

**WAVE MATE, INCORPORATED**

**BULLET CP/M SOFTWARE MANUAL**

## **NOTICE**

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# BULLET CP/M SOFTWARE MANUAL

## 1. THE FIRST TIME THROUGH

The most important thing to do when you first receive your system is to make a copy of the release diskette. This is very important as it is possible to inadvertently render your release diskette unusable with some of the utilities provided. The *only* way the copy should be done is by use of the FORMAT utility.

*NOTE:* Do *not* use the SYSGEN utility. SYSGEN is provided on the release diskette, but the proprietary WAVE MATE CBIOS is not currently integrated into MOVCPM. This information is not important if you are not already familiar with using the CP/M SYSGEN utility. Simply follow the instructions provided below in order to copy your release diskette.

The process of copying a diskette is frequently referred to as "backing up". To back up a system diskette, boot in the system and place a blank diskette in drive B. Be sure to use a diskette certified for double density. If the diskette is not certified for double density, it will eventually fail to read properly, invariably at an inopportune time. Type in the command "FORMAT". The utility will load and display several lines of information on the screen. Take the time to carefully read the information. Select the single diskette mode of formatting by entering a "S" followed by a carriage return. The utility will then prompt for a drive specification. Type "B:" followed by a carriage return. The physical diskette parameters contained in the CBIOS table for drive B will then be displayed. A request for confirmation is then made, and the formatting can be started by typing "YES" followed by a carriage return.

*Note:* at any point prior to typing the "YES", the operation may be cancelled by typing a control-C. The control-C is typed by holding down the "CTRL" key and pressing the "C" key.

If the diskette formats without error, the utility will ask if you wish to copy the operating system onto the newly formatted diskette. Type a "Y" followed by a carriage return. The utility will prompt for a drive, and you should type an "A" followed by a carriage return. The utility will copy the system over to the new diskette to create a working, bootable diskette. Insure you affix the copyright notices to the new diskette.

The files may now be copied over to the new diskette by using the PIP utility. To do this now, enter a control-C to return to the CP/M "A)" prompt. To copy all files to the new diskette with PIP, type the following command:

```
PIP B:=A:*. *[O]
```

There is one space between the "PIP" and the "B:"; and the character in brackets is the letter "O", not a zero. Terminate the command with a carriage return. As PIP copies each file over to the new diskette, the name of the file will be displayed. For further information on using PIP, please consult the CP/M manuals.

## 2. THE WAVE MATE CBIOS

Several important notes should be kept in mind when using the BULLET with CP/M and the WAVE MATE CBIOS. It is important to recognize that the CBIOS uses interrupts and operates the Z80 in interrupt mode 2. Accordingly, any user program which changes the interrupt mode or interrupt vector page will probably crash the system. Programs which disable interrupts will interfere with the CBIOS and prevent keyboard input through the CBIOS if the interrupts are disabled during the CBIOS call. It is not recommended that application programs disable interrupts. Finally, if the user program does not allow sufficient stack space for the program counter, the results can be unpredictable when an

interrupt occurs. It is strongly recommended that application programs allow sufficient stack space. The CBIOS does not use any additional stack during the interrupt service routines; however, the interrupt automatically pushes the program counter onto the stack. If the program has not allowed sufficient space for this data, unpredictable reactions can occur depending upon what data was damaged and when.

Errors occurring during diskette writes are also handled somewhat differently under the WAVE MATE CBIOS. CBIOS calls for diskette writes never return an error to the caller. The data is not written immediately, but is buffered pending a CBIOS track buffer operation. Accordingly, if an error occurs during the actual write operation, it is too late to return the error to the caller. In this event, the message "CBIOS WRITE VERIFICATION ERROR" is displayed on the user console and the user must enter a control-C to execute a warm boot. The most frequent cause of this error message is a write protected drive.

### 3. THE SETUP UTILITY

The SETUP utility provides a convenient method to redefine parameters within the CBIOS. It is used to change the baud rates for the two serial ports and to define the printer port as either a serial or parallel printer port. It is particularly useful in redefining the diskette formats. Caution should be exercised to use this utility *only* with a working boot diskette as it modifies the CBIOS on the system tracks. It is possible to define parameters using SETUP which will prevent the boot diskette from booting properly. An example would be redefining the boot drive A to have two sides when the physical formatting of the diskette is one side. If this is done, the boot process will hang when it tries to read the second side of the diskette. If this occurs, it is necessary to create a new working boot diskette using the release diskette.

The important thing to keep in mind when using SETUP is that the utility modifies the CBIOS on the system tracks of the diskette in drive A. It does not change the CBIOS of the system currently loaded into memory. It also does not physically change the format of the system diskette in drive A. Thus to change the parameters of the CBIOS in memory, you must first run SETUP and then BOOT to reload the CBIOS.

When changing diskette parameters, only minimal validity checking is performed by SETUP. This is done to allow maximum flexibility to the user. This minimal checking does enable definition of formats which would be impossible to create. For example, since the total number of bytes of data which can be recorded on one track of a diskette is fixed, defining more sectors than will fit will only cause an error when the FORMAT utility is executed.

Modifying diskette parameters with SETUP provides three functions: (1) It allows the user to format diskettes with various sector-size/sectors-per-track parameters. There are limits to the combinations, and the user should consult Section 4 on the FORMAT utility for more information. By changing parameters, it may be possible to create diskettes which may be used on other systems provided there are no inherent diskette controller incompatibilities. (2) The user may be able to read diskettes created on other systems. This capability is also subject to any diskette controller incompatibilities, but is not subject to formatting incompatibilities. For example, if the FORMAT is unable to create a diskette with highly packed sectoring due to the diskette drive speed being too fast, the controller can still read the diskette since the clocking information for reading is recorded on the diskette. (3) The basic CBIOS parameters may be reconfigured to provide for double sided diskettes or the sector sizing may be redefined to allow more information to be recorded on a diskette. For example, the format may be changed from sixteen 256-byte sectors to nine 512-byte sectors on each track.

Valid ranges for the various SETUP parameters are as follows:

SIDES:	1 or 2
TRACKS:	1 through 99
SECTORS:	1 through 99

SECT-SIZ: 128, 256, 512, or 1024  
DEN: D or S

*Note:* the above ranges are valid only in the sense that they may be typed in response to the SETUP utility prompts. This does not mean that *all* combinations of the values will be valid for the FORMAT utility.

In addition, the user may define the number of operating system tracks (OSTRKS) to be 0 through 9. This is useful in reading a foreign diskette where the number of reserved tracks is different.

The STEP-RATE field does not affect the formatting parameters, but is provided to allow the user to adjust the diskette drive stepping rate used by the CBIOS to the fastest allowed by the attached diskette drives. Valid parameters depend upon whether the drive is five inch or eight inch. The following table defines the valid entries for SETUP:

DISK SIZE RATES

5-inch	6ms, 12ms, 20ms, 30ms
8-inch	3ms, 6ms, 10ms, 15ms

The diskette drive manufacturer's manual should be consulted to determine the fastest step rate allowed. The closest step rate which does not exceed that rate should be selected in SETUP. For example, if a 5-inch diskette is being used and the manufacturer specifies a 10ms stepping rate, then 12ms should be selected using SETUP.

The SETUP utility provides a powerful tool for system reconfiguration. The user may reconfigure the CBIOS diskette parameters to define virtually any soft sectored diskette. The utility reads in the operating system and CBIOS from the system tracks, alters parameters based upon the user specifications, and then writes the system back onto the operating system tracks. Since the utility alters the system tracks, it should only be used on a working copy of the release diskette as it is possible to create a system that will not boot properly if the user specified parameters do not correspond to the physical format of the diskette. As an illustration, the following procedure describes how to reconfigure the single sided diskette to a double sided bootable diskette.

- (1) Using a working copy of the release master diskette, boot the system and then execute the SETUP utility. Select option 4 to edit the diskette parameters, then enter drive B as the diskette parameter to edit. Change the sides parameter to 2, exit the diskette parameter edit mode, and enter "E" to exit the SETUP utility. At this time, SETUP will write out the revised operating system on the system tracks (if control-C was entered instead, SETUP will return to the operating system and not modify the system tracks).
- (2) Now re-boot the modified operating system. This will load the system with the CBIOS diskette tables set to indicate that drive A is single sided (the standard release diskette mode) and drive B is double sided. Execute SETUP again. This time edit the diskette parameter to change drive A to double sided. Exit the SETUP utility to write the modified system out with both drives A and B defined as double sided.

*Note:* At this point, the system in memory has the drive tables defined with A as single sided (it physicaly is and must be for the system to correctly access it), and drive B as double sided. However, the operating system on the diskette in drive A is defined to have both A and B as double sided. If you were to attempt to re-boot at this point, the boot would fail as the system is on a single sided diskette but the tables define A as double sided.

- (3) To complete the process of conversion to a double sided system, execute the FORMAT utility. This utility uses the parameters in the CBIOS tables in memory to determine what format to place on the designated diskette. Select the single mode of operation to allow you to copy the operating system from another diskette onto

the newly formatted diskette. Keep in mind that the operating system in memory has drive A defined as single sided and drive B as double sided. The operating system on the system tracks of the diskette in drive A is defined to have both drive A and drive B as double sided. After selecting the single mode of formatter operation, select drive B as the formatting drive. The formatter will display the parameters from the CBIOS tables in memory. This should confirm that drive B is defined to have two sides, as set during the first execution of the SETUP utility. Place a blank diskette in drive B, and type "YES" in response to the formatter request for confirmation. The formatter will format the diskette and verify the format. If there are any errors during the formatting process, repeat the formatting with another diskette. When the verification is completed without errors, the FORMAT utility will ask if you wish to copy an operating system to the system tracks of the newly formatted diskette. Type "YES" and the FORMAT utility will prompt for a source drive for the operating system. Respond with "A" to this prompt, and the FORMAT utility will read the operating system from the system tracks of drive A, modify the bootstrap sector parameters to reflect the CBIOS parameters in memory for the target drive, and then write the bootstrap sector and operating system out on the target drive (drive B in this example). Remember that the second time you executed the SETUP utility you defined both drives A and B to be double sided, which is what is copied to the diskette in B. Now the diskette in B is formatted with two sides and has an operating system on it which defines A and B as having two sides. The operating system in memory defines A as single sided and B as double sided from your first execution of the SETUP utility. Now execute PIP to copy all the files from drive A to B. Place the double sided diskette in A and re-boot. This diskette should be marked as your first generation system redefinition diskette. You may make a working copy of it by executing the FORMAT utility, formatting a diskette in drive B, copying the system tracks, and using PIP to copy all the files. If you later have a diskette which is single sided and wish to move the files from it to your double sided diskette, you may execute SETUP and define B as single sided. Re-boot this system and copy from a single sided diskette in B to a double sided diskette in A. The same operation may be carried out to read/write or format diskettes having different sector sizes and sectors per track.

#### 4. THE FORMAT UTILITY

The FORMAT utility provides a method to initialize new diskettes. Frequently, diskettes are purchased which do not have a prerecorded soft sectored format upon them or the prerecorded format may not correspond with the format being used. It must be emphasized that the purchased diskette must be certified by the manufacturer for the format to be recorded upon it. While a diskette which is certified only as single density may frequently be formatted as double density, such a practice invariably leads to future errors in reading/writing the diskette. If the diskette is not marked or otherwise certified as single or double density, it should be assumed to be a reject and unsuitable for use.

The exact number and size of sectors which will fit on a diskette track are variable depending upon diskette drive speed and gaps between sectors. If the diskette drive is rotating at the exact speed specified by the manufacturer, the number of bytes that can be recorded upon a track is as follows:

DISK SIZE	BYTES/TRACK
	FM/MFM
5-inch	3125/6250
8-inch	5208/10416

*Note* that the double density (MFM) mode provides exactly twice as many bytes per track as the single density (FM) mode; however, the gaps are slightly different so twice as much formatted data is not always available. The user should be aware that diskette drive

speed variation of plus or minus three percent should be allowed for, so the preceding figures should be adjusted accordingly.

The following formats are utilized on the WAVE MATE distribution diskettes:

DISK SIZE	TRACKS	SECTORS	SECTOR SIZE	DENSITY
5-inch	40	16	256	Double
5-inch	80	16	256	Double
8-inch	77	26	256	Double

In formatting the diskette, the FORMAT utility uses either the single density or double density format described in Figure 1.

When the FORMAT utility is used, it obtains the parameters from the CBIOS diskette parameter block to determine what format to write. Since the SETUP utility does not strictly enforce that a given format can be achieved, it is possible to have parameters passed to FORMAT which are impossible to realize; i.e., 12000 bytes/track on an 8-inch double density diskette. The only way this error will be detected is when FORMAT does the verification pass. At this time, the data not written on the diskette will result in errors in those sectors not successfully written during the format pass. The user must compute a format which will actually fit on the diskette track.

## 5. THE BOOT UTILITY

The BOOT utility provides a convenient method to reboot the system and the CBIOS after executing the SETUP utility. To execute the boot, simply type in "BOOT".

## 6. THE MEMTEST UTILITY

The MEMTEST utility provides a useful method to verify the operation of the memory array over the most rigorous of operating conditions. In a Z80 based system, the worst case memory timing occurs during the opcode fetch. This means that it is extremely difficult to test memory under worst case conditions and even more difficult to test for pattern sensitive locations under worst case conditions. The WAVE MATE MEMTEST diagnostic utility overcomes this problem by utilizing the DMA controller to move test pattern bytes at worst case timing conditions. MEMTEST also uses a proven test pattern algorithm which is independent of memory cell topology. This pattern is designed to check physically adjacent bits within the memory chip that change state together.

To test the memory system, type "MEMTEST". Since this utility destroys all data currently in the memory, confirmation is requested. If any errors are reported, write the results down and repeat the test. If the error occurs again, the board should be returned to WAVE MATE for repair. It is important to note that the address may not be exactly the same, but the bit position will be since each bit represents one chip. For example, if the following results are determined:

```
**MEMORY ERROR** ADDRESS: 01823B, WRITE DATA: 55, READ DATA: 51
**MEMORY ERROR** ADDRESS: 018239, WRITE DATA: 55, READ DATA: 51
```

then the diagnosis is: pattern sensitive bit 2 in 01823X area.

If the second result shows no errors, it is likely that the first error was due to other factors. Factors which could cause a one time error include alpha particles or line voltage fluctuations or spikes.

All BULLET computers are carefully tested for pattern sensitivity prior to shipment, and it is unlikely that this error will occur in the field. The MEMTEST utility should be executed periodically to check for component degradation or failure. At a minimum, it is recommended that MEMTEST be executed at least once per month.

### IBM 3740 FORMAT (SINGLE DENSITY)

NUMBER OF BYTES	HEX VALUE	
Header:		
-- 40	FF	
6	00	
1	FC	(index mark)
-- 26	FF	
Each sector:		
-- 6	00	
1	FE	(ID address mark)
1		Track Number (1 to nn)
1		Side Number (00 or 01)
1		Sector Number (1 to nn)
1	00	(Size = 128 bytes/sector)
2		Header CRC bytes
11	FF	
6	00	
1	FB	(DATA address mark)
128	E5	(data field)
2		Data CRC bytes
-- 27	FF	
End of track:		
247	FF	(end of track fill)

### IBM SYSTEM 34 FORMAT (DOUBLE DENSITY)

NUMBER OF BYTES	HEX VALUE	
Header:		
-- 80	4E	
12	00	
3	F6	
1	FC	(index mark)
-- 50	4E	
Each sector:		
-- 12	00	
3	F5	
1	FE	(ID address mark)
1		Track Number (1 to nn)
1		Side Number (00 or 01)
1		Sector Number (1 to nn)
1	01	(Size = 256 bytes/sector)
2		Header CRC bytes
22	4E	
12	00	
3	F5	
1	FB	(DATA address mark)
256	E5	(data field)
2		Data CRC bytes
-- 54	4E	
End of track:		
598	4E	(end of track fill)

Figure 1