPUT
CONOUT   EQU CRTBASE+1       ;CONSOLE OUTPUT
         ENDIF
         ...
         IN CONTIN           ;READ CONSOLE DATA
         ...
         OUT CONOUT          ;WRITE CONSOLE DATA
```

In this case, the program would assemble for an environment where a Teletype is connected, based at port 10H. The statement defining TTY could be changed to:

```
TTY      EQU FALSE
```

and, in this case, the program would assemble for a CRT based at port 20H.

5.7 The DB Directive

The DB Directive allows the programmer to define initial storage areas in single-byte format. The statement appears in the form:

label DB e#1,e#2, ...,e#n

Where "e#1" through "e#n" are either:

- Expressions which evaluate to 8-bit values (the high order eight bits must be zero), or
- ASCII strings of fewer than 65 characters.

There is no practical restriction on the number of expressions that can be included on a single source line. The expressions are evaluated and placed sequentially into the machine code file following the last program address generated by ASM. String characters are similarly placed into memory, starting with the first character and ending with the last character.

Strings containing more than two characters cannot be used as operands in more complicated expressions. They must stand alone between the commas. ASCII characters are always placed in memory with the parity bit reset (to 0). There is no translation from lower to upper case with strings. The optional label can be used to reference the data area throughout the remainder of the program. Examples of valid DB statements are:

```
data:   DB 0,1,2,3,4,5
        DB data and 0ffh,5,377Q,1+2+3+4
signon: DB 'please type your name',cr,lf,0
        DB 'AB' SHR 8, 'C', 'DE' and 7FH
```

5.8 The DW Directive

The DW Directive lets you define initial storage areas in double-byte words. The statement appears in the form:

```
label    DW    e#1,    e#2,    ...,    e#n
```

Where "e#1" through "e#n" are expressions which ASM evaluates in 16-bit results.

ASCII strings are limited to one or two characters. Data storage is consistent with the 8080 processor. The least significant byte of the expression is stored first in memory, followed by the most significant byte. The following are examples of DW usage:

```
doub:   DW 0ffefh,doub+4,signon-$,255+255
        DW 'a', 5, 'ab', 'CD', 6shl 8 or 11b
```

5.9 The DS Directive

The DS Directive is used to reserve an area of uninitialized memory. This directive takes the following form:

```
label    DS  expression
```

Where the label is optional.

The assembler begins subsequent code generation after the area reserved by the DS. The DS statement given previously has exactly the same effect as the following statement:

```
label:  EQU  $              ;LABEL VALUE IS CURRENT CODE LOCATION
        ORG  $+expression   ;MOVE PAST RESERVED AREA
```

6. ASM ERROR MESSAGES

The ASM utility has two kinds of error messages. One signals problems that occur during ASM file manipulation (6.1), and another signals errors in the assembly language source file (6.2).

6.1 File Manipulation Error Messages

The following error messages are displayed when ASM encounters difficulty in manipulating the source and/or output files involved in operation of the ASM utility:

```
NO SOURCE FILE PRESENT
```

EXPLANATION: The file specified in the ASM command does not exist on the accessed disk.

```
NO DIRECTORY SPACE
```

EXPLANATION: The disk directory is full. Unnecessary files should be erased, and the operation attempted again.

```
SOURCE FILE NAME ERROR
```

EXPLANATION: Improperly formed ASM file name (such as it is specified with "?" fields).

```
SOURCE FILE READ ERROR
```

EXPLANATION: The source File cannot be read properly by the assembler. The TYPE command should be used to determine the location of the unreadable code.

```
OUTPUT FILE WRITE ERROR
```

EXPLANATION: Output files cannot be written properly. The most likely cause is a full disk. Unnecessary files should be erased, and the operation attempted again.

```
CANNOT CLOSE FILES
```

EXPLANATION: Output files cannot be closed. Disk should be checked for write protection.

```
SYMBOL TABLE OVERFLOW
```

EXPLANATION: The symbol table has exceeded memory capacity.

6.2 Assembly Program Error Messages

When errors occur within the assembly language program, they are listed as single character flags in the left-most position of the source listing. The line in error is also echoed in a terminal display so that the source listing need not be examined to determine if errors are present. The error codes are:

D Data error: Element in data statement cannot be placed in the specified data area.

E Expression error: Expression is badly formed and cannot be computed at assembly time.

L Label error: Label cannot appear in this context (may be duplicated label).

N Not implemented: Features which will appear in future ASM versions (e.g., macros) are recognized, but flagged in this version.

O Overflow: Expression is too complicated (i.e., too many pending operators) to compute, simplify it.

P Phase error: Label does not have the same value on two subsequent passes through the program.

R Register error: The value specified as a register is not compatible with the operation code.

S Syntax error: The program included a character string that does not comprise a valid label, operator, or operand.

U Undefined symbol: The program made a reference to a label or variable that had not been defined earlier in the program.

V Value error: Operand encountered in expression is improperly formed.

ASSIGN

The Utility that Assigns Winchester Disk Partitions to Drive Names

(Used with H/Z-67 Drive Model)

The ASSIGN utility enables you to access software and data from Winchester Disk partitions by assigning these partitions to drive names (4), or by changing assignments (5). ASSIGN can also identify all of the partitions on a Winchester Disk and identify which of these are currently accessible through a drive name.

1 WINCHESTER DISK PARTITIONS

Partitions are independent logical devices that are established on a Winchester Disk using the PART program. (For a detailed explanation of the PART program, refer to the documentation accompanying the H/Z-67 disk drive hardware.)

The Winchester Disk can be divided into as many as 63 partitions to accommodate separate groups of data files and operating systems. Two of these partitions can be made accessible at one time by assigning them to a drive name with the ASSIGN utility.

A Winchester Disk partition can be identified by the following:

- a partition name of 16 or fewer characters;
- a semicolon (;); and
- an occurrence number ranging from 0 to 62.

The semicolon and occurrence number are optional. When not used, the occurrence number zero is assumed.

Partitions can bear the same partition name as long as they have different occurrence numbers.

2 INQUIRY OF AVAILABLE PARTITIONS

To find out the names of **all** of the partitions on the Winchester Disk, enter the following command:

A>**ASSIGN ?** ***RETURN***

ASSIGN will respond with a display in the following form:

```
PARTITION NAME      OCCUR      SIZE

--------------      -----      ------
CPM                 ;  0       3200k
CPM                 ;  1       2860k
CPM                 ;  2       2020k
HDOS                ;  0       1600k
```

Where the letters listed beneath "PARTITION NAME" are the names that were designated for each partition when the PART utility was run;

where the numbers listed beneath "OCCUR" are the occurrence numbers that help you to distinguish between different partitions that have the same partition name (such as "CPM;0" and "CPM;1); and

where the numbers listed beneath "SIZE" show the total file capacity (in kilobytes) of the partition named to the left. If a listed partition already contains files, some or all of this space is already occupied. (To determine the amount of **empty** space on a partition, assign the partition to a drive and then run the STAT utility.

NOTE: The partitions listed in the example shown above may or may not be assigned.

3 INQUIRY OF CURRENT ASSIGNMENTS

To find out the names of the partitions on the Winchester Disk that are **currently** accessible through a drive name, enter the following command:

A>**ASSIGN** ***RETURN***

The ASSIGN utility will display equations to indicate which drive names can be used to access which partition names, as in the following example:

```
A: = CPM;1
B: = HDOS
```

If you boot up with a Winchester Disk partition, that partition is automatically assigned to drive A. If you wish to access an additional partition, you can assign the additional partition to drive B using the ASSIGN utility.

If you boot up with the floppy disk drive in the H/Z-67, that floppy disk drive is automatically drive A. You can then assign partitions to drives B and C using the ASSIGN utility.

4 ASSIGNING PARTITIONS TO DRIVE NAMES

To assign a partition to a drive name, enter a command in the following form:

A>**ASSIGN {drive}:={partition name};{occurrence number}** ***RETURN***

Where {**drive**} is the letter for the drive;

where {**partition name**} is a name of 16 or fewer characters (characters that are valid in CP/M file names can be used); and

where {**occurrence number**} is a one-digit or two-digit number from 0 to 62, preceded by a semicolon. If this number is omitted, 0 will be assumed.

If you booted up with the floppy disk drive slot of the Z67, drive A would be assigned that floppy drive, but drive B and drive C would initially be unassigned and thus inaccessible.

Assuming that your partitions were named as those in Section 2, you could assign drive B by entering the command:

A>**ASSIGN B:=CPM;1** ***RETURN***

and assign drive C by entering the command:

A>**ASSIGN C:=HDOS** ***RETURN***

NOTE: The occurrence number of the "HDOS" partition can be omitted from this command because the occurrence number of this partition is 0 and ASSIGN assumes an occurrence number of 0 with any partition for which you do not specify the occurrence number.

5 CHANGING AN ASSIGNMENT

If a drive has already been assigned a particular partition and you wish to assign a different partition to this drive, enter a command in the following form:

A>**ASSIGN {drive}:={new partition}** ***RETURN***

Where **{drive}** is the letter for the drive; and

where **{new partition}** is the partition name and occurrence number of a partition that was not assigned to any drive at the time of this command.

NOTE: You cannot assign a partition to a drive if that partition is assigned to a different drive at the time of the command.

You can remove an assignment from a drive, by entering a command in the following form:

A>**ASSIGN {drive}:=** ***RETURN***

Where **{drive}** is the letter of a drive that is currently assigned a partition.

NOTE: While this command will unassign any partition that was assigned to the specified drive, it will also cause the "BAD PARTITION NAME" message to be displayed.

6 ASSIGN RESTRICTIONS

A maximum of two Winchester Disk partitions can be assigned to drive names at one time, regardless of how many partitions have been established on the disk.

If you boot up to one of the Winchester Disk partitions, that partition will be drive A. The 8-inch drive will be drive C, which leaves drive name B open for another Winchester Disk partition. In this case, it is not advisable for you to later assign a different partition to drive A. An error might occur if you reassign drive A and then perform a warm boot or exit from an application program, because CP/M will try to reload part of the operating system from the partition that has been newly assigned to drive A. This newly assigned partition might have a different kind of CP/M system or no CP/M system at all.

If you boot up to the 8-inch drive of the Z67, that drive will begin the session as drive A, and two Winchester Disk partitions can be assigned B and C.

The drive name B can never be assigned to the 8-inch drive, and the drive names A and C can never be assigned to two Winchester Disk partitions at the same time.

When you boot up to the Z67 disk drive unit (to the floppy disk or to a Winchester Disk partition) then any other drives in the hardware environment are automatically assigned the drive names D, E, and F.

7 ASSIGN ERROR MESSAGES

BAD PARTITION NAME

EXPLANATION: You tried to assign a valid drive name to an invalid partition name, or user made syntax error during command entry. You must perform cold boot, and re-enter any assignments made.

BAD DRIVE NAME

EXPLANATION: You tried to assign partitions to both drive names A and C, or to assign drive name B to the H/Z-67 floppy disk. Assignment commands must be re-entered.

PARTITION ALREADY IN USE

EXPLANATION: You tried to assign a new drive name to a partition name that already has an assigned drive name. The assignment of the partition's currently assigned partition must be removed before a new drive name can be assigned to the partition.

BAD OCCURRENCE NUMBER

EXPLANATION: You tried to assign a partition name with an invalid occurrence number to a valid drive name. This assignment should be attempted again with an occurrence number that identifies an existing partition.

BIOS DOESN'T SUPPORT PARTITIONING

EXPLANATION: The operating system used for bootstrap will not accommodate Winchester Disk partitions. This system can be modified to accommodate partitions by performing the MAKEBIOS, MOVCPM67, SYSGEN activities in sequence.

INCORRECT VERSION OF BIOS

EXPLANATION: The operating system in use is the wrong version of CP/M. CP/M Version 2.2.04 must be used to perform bootstrap.

SECTOR SIZE OF DISK IS ZERO -- FATAL ERROR

EXPLANATION: The superblock may have been damaged. (The superblock is a unit of software recorded on the first sectors of your Winchester disk. This software makes it possible for you to access your partitions.) Repeat the ASSIGN command. If the command fails repeatedly, then copy all accessible data and software from your CP/M partitions, using BRS, PIP, and/or MOVCPM and SYSGEN. Then use the PREP and PART utilities that were supplied with your H/Z-67 hardware.

DISK READ ERROR

EXPLANATION: Part of the reserved software recorded on the first sectors of your Winchester disk may have been damaged. Repeat the ASSIGN command. If the command fails repeatedly, then copy all accessible data and software from your CP/M partitions, using BRS, PIP, and/or MOVCPM and SYSGEN. Then use the PREP and PART utilities that were supplied with your H/Z-67 hardware.

BRS

The Utility that Facilitates Backup of Winchester Disk Files to Floppy Disks

(Used with the H/Z-67 drive model)

The BRS (Backup and Restore System) utility enables you to create backup copies of all files on a Winchester Disk, and to put those files onto floppy disks (4). It also enables you to restore the backup copies to the Winchester Disk (5). In addition, BRS will compare floppy disk files with Winchester Disk files to verify the accuracy of the copies (6), and display a directory list of files that have been backed up (7).

1. BEGINNING BRS USE

Before using BRS, you must be certain that the Winchester Disk Partition to be used has a currently assigned drive name. Drive names can be assigned to partitions by using the ASSIGN utility.

To begin using BRS, you invoke the utility, enter the date, specify a drive name for a Winchester Disk partition, and specify a drive name for a floppy disk.

1.1 BRS Invocation

The Backup and Restore Utility is stored on the distribution disk under the file name BRS.COM. When the system prompt appears, it can be invoked by the entry of the primary file name, as shown:

A>**BRS *RETURN***

1.2 Initial BRS Display

This entry will cause BRS to produce a display in the following form:

```
   H/Z67 Winchester Disk Backup/Restore System  (BRS)
------------------------------------------------------------

Release Ver. 1.2              Copyright (C)   March 1982
                Heath/Zenith Data Systems


Enter Today's Date. (MM/DD/YY)    ===>
```

1.3 Entering Today's Date

The initial BRS display prompts you to enter the date on which the utility is being operated.

```
Enter Today's Date.  (MM/DD/YY)    ===>
```

DATE ENTRY FORM

This date must be entered in a specific form:

- Numerals must be entered to represent the month, day, and year—in that order.
- Month, day, and year must be separated by the slash symbol.
- One or two digits may be entered for the month and day, while two digits must be entered for the year.
- The value entered for month can be no greater than 12.
- The value entered for day can be no greater than 31.
- Zeros can be entered for any component of the date

The following example shows the display that could result from entering a valid date response:

```
Enter Today's Date.  (MM/DD/YY)    ===>7/4/76  RETURN
```

DATE ENTRY FORM

This date must be entered in a specific form:

- Numerals must be entered to represent the month, day, and year—in that order.
- Month, day, and year must be separated by the slash symbol.
- One or two digits may be entered for the month and day, while two digits must be entered for the year.
- The value entered for month can be no greater than 12.
- The value entered for day can be no greater than 31.
- Zeros can be entered for any component of the date

The following example shows the display that could result from entering a valid date response:

```
Enter Today's Date.  (MM/DD/YY)  ===>7/4/76  RETURN
```

DATE ENTRY ERRORS

When you enter a date with an improper quantity or type of characters, the utility displays the message:

```
Syntax Error
```

and reprompts you for a valid entry. If you enter a date with month or day values exceeding the limits for these components, the utility displays the message:

```
Invalid Date Entered:
```

and reprompts you for a valid entry.

If you enter a date in the proper form, but wish to change it, then you may select a "DATE Change" operation from an upcoming menu.

1.4 Disk Drive Specification

After the date prompt has been answered, BRS will prompt for drive device specifications.

WINCHESTER DISK SPECIFICATION

The first drive prompt will ask for a drive name that has been assigned to a Winchester Disk partition, as shown:

```
Enter Winchester Disk Drive Spec. (A:-P:) ===>
```

Enter the drive name that has been assigned the Winchester Disk partition involved in the BRS operation. Then enter a carriage return. (No drive name colon is necessary.)

FLOPPY DISK SPECIFICATION

After you enter the drive name of the Winchester Disk partition, BRS will prompt for the drive name of the floppy disk drive being used for backup copies, as shown:

```
Enter Floppy Disk Drive Spec.   (A:-P:) ===>
```

Enter the name of the drive containing the floppy disk involved in the BRS operation. Then enter a carriage return. (No drive name colon is necessary.)

DRIVE SPECIFICATION ERRORS

If you enter an invalid drive name (only drive names A through F are valid), the utility displays the error message:

```
Invalid Drive Specification
```

The utility then reprompts for a valid drive name.

If you enter a drive name from A to F which does not exist in your hardware environment, or which has not been assigned to a Winchester Disk partition since the last cold boot, then BRS will display the message:

```
Drive not available in Current Configuration
```

The utility then reprompts for a valid drive name. You can use the ASSIGN utility to assign a drive name to a Winchester Disk partition, and then reinvoke BRS. When a valid, assigned drive name is entered for the Floppy Disk Drive, BRS will display the Master Menu (See "2 BRS Master Menu Transactions").

2 BRS MASTER MENU TRANSACTIONS

The BRS Master Menu gives you the choice of performing any of six operations coordinated by the BRS utility. The most important of these operations are "BACKUP Creation" and "RESTORE Files". These and the other menu operations ("DATE Change", "COMPARE Files", "LIST Directory", and "EXIT to CP/M") are explained in upcoming text.

2.1 The Master Menu

After you invoke the BRS utility and enters the date and drive specifications, BRS will display the following menu and prompt:

```
          BACKUP AND RESTORE MASTER MENU
        ----------------------------------------

                D   DATE Change
                B   BACKUP Creation
                R   RESTORE Files
                C   COMPARE Files
                L   LIST Directory
                E   EXIT to CP/M

    OPTIONS: Valid Only on BACKUP(B) and RESTORE (R) Operations

          V = Verify Files After Writing.  (B/R)
          W = Warning Messages Disabled.  (B/R)
          A = Allow R/O Files For Restore.  (R)
          F = File Deletion After Saving.  (B)
          P = Prompt all actions.  (B/R)

    Select Operation (X /Y/Y/Y)       ====>
```

You can select a BRS Operation and, in some cases, one or more Options from the Master Menu. The selection is entered in response to the prompt at the bottom of the display.

OPERATION AND OPTION ENTRY METHOD

An Operation can be selected at the

```
Select Operation (X /Y/Y/Y)        =====>
```

prompt by entering the Operation letter (D, B, R, C, L, or E). BRS immediately spells out the rest of the title of the Operation.

If you are performing the BACKUP Operation (B) or the RESTORE Operation (R), then Option letters (V, W, A, F, or P) can be entered to govern the characteristics of the operation. Each Option should be preceded by a slash mark ("/"). Enter Option letters immediately after the Operation letter is entered. However, on the screen display, it will appear that the Option follows the word "Backup" or "Restore" in the Operation title, because BRS finished spelling the word automatically.

EXAMPLE MASTER MENU SELECTION

Your entry of the "B" menu Operation will cause BRS to immediately spell out the command by adding the characters "ackup". The resulting screen display would look like this:

```
Select Operation (X /Y/Y/Y)        =====> Backup
```

To further define this Backup Operation, you can enter slash marks and Option letters, such as "V" and "P", at the right end of the word "Backup". The entry is terminated by a carriage return. The resulting display would look like this:

```
Select Operation (X /Y/Y/Y)        =====> Backup/V/P
```

After such an entry, BRS will begin the Operation that backs up files from a Winchester Disk partition to a floppy disk. After copying the files to the floppy disk, the program will Verify (/V) the backup files to ensure that they are identical to the files on the Winchester Disk partition. In addition, BRS will Prompt (/P) you before it performs any step in the Backup Operation. (All Operations and Options are explained in detail in upcoming text sections.)

2.2 Master Menu Operations

The paragraphs on this page summarize the properties of each BRS Master Menu Operation.

Date Change — This Operation enables you to correct the date entered when the BRS program was invoked.

Backup — This Operation sends copies of a selected group of files from a Winchester Disk partition to one or more floppy disks. It can be used with Options "V", "W", "F", and "P".

Restore — This Operation sends copies of a selected group of files from one or more floppy disks to a Winchester Disk partition. It can be used with Options "V", "W", "A", and "P".

Compare Files — This Operation checks file backups on a floppy disk against file originals on a Winchester Disk to detect any differences between them.

List Directory — This Operation displays a directory of your backup files, the date they were created, the number of volumes within the disk set, the volume number of the disk containing the file, and the user number of the file.

Exit to CP/M — This Operation ends all other BRS Operations and returns control to the CP/M Operating System, which displays the CP/M system prompt.

2.3 Master Menu Options

If you select Master Menu Operation "B" or "R", then you can also enter options to tell BRS how to perform the BACKUP or RESTORE Operation. The letters that stand for Options should be entered with a slash mark ("/") after the letter standing for the selected Operation. (BRS will instantly display the entire word or title for the Operation after you enter the first letter.) Options **cannot** be entered with the "D", "C", "L", or "E" Operations.

For example, you could respond to the "Select Operation" prompt at the bottom of the menu with the following Operation and Option entry:

```
Select Operation (X /Y/Y/Y)        ====> Backup/V/P
```

The following descriptions explain how each Master Menu Option works:

/V **The Verify Option:** This Option checks each byte of the destination file against each byte of the source file to see that both files are identical. If the two files are not identical, BRS displays an error message.

NOTE: If a discrepancy between the data of two files does occur, you must decide which file is the accurate one, delete the inaccurate file, and make another attempt at creating an identical file. If this option is performed during all Backup and Restore operations, you may assume that the oldest file of the two being compared is the correct file because it has been verified previously. Hence the file that is the most recent copy would be the one that is in error. That file should be deleted, and a new copy made.

The "/V" Option can be used with both the BACKUP and RESTORE Operations.

/W **The Warning Message Disable Option:** Selection of this Option suppresses all warning messages that may occur during an Operation. These warning messages are of two types, and occur when you attempt to:

- write to a disk that is not blank
- delete files from the Winchester Disk

When the "/W" Option is specified, the program will perform the requested command without warning you beforehand. The "/W" Option can be used with both the BACKUP and RESTORE Operations.

/A **The Allow R/O File Restoration Option:** Selection of this Option allows you to restore files that have been given R/O (Read/Only) status. It allows the utility to delete R/O files if they exist on the Winchester Disk. If the "/A" option is not selected, and an attempt is made to restore the R/O file, then BRS will respond:

```
Found User# 00 BRS.COM File is R/O, Not Being Restored
        Enter Carriage Return When Ready
```

This Option can be entered only with the RESTORE Operation.

/F **The File Deletion Option:** Selection of this Option causes the program to delete the files from the source disk after the files have been copied to the destination disk that is being used for backup. The "/F" Option is only available when the BACKUP Operation is selected.

/P **The Prompt Option:** If the "/P" Option is selected, you must respond to a prompt for each action before BRS performs that action. When the "/P" Option is selected during the RESTORE Operation, for example, BRS would ask you if the existing files on the Winchester disk may be deleted so that they can be replaced with restored backup files. Only those files on the Winchester Disk that have names that are identical to those being restored can be deleted. The "/P" Option can be selected with both the BACKUP and RESTORE Operations.

3 THE DATE CHANGE OPERATION

The "DATE Change" Menu Operation enables you to change the date that was entered during the initial date prompt, in case that date was incorrect. The date helps BRS to distinguish between different disks that may contain files with identical file names.

3.1 Selecting the DATE Change Operation

The "DATE change" operation is invoked by entering the letter **D** and a carriage return in response to the Master Menu prompt. (BRS will instantly complete the command with the characters "ate Change".)

This entry will cause BRS to display the date you entered in response to the initial BRS display, and a prompt requesting the corrected date. If you initially entered the date "02/30/84", and now wants to correct it, the BRS utility would display the following message and prompt:

```
Current Date is 02/30/84

Enter Change else hit RETURN ====>
```

3.2 DATE Change Execution

To change the date entered initially, you should enter a new date in the appropriate form, and then a carriage return. The same form for date entry is used here as with the original date entry (see 1.3 "Entering Today's Date"), and the same error messages will result if an invalid date entry is made.

The date listed as "Current Date" will be retained if the you answer the prompt with a carriage return alone.

After you enter the carriage return, the Master Menu reappears.

4 THE BACKUP CREATION OPERATION

The BACKUP Operation transfers files from Winchester disk partitions to floppy disks. During this Operation, you must specify which files on the partition should be left alone ("rejected" by the Operation) and which files should be copied ("selected" by the Operation).

To make file specification more convenient, you can enclose the names of several files in a batch file. When the name of a batch file is specified, the names of all of the enclosed files will be specified automatically.

4.1 Selecting the BACKUP Creation Operation

To begin the BACKUP operation, enter the letter **B** at the Master Menu selection prompt. After the "B" you may enter four of the five options listed at the bottom of the Master Menu (**V, W, F,** and **P**) with a slash mark immediately before each one. The entry should end with a carriage return.

In the following example, the "**B**" is the command for the BACKUP Operation, and the "**/V/F/P**" are the three options selected as an example:

```
Select Operation (X /Y/Y/Y)        ====> Backup/V/F/P
```

BRS adds part of the command by instantly displaying "ackup" after the "B" that you entered.

4.2 Rejection File Specification

After you choose the BACKUP operation, the following prompt is displayed:

```
Enter Rejection File Spec(s).  ====>
```

Any file specified at this prompt will be executed from the upcoming BACKUP operation.

ENTERING EXPLICIT FILE NAMES

The Rejection File prompt will reappear each time you responds to it with a file name and carriage return, as shown:

```
Enter Rejection File Spec(s).  ====> TESTFILE.DOC  RETURN

Enter Rejection File Spec(s).  ====> RETURN
```

The file named "TESTFILE.DOC" will be excluded from the upcoming BACKUP operation (rejected).

ENTERING "WILD CARD" FILE NAMES

You can also answer the prompt with a "wild card" file name (a file name with "*" or "?" characters in it), as shown:

```
Enter Rejection File Spec(s).  ====> *.ASM  RETURN
```

When this entry is made, BRS automatically displays the explicit file names that are implied by the "wild card" file name. These explicit file names are displayed at the end of rejection prompts beneath the prompt you just answered, so it appears as if you entered them. For example, the explicit file names implied by specifying "*.ASM" might display as shown:

```
Enter Rejection File Spec(s).  ====> *.ASM  RETURN

Enter Rejection File Spec(s).  ====> DUMP.ASM  RETURN

Enter Rejection File Spec(s).  ====> BIOS.ASM  RETURN

Enter Rejection File Spec(s).  ====> PROGRAM9.ASM  RETURN

Enter Rejection File Spec(s).  ====> RETURN
```

ENTERING BATCH FILE NAMES

Another way you can reject more than one file at once is to specify a batch file name. A batch file contains the names of several other files that will be specified automatically. (See 4.4 Creating Batch Files.) A batch file name must be preceded by a semicolon (;) when specified at the rejection prompt, as shown:

```
Enter Rejection File Spec(s).  ====> ;BATCHFIL.DOC  RETURN
```

The files within batch file "BATCHFIL.DOC" will be excluded from the BACKUP operation (rejected).

When this type of entry is made, BRS automatically displays the names of the files that are stored in the specified batch file. These file names are displayed at the end of rejection prompts beneath the prompt you just answered, so it will appear as if you had entered them. For example, BRS might display the names of files contained in "BATCHFIL.DOC" as shown:

```
Enter Rejection File Spec(s).  ====> PIP.COM  RETURN
Enter Rejection File Spec(s).  ====> STAT.COM  RETURN
Enter Rejection File Spec(s).  ====> MBASIC.COM  RETURN
Enter Rejection File Spec(s).  ====> PROG2A.BAS  RETURN
Enter Rejection File Spec(s).  ====>  RETURN
```

REJECTING FILES WITH THE MASTER MENU PROMPT OPTION

If the /P ("Prompt all actions") Option was selected with the BACKUP operation, BRS will prompt you to confirm the rejection of each specified file. For the specification "TESTFILE.DOC", one of these prompts might be displayed as follows:

```
Found User# 00 TESTFILE.DOC Reject ? (Y/N) <Y>  ====>
```

To confirm the rejection, enter the letter **Y** or a carriage return. To nullify the rejection, enter the letter **N**.

INVALID FILE SPECIFICATION

If you respond to the prompt by entering the name of a file that does not exist on the specified drive device, BRS will display the message:

```
No Files Found For Entered Spec.
```

and redisplay the prompt.

ENDING REJECTION SPECIFICATIONS

You can stop the specification of rejection files by entering a carriage return alone in response to the prompt:

```
Enter Rejection File Spec(s)?  ====> RETURN
```

This response will produce the menu for File Selection Specifications and the "Selection File Spec(s). (X /Y/Y/Y) = = = =>" prompt.

4.3 Selection File Specification

After you have specified a desired number of rejection files, the following display and prompt will appear:

```
        Options for File Selection Spec(s).
-------------------------------------------------
          A  - All File Types (Default)
          N  - Nonsystem
          S  - System
          U  - Current User #  (Default)
          U* - All Users
          Un - One Specific User #

Enter Selection File Spec(s). (X /Y/Y/Y) ====>
```

Any file specified at this prompt will be included in the upcoming BACKUP Operation (unless it was first specified at a rejection prompt).

ENTERING EXPLICIT FILE NAMES

The Selection File prompt will reappear each time you respond to it with a file name and carriage return, as shown:

```
Enter Selection File Spec(s). (X /Y/Y/Y)  ====> TESTFILE.DOC  RETURN

Enter Selection File Spec(s). (X /Y/Y/Y)  ====> RETURN
```

The file "TESTFILE.DOC" will be included in the upcoming BACKUP operation (selected).

ENTERING "WILD CARD" FILE NAMES

You can also answer the prompt with a "wild card" file name (a file name with "*" or "?" characters in it), as shown:

```
Enter Selection File Spec(s). (X /Y/Y/Y)  ====> *.ASM RETURN
```

When this entry is made, BRS automatically displays the explicit file names that are implied by the "wild card" file name. These explicit file names are displayed at the end of the selection prompts beneath the prompt you just answered, so it appears as if you entered them. For example, the explicit file names implied by specifying "*.ASM" might display as shown:

```
Enter Selection File Spec(s). (X /Y/Y/Y) ====> *.ASM  RETURN

Enter Selection File Spec(s). (X /Y/Y/Y)  ====> DUMP.ASM  RETURN

Enter Selection File Spec(s). (X /Y/Y/Y)  ====> BIOS.ASM  RETURN

Enter Selection File Spec(s). (X /Y/Y/Y)  ====> PROGRAM9.ASM  RETURN

Enter Selection File Spec(s). (X /Y/Y/Y)  ====> RETURN
```

ENTERING BATCH FILE NAMES

You can select more than one file at once by specifying a batch file name. A batch file contains the names of several other files that will be specified automatically. (See 4.4 Creating Batch Files.) A batch file name must be preceded by a semicolon (;) when specified at the selection prompt, as shown:

```
Enter Selection File Spec(s). (X /Y/Y/Y)  ====>;BATCHFIL.DOC  RETURN
```

The files within batch file "BATCHFIL.DOC" will be included in the BACKUP operation (selected).

When this entry is made, BRS automatically displays the names of the files that are stored in the specified batch file. These file names are displayed at the end of selection prompts beneath the prompt you just answered, so it appears as if you entered them. For example, BRS might display the names of files contained in "BATCHFIL.DOC" as shown:

```
Enter Selection File Spec(s). (X /Y/Y/Y)  ====> PIP.COM  RETURN
Enter Selection File Spec(s). (X /Y/Y/Y)  ====> STAT.COM  RETURN
Enter Selection File Spec(s). (X /Y/Y/Y)  ====> MBASIC.COM  RETURN
Enter Selection File Spec(s). (X /Y/Y/Y)  ====> PROG2A.BAS  RETURN
Enter Selection File Spec(s). (X /Y/Y/Y)  ====>  RETURN
```

SELECTING FILES WITH THE MASTER MENU PROMPT OPTION

If the /P ("Prompt all actions") Option was selected with the B ("BACK-UP") operation, BRS will prompt you to confirm the selection of each specified file. For the specification "TESTFILE.DOC", one of these prompts might be displayed as follows:

```
Found User# 00 TESTFILE.DOC Select ? (Y/N) <Y>  ====>
```

To confirm the selection, enter the letter **Y** or a carriage return. To nullify the selection, enter the letter **N**. After one of these responses is entered, BRS displays a similar prompt for the next explicit file name implied by the specified "wild card" name, and another, and another, until you have confirmed or nullified selections for all of the implicated files.

INVALID FILE SPECIFICATION

If you respond to the prompt by entering the name of a file that does not exist on the specified drive device, BRS will display the message:

```
No Files Found For Entered Spec.
```

and redisplay the prompt. This message will also appear if you specify a file (explicit, "wild card", or batch) for both file rejection and file selection. A rejected file cannot be selected during the same run of the BACKUP operation.

```
Ending Selection Specifications
```

ENDING SELECTION SPECIFICATIONS

You can end the specification of selection files by entering a carriage return alone in response to the prompt (as shown),

```
Enter Selection File Spec(s).  ====>
```

This response will lead to execution of the BACKUP operation, which begins with erasure and preparation of the floppy disk (See "4.5 BACK-UP Creation Execution").

SELECTION FILE OPTIONS

You can also limit the types of files that may be affected during the BACKUP operation by specifying Selection File Options. (These options are not to be confused with the Main Menu Options for Operation Selection, although they are entered in a similar fashion.)

These Options are entered after the name of any file specified for selection. Each option letter must be preceded by a slash mark. If no Options are entered, BRS assumes default values. (See "Selection File Option Defaults".) A description of each of these Options follows.

/A **All System and Non-System files Option.** It defines the Backup operation so that both System and/or Non-System files will be affected. This is one of the default Options.

/N **Non-System files Option.** It defines the Backup Operation so that only Non-System files will be affected.

/S **System files Option.** It defines the Backup Operation so that only System files will be affected.

/U **Current User Option.** It defines the Backup Operation so that only those files accessible through the currently logged user area will be affected. This is one of the default Options.

/U* **All User files Option.** It defines the Backup Operation so that the files to be affected can be accessed through any user area on the partition.

/Un **User Number "n" files Option**, where "n" is a number from zero (0) to fifteen (15), inclusive. It defines the Backup Operation so that only the files of user number "n" will be affected.

NOTE: User areas are accessed by implementing the USER resident command. Files can be transferred between user areas by implementing the PIP utility with the [G] parameter. USER and PIP can only be invoked in response to the CP/M system prompt.

SELECTION FILE OPTION DEFAULTS

Two of the Options are applied to Selection File Specifications by default if you do not specify any Options. These two default Options are "A—All File Types" and "U—Current User #".

These Options automatically affect the characteristics of any Selection File Specification for which other Options are not specified. Therefore, a Selection File Specification entered with no Options will select files of all types from the currently logged user area number. (Unless one has been designated since the last cold boot, the currently-logged user area number is zero.)

EXAMPLE ENTRIES WITH SELECTION FILE OPTIONS

Selection File Specifications can be entered with Options as shown:

```
Enter Selection File Spec(s) ====> TESTFILE.COM/N/U* RETURN
```

In the preceding example, **TESTFILE.COM** is the filename, **/N** limits the selection at this prompt to Non-System files only, and **U*** allows the selection to be made from any user area.

Options are also used in this example:

```
Enter Selection File Spec(s) ====> *.*/S/U14  RETURN
```

In this example, ***.*** is the file name, **/S** limits file selection at this prompt to system files only, and **/U14** further limits file selection at this prompt to files accessible from user area 14.

SELECTION FILE OPTION ERRORS

The following two error messages occur when Selection File Options are entered improperly:

```
Invalid Option Format or Selection
```

and

```
Invalid User Number or Format
```

If these messages do occur, the "Enter Selection File Spec(s)" prompt will appear again and await an appropriate entry.

4.4 Creating Batch Files

You can enter several file names in response to a file rejection or specification prompt by storing these file names in a batch file.

A batch file is a text file composed entirely of file names and Options.

The name of the batch file itself is entered at file rejection or specification prompt to trigger the entry of all of the file names within it. When entered, the name of the batch file itself must be preceded by a semicolon (;), as in the following example:

```
Enter Rejection File Spec(s).  ====> ;BATCHFIL.DOC  RETURN
```

The batch file can be composed using the ED utility or any other text editor or word processor. It can contain any file name that conforms to CP/M file naming conventions.

The file names within the batch file should be entered on separate, successive lines. Each line must be terminated with a carriage return.

CONTENTS OF EXAMPLE BATCH FILE

The example batch file BATCHFIL.DOC, for instance, contains the following file names:

```
ACCOUNTS1.DAT
ACCOUNTS2.DAT
FINANCE.COB
STATS.FOR
```

When you specify the batch file BATCHFIL.DOC at a rejection or selection prompt, these files will be automatically specified for rejection or selection.

FILE SELECTION OPTIONS WITHIN A BATCH FILE

If you enter a batch file name at a selection file specification prompt, the file names within the batch file can have Selection File Options. The following example shows the contents of a batch file that contains options with some of its files:

```
BIOS.SYS/S
PAYROLL5.DAT/U14
MEMO????.DOC/U*
*.*/N/U
```

In addition, you can enter a batch file name with options when responding to a selection file prompt. The options will apply to all of the files within the batch file.

4.5 BACKUP Execution

After you have specified the names of the files that should be backed up, the "Enter Selection File Spec(s). (X /Y/Y/Y)= = = =>" prompt should be answered with a carriage return alone. This entry tells BRS to begin execution.

BACKUP EXECUTION MESSAGE

BRS will display the following message when it is ready to execute the BACKUP Operation:

```
        Load Drive B: with a Blank Floppy Disk

*** WARNING Data on This Disk Will be DESTROYED !! ***

            Press RETURN to begin
```

(This warning message will not appear if you entered the "/W" option at the Master Menu.)

PREPARING BACKUP FLOPPY DISKS FOR DATA STORAGE

You should insert a floppy disk into the floppy disk drive in the H/Z-67 drive unit. This disk need not be blank, but any data on it must be expendable, because the BACKUP Operation begins by preparing the disk surface for the storage of **new** data.

After inserting a disk into the floppy disk drive, enter a carriage return. The following prompt will be displayed:

```
Which density? (S=single, D=double) ====>
```

Enter **S** or **D** depending upon the amount of data desired on the Backup Disk. Then BRS will prompt:

```
Press RETURN to begin.
```

The entry of a carriage return will begin execution of the BACKUP operation.

If one of the floppy disks used for backup cannot be formatted, then BRS will display:

```
Unable to format this disk. Place a different disk in the drive.
```

Make sure the disk is properly inserted and write enabled. Then, if it still cannot be formatted, replace it with a different disk for this Operation.

ACTUAL BACKUP EXECUTION

When actual BACKUP execution begins, BRS will display the following message:

```
********  BACKUP OPERATION IN PROGRESS  ********
```

If BACKUP execution stops because all of the selected files have been backed up to the floppy disk, then the operation is finished and the Master Menu will be displayed again.

If BACKUP execution stops because the floppy disk has been backed up to capacity while more selected files remain on the Winchester Disk, then more floppy disk space is needed. Refer to the next text section for guidance.

BACKING UP TO SEVERAL FLOPPY DISKS

If the files selected for the BACKUP Operation will not all fit on a single floppy disk, then BRS will interrupt BACKUP execution with the following message:

```
                Current Floppy Disk is Full

          Load Drive X: with a Blank Floppy Disk

*** WARNING  Data on This Disk Will be DESTROYED !! ***

             Enter Carriage Return When Ready
```

Where "`Drive X:`" is the drive already specified as the Floppy Disk Drive for the operation.

After inserting a new disk and entering a carriage return, the density prompts will appear again, as shown:

```
Which density? (S=single, D=double) ====>
```

Enter **S** or **D** to indicate the density desired on the backup floppy disk. Then the following prompt will appear as shown:

```
Press RETURN to begin.
```

Enter a carriage return to begin the formatting and copying of data to this floppy disk.

BACKUP DISK SET DIRECTORY

When Winchester Disk files are backed up to more than one floppy disk, then the floppy disks used are referred to as the "Backup Disk Set". BRS automatically gives each disk in this set a volume number, starting with the first disk inserted (Volume 01).

Volume 01 of the Backup Disk Set is also referred to as the "Directory Disk".

To ensure that the volumes in a Backup Disk Set are kept in order, BRS records a directory on the Volume 01 disk. This directory is stored in a file named "MASTBRS.DIR". BRS prompts you to reinsert the Volume 01 disk so that the directory can be recorded:

```
Load Drive X: With Volume 01 of Backup Disk Set

        Enter Carriage Return When Ready
```

Where "Drive X:" is the drive already specified as the Floppy Disk Drive for the Operation.

WRONG DISK ERROR MESSAGE

If you are prompted to load "Volume 01" and insert a disk other than Volume 01 (the Directory Disk), the following error message will appear:

```
Wrong Disk Inserted in Drive

 Enter (CR) for Master Menu
```

Respond to this message by entering a carriage return. The Master Menu will appear.

5 THE RESTORE FILES OPERATION

The RESTORE operation transfers backup files from floppy disks to a Winchester disk partition. During execution of this Operation, you must specify which files on the floppy disk should be left alone ("rejected" by the Operation), and which files should be copied ("selected" by the Operation).

RESTORE is similar to BACKUP in the form of its messages and prompts. The biggest difference is the appearance of two extra screen displays after you select RESTORE from the Master Menu.

5.1 Selecting the RESTORE Files Operation

To begin the RESTORE Operation, enter the letter **R** at the Master Menu selection prompt. After entering the "R", you may enter four of the five options listed at the bottom of the Master Menu (**V, W, A,** and **P**)

In the following example, the "**R**" is the command for the RESTORE Operation, and the "**/V/A/P**" are the three options selected:

```
Select Operation (X /Y/Y/Y) ====>Restore /V/A/P
```

BRS adds part of the command by instantly displaying "estore" after the "R" that you entered.

5.2 The Disk Set Directory

The files transferred during a single BACKUP Operation can reside on several floppy disks. These disks are collectively called a Disk Set. BRS maintains a Disk Set Directory that helps it to restore files to the Winchester disk in the same order that they existed before they were backed up.

The Disk Set Directory is stored on the first disk that you inserted during the BACKUP Operation, which becomes known as the Directory Disk. This directory assigns a "Volume" number to each disk in the set, and "Volume 01" is always assigned to the Directory Disk.

When you want to RESTORE files from a floppy Disk Set, BRS must access the directory from the Directory Disk (Volume 01 of the Disk Set) to determine where the files are.

INSERTING THE DIRECTORY DISK

To remind you to insert the Directory Disk, BRS displays the following prompt:

```
Load Drive    X: With Volume 01   of Backup Disk Set.
          Enter Carriage Return When Ready.
```

Where "Drive X:" refers to the drive (A through P) that you assigned as the Floppy Disk Drive before the Master Menu appeared.

Respond to this prompt by inserting the Directory Disk (Volume 01) into the specified drive and entering a carriage return.

WRONG DISK ERROR MESSAGE

If you are prompted to load "Volume 01" and insert a disk other than Volume 01 (the Directory Disk), the following error message will appear:

```
Wrong Disk Inserted in Drive
 Enter (CR) for Master Menu
```

Respond to this message by entering a carriage return. The Master Menu will appear.

DIRECTORY VERIFICATION

When a Directory Disk (Volume 01) is inserted, BRS examines it and displays some of the characteristics of the Backup Disk Set in the following form:

```
Backup Disk Set:  Created mm/dd/yy
                  Start vol. 01
                  Last  vol. nnn

Is This The Correct Backup Set?  (Y/N) <Y> ====>
```

Where "mm/dd/yy" is the date you performed the BACKUP operation that created the file copies in this Disk Set; and

where "nnn" is the volume number of the last disk in the set.

If the "Created" date and the "Last vol." number shown in this display do not match those of the Disk Set that you want to restore, the prompt at the bottom of the display should be answered with an "N". BRS will redisplay the "Load Drive X:" prompt to allow you to insert a different Directory Disk.

If the date and volume numbers match, enter **Y** or a carriage return, and read about "Rejection File Specification".

5.3 Rejection File Specification

After you verify that the disk in the floppy disk drive is Volume 01 of the "Correct Backup Set", the following prompt is displayed:

```
Enter Rejection File Spec(s).  ====>
```

Any file specified at this prompt will be excluded from the ensuing RESTORE operation.

USER RESPONSE

This prompt will reappear each time you respond to it with a file name and carriage return, as shown:

```
Enter Rejection File Spec(s).  ====>TESTFILE.DOC  RETURN

Enter Rejection File Spec(s).  ====>  RETURN
```

or a batch file name,as shown:

```
Enter Rejection File Spec(s).  ====>;BATCHFIL.DOC  RETURN

Enter Rejection File Spec(s).  ====>  RETURN
```

The file named "TESTFILE.DOC" will **not** be backed up. The files within batch file "BATCHFIL.DOC" will not be backed up either. The specification of a batch file must be preceded by a semicolon. (See 5.5 "Creating Batch Files".)

INVALID FILE SPECIFICATION

If you respond to the prompt by entering the name of a file that does not exist on the specified drive device, BRS will display the message:

```
No Files Found For Entered Spec.
```

and redisplay the prompt.

Each file name entry must be followed by a carriage return. Ambiguous file names can be entered (using wild card symbols "*" and "?"). But no drive names can be specified at this prompt.

ENDING REJECTION SPECIFICATIONS

You can end the specification of rejection files by entering a carriage return alone in response to the prompt:

```
Enter Rejection File Spec(s).  ====>
```

This response will produce the "Selection File Specification" display and prompt.

5.4 Selection File Specification

After you have specified the desired number of rejection files, the following display and prompt will appear:

```
        Options for File Selection Spec(s).
-------------------------------------------------
          A  - All File Types (Default)
          N  - Nonsystem
          S  - System
          U  - Current User =   (Default)
          U* - All Users
          Un - One Specific User =

Enter Selection File Spec(s). (X /Y (X /Y/Y/Y)  ====>
```

Any file specified at this prompt will be included in the ensuing RESTORE Operation.