

# **nascom**

**Nascom Microcomputer  
DOCUMENTATION  
CP/M 2,2 REV 2,1**

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## User guide for NASCOM implementation of CP/M 2.2 Rev 2.1.

**NOTICE:** CP/M is a registered trade mark of Digital Research Inc.

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## CP/M 2.2 Nascom implementation Rev 2.1 changes

The current version of NASCOM CP/M is CP/M 2.2 Rev 2.1.

The following differences exist between this and earlier CP/M BIOS revisions :-

The line printer device LPT: is now a Centronics type parallel printer interface. See Application Note AN006 for a description of the NASCOM standard interface.

The user console device is now treated as the CRT and keyboard rather than a TTY:

The user devices UC1,UR1,UR2,UP1 and UL1 are now vectored via ram allowing the user to substitute his own device drivers where required.

The CRT display has been increased from 15 to 16 scrolling lines of 48 characters.

The left margin width on the CRT can be changed to allow centering of the display.

Double sided disks are supported giving a capacity of 760k per drive. Double and single sided drives may be mixed.

Due to media problems only 77 tracks are used per disk side not 80.

The drive stepping rate is variable to give minimum disk access times.

Improved disk error handling is included.

The I/O device selection does not change after a warm boot.

An auto load facility is provided for automatic execution of user programs.

Control X rather than ESC now deletes a line in screen edit mode.

Erase to end of line and Erase to end of screen are supported.

Direct cursor addressing is supported.

Provision is made for upgrading to use the Advanced Video Controller.

Both senses of handshaking can be used on the serial port.

Line feeds may be deleted following a carriage return when sending to the LPT: device to allow the use of printers that automatically insert them.

A patch area is provided for user device drivers with provision for initialising any peripheral devices.

A configuration program is supplied to allow options to be easily selected.

## 1. Hardware requirements

The following hardware requirements must be met before CP/M 2.2 can be implemented on a NASCOM 2 microcomputer.

### 1.1 NASCOM 2

A few changes must be made to a standard NASCOM 2 to enable CP/M to be used. These are as follows:

The restart address set up on LSW1 must be changed to F000 (hexadecimal). This can be done by moving switches 1, 2, 3 and 4 off, or if links are in the board, by removing the links between pins 1 and 20, 2 and 19, 3 and 18, and finally 4 and 17.

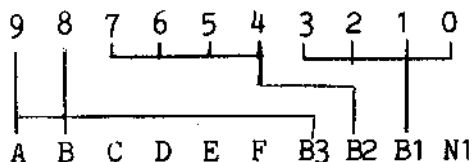
To achieve the fastest operation of CP/M ensure that the board is set up for 4MHz operation with no wait states, although operation (at a reduced speed) is possible at 4MHz with wait states. 2MHz operation is only possible without wait states however; this will require a change in the FDC card configuration (see FDC card hardware manual).

LSW2/8 should be set to external port addressing to enable the FDC to function. In the case of a board fitted with a switch pack, switch 8 should be up when viewing the board with the UHF modulator on the left or, if links are used, then a connection should be made between holes 18 & 28 (the upper pair)

More details of these changes can be found by referring to the NASCOM 2 hardware manual.

### 1.2 Minimum memory requirements

The CP/M 2.2 operating system as implemented on NASCOM requires a minimum of 20K of RAM starting at address 0000. This can all be on a separate RAM card or combined with RAM on the NASCOM 2 board, so long as it remains contiguous from 0000. A RAM B card with 48K of RAM should be set up to address from 0 to BFFF by setting up the decode header as follows:



### 1.3. Boot loader

The actual operating system software is contained on disk, so before this can be used it has to be loaded into memory (RAM). This process is called bootstrapping and is performed on the NASCOM 2 by a simple disk loader contained in a 2K EPROM. This EPROM replaces the monitor EPROM, IC 34 (e.g. NAS-SYS 1 or 3) on the NASCOM 2 board.

### 1.4 Memory decode PROM

The operation of CP/M places certain requirements on the memory map of the computer system. Specifically RAM is required to be contiguous from 0. This requirement clashes with the memory map of a standard NASCOM 2 system. To overcome this problem and to allow maximum memory to be

available to CP/M, a new address decode PROM is supplied (see section 1.5). The new N2MD PROM is inserted in position IC47, in place of the standard N2MD PROM.

### 1.5 Revised header

Since the decode PROM has been altered, a change is also required in the associated header (LSK1). The minimum links necessary are to enable the Boot EPROM (from F000 to F7FF) and to enable the video/workspace RAM (VWRAM) from F800 to FFFF. These require links from pin 1 to 10 and pin 2 to 9. Other links can be added to enable the eight on board memory sockets to be used as required. The header layout with the new MD PROM is as follows:

| Function  | Pin | Pin | Address   |
|-----------|-----|-----|-----------|
| BOOT ROM  | 1   | 16  | 0000-07FF |
| VWRAM     | 2   | 15  | 0800-0FFF |
| RAM GATE1 | 3   | 14  | 1000-1FFF |
| BLOCK A   | 4   | 13  | 0000-CFFF |
| RAM GATE2 | 5   | 12  | D000-DFFF |
| BLOCK B   | 6   | 11  | E000-EFFF |
| XROM      | 7   | 10  | F000-F7FF |
| BROM      | 8   | 9   | F800-FFFF |

### 1.6 Disk Drives

Although it is possible to use a lot of CP/M facilities with only one disk drive, it can often be time consuming, especially when backing up programs (See appendix A). For this reason two or more drives are usually used. The NASCOM disk drives are designed to be compatible with the NASCOM FDC card described in the section 1.7.

Both single and double sided drives are supported under CP/M giving 374k and 760k bytes capacity respectively.

### 1.7 FDC card

The floppy disk controller card (FDC) is NASBUS compatible. Each card can support up to 4 drives. More details can be found in the disk system hardware manual. As far as CP/M is concerned the base address of this board should be set to EDH.

If double sided disk drives are to be used then two links may be required on the FDC card. Links LK3 and LK4 if installed select drives A: and B: or C: and D: respectively to be double sided.

More technical details can be found in the FDC hardware manual.

### 1.8 CP/M 2.2 system disk

As mentioned previously the actual CP/M operating software is contained on disk, therefore a system disk is required. This disk is serialised, the number corresponding to a Digital Research licence number. Although back-ups of this disk should be made in case of accidental erasure or wear, these copies must only be used on the system for which they were purchased. Several other requirements as described in the Digital Research Licence Agreement must also be noted carefully. **Make sure you understand this agreement before proceeding to use CP/M!**

## 2.0 Starting CP/M

Once the required hardware has been assembled and connected together the system can be switched on. This should be carried out in the following order (NOTE - error messages are explained in section 4):

Turn on computer, disk drives and associated monitor or TV. A sign on message should appear at this stage:

**CP/M 2.2 Boot Rev 2.1  
Insert disk**

Now insert the system disk into drive A: (the right hand drive) as follows:

First ensure the door locking slide in the top right hand corner is unlocked (no red dot showing).

Open the door by squeezing the door knob between finger and thumb.

Take the system disk from its envelope and insert fully into the drive with the head window facing inwards and the write enable notch (which may be covered by a write protect tab) on the left side.

### **DO NOT USE EXCESSIVE FORCE!**

Now push the door knob downwards until it clicks. Again excessive pressure should be avoided. If there is a problem closing the door it is probably due to incorrect insertion of the disk.

If more than ten seconds has elapsed then a further message will have appeared on the screen

**Press RESET.**

In this case press RESET and the system should now boot from the disk.

If all is well a sign on message should be displayed.

**Digital Research 20k CP/M vers 2.2  
Nascom Microcomputers - rev 2.1  
Drives A: & B: aaak, C: & D: bbbk**

where aaa and bbb are the disk drive capacities (374k for single sided and 760k for double sided drives).

This message should then quickly be followed by the system prompt:

**A>**

The system is now ready to accept CP/M 2.2 commands as described in CP/M handbook. **WARNING:** It should be noted that when any disk is changed a warm or cold start should be performed to prevent some errors which can occur if this is not done.

The first process once the system has been started for the first time is to make a copy of the received system disk. At the same time, the

size of the system should be altered to allow the system to use the maximum amount of memory. This process can be performed by first formatting a blank disk (as described in the next section) and using PIP to copy all the files across, MOVCPM to create a system to use all the available memory and finally SYSGEN to save this system on the new disk. The following commands could be used to make a new system disk in drive B:

Format the disk (see section 3).

Copy all the files to the new disk.

**PIP B:=A:\*.\***

Create a CP/M system for the memory available.

**MOVCPM \* \***

Generate a system on the new disk.

**SYSGEN**

press ENTER when asked for source drive, and B when asked for destination drive.

This new disk should then be used and the master disk as supplied should be kept somewhere safe and not subjected to constant use.

### 3. FORMAT

#### 3.1 Description

Before any disk can be used on a NASCOM CP/M system it has to be formatted. This puts sector and track information on the disk. This information is then used by the floppy disk controller and CP/M to store and subsequently retrieve information.

The disks are formatted into 10 sectors per track of 512 bytes each. There are 77 tracks on a single sided disk and 154 on a double sided one.

To give improved system performance a skew factor is introduced at the formatting stage. This means that the sectors are not numbered sequentially on the disk. This allows time for some processing between reading consecutive sectors from the disk.

A skew of 1 (no skew) gives sectors in the order:

1,2,3,4,5,6,7,8,9,10

A skew of 3 gives:

1,8,5,2,9,6,3,10,7,4

Skew values of 1 to 5 are implemented in FORMAT rev 2.1.

A skew of 3 gives the fastest operation in normal use ie. 4Mhz clock with no wait states. A little experimentation may give improved results in particular instances.

#### 3.2 Using FORMAT

The FORMAT program FORMAT.COM is invoked by typing FORMAT followed by the ENTER key whenever the CP/M prompt ">" appears on the screen:

The sign on message should now be displayed followed by a request for the drive to be formatted:

**Disk formatter Rev 2.1**

**Which Drive (A-D)?**

Respond to this with relevant letter within the range stated (FORMAT is aborted if an invalid drive letter is used)

NOTE: This can be drive A, but in this case ensure that the system disk is removed before proceeding further otherwise ALL the information on this disk will be lost in the formatting procedure!)

The system will respond with a message indicating whether a single or a double sided disk is to be formatted.

**Formatting Single Sided Disk**

or

**Formatting Double Sided Disk**



NOTE: If the drive selected is double sided then a double sided disk will be formatted otherwise a single sided disk is assumed.

The system now requests a skew value between 1 and 5.

### Skew value (1-5) ?

Type the skew factor required (3 is standard) followed by the ENTER key.

The side being formatted will be displayed followed by the track number and the number of bytes written per track giving an indication of the speed of the disk for each track.

### Formatting side 1

10 6250

If the bytes written differs by more than 3% from the nominal value of 6250 then the format will terminate with the display of an error message (see section 3.3.).

If a double sided disk is being formatted then the process is repeated for side 2.

Once the disk has been formatted a check is made to make sure that the disk is readable. This consists of reading all the tracks and sectors on the disk in sequence. The side being checked is shown followed by the track and sector numbers as they are read.

### Checking Side 1 T 1 2 3 4 5 6 7 8 9 10

where T is the number of the track being checked, and the other numbers are the sector numbers as they are read.

Once the checking has been completed, and if all is correct, the message:

**0 total retries.**

will be printed.

This is repeated for side 2 if a double sided disk is being formatted.

Another disk to be formatted will now be asked for. To abort FORMAT press ENTER or control C when requested for the drive name or skew value.

### 3.3 Error messages from FORMAT

Several error messages detailed below may appear if a problem is detected by FORMAT. These are as follows:

The actual speed is checked to be within 3% of a nominal value (6250) and if it is not an error message will appear:

#### **Disk speed more than 3% fast/slow**

Any disk giving this error should not be used. Consistent errors of this type may indicate a problem with the disk drive or the FDC card.

### 3.3.2 Retries

If any sector cannot be read first time, then a retry is automatically initiated. To inform the user that this has occurred, an asterisk is written next to the sector number, one for each error. This line is scrolled up so that the location of errors can be seen when format has finished. The total number of retries on the disk is given at the end of checking. After 5 unsuccessful tries to read a sector the format will terminate with an error message.

Failure to format a disk would indicate damaged or sub standard media. If several disks fail on the same drive then either the type of disk or the drive should be suspected.

### 3.3.3 Miscellaneous errors

Other errors are indicated with the message :-

#### **Format error code E**

see section 4.2 for details of the error codes.

## 4. NASCOM CP/M error messages

Several error messages may occur in the use of CP/M, some of which are peculiar to the NASCOM implementation.

### 4.1 Boot errors

#### 4.1.1 Hardware errors

If the error message:

##### **Hardware error**

appears when starting up the system, this indicates that it was not possible for the computer to write to and/or read from the FDC card, indicating that it is not set up correctly, not present or is faulty. This fault must be corrected before proceeding further.

#### 4.1.2 Bad disk reads

If the system cannot read the system tracks correctly from the disk then the following message will appear:

##### **Bad read**

If the system booted off disk is configured for more memory than is contained in the system used, a total system crash will result since the operating software is written into the top of memory as defined on the disk. It is for this reason that a minimum size system is supplied (20K). This crash may show itself as spurious characters on the screen, or simply not getting further than:

##### **CP/M 2.2 Boot Rev X.Y Insert disk**

#### 4.1.3 Non-system disk

The CP/M operating system is stored on all system disks on reserved tracks on the disk. If the disk being used has not had a CP/M system installed on it (by SYSGEN) then the following message may appear:

##### **Not a system disk**

**NOTE:** There is no reason why a system should not be installed on all disks, since there is space always reserved for this purpose and this space would not normally be used for any other purpose.

### 4.2 BDOS errors

The standard BDOS error message is:-

##### **BDOS ERR ON x: error**

where x is the drive number, and "error" is one of three possible types:

##### **Bad Sector**

##### **Select**

##### **R/O (Read Only)**

Notification of Read/write errors occur only after five retries, a

reseek to track zero and five more retries have all failed to read the sector.

The **BDOS ERR ON x: Bad Sector** message is preceded in the NASCOM implementation of CP/M, by the following message:

```
Disk read error
Code Driv Trak Sect (in Hex)
  C   D   T   S
Try again (Y/N/↑C) ?
```

(NOTE: A "read" error may occur even though the operation required is to write to the disk.

C,D,T & S have the following meanings:

C is the error code taken from the 1793 FDC controller status register. The error code is the sum of the individual errors detected as shown in the table below.

| Bit    | Description          |
|--------|----------------------|
| 7 (80) | Drive not ready      |
| 6 (40) | Write protected disk |
| 5 (20) | Head loaded          |
| 4 (10) | Seek error           |
| 3 (08) | CRC error            |
| 2 (04) | Lost data            |
| 1 (02) | Data request         |
| 0 (00) | Busy                 |

Error 40 means a write protected disk was encountered - this can be easily rectified by removing the write protect tab.

Error code 1F is a special case indicating a drive select failure. This caused by the failure to read any data from the selected drive and is usually due to no disk being in the drive, or the drives not being switched on.

D is the drive number where 00=drive A, 01=drive B etc. T is the track number (in hex) - this will be between 00 and 9A (equivalent to 154 tracks)

S is the sector number - from 0 to 9

There are three acceptable responses to this message:

Y (Yes) - Initiate a further re-try.

↑C - Warm starts CP/M.

N (No) - Pass control to the normal CP/M error handling routines which will respond as follows:

**Bdos Err On x: Bad Sector**

The **Bad Sector** error means that the disk controller cannot find a particular track and sector on the disk. This can be caused by either a faulty disk (worn or not properly formatted) or a fault in the disk controller hardware.

After printing this message, the computer waits for a user input. If the response is anything other than ↑C, then the error is ignored and disk operations continue. ↑C will warm start CP/M and is the safest response.

The **Select** error occurs if the drive letter used was beyond the largest allowable. In revision 2.1 of CP/M letters A: to D: are allowed. Any keyboard input causes a warm boot.

A **Read Only** error occurs if an attempt is made to write to a read only file or disk. In the case of a read only file this will have been set using the STAT command. In the case of a read only disk this could have been set using either by the STAT command or automatically set by the BDOS when it detected that a disk has been changed.

Normally a warm or cold start should be done after any disk change though no problems will occur if the new disk is only read. By making the disk read only the BDOS prevents accidental writing to a changed disk. To reset the flag in this case do a warm or cold start.

## 5. NASCOM CP/M 2.2 software user notes - REV 2.1

These notes refer to CP/M 2.2 BIOS rev 2.1 and Boot EPROM rev 2.1.

### 5.0 Block size

The CP/M block size is 2k, meaning that a minimum of 2k of storage is set aside for each disk directory entry, with a maximum of 128 directory entries.

### 5.1 Physical I/O devices

The following physical I/O devices are provided for in this version of the CP/M BIOS, with provisions for the user to add further devices that may be required.

#### **CON:**

**TTY:** Send even parity, receive strips parity  
**\*\* CRT:** Video screen and keyboard  
**BAT:** as TTY:  
**UC1:** as CRT: with user vector

#### **RDR:**

**TTY:** Strips parity  
**\*\* PTR:** Returns 8 bits as received  
**UR1:** as TTY: with user vector  
**UR2:** as TTY: with user vector

#### **PUN:**

**TTY:** sends even parity  
**\*\* PTP:** send all 8 bits as given  
**UP1:** as TTY: with user vector  
**UP2:** RET instruction only (Null device)

#### **LST:**

**TTY:** sends parity even with handshake  
**CRT:** to screen  
**\*\* LPT:** Centronics parallel  
**UL1:** as TTY: with user vector

**\*\* Indicates Distribution default values**

### 5.2 Special key functions

The following special key functions are provided in addition to the standard CP/M functions :-

5.2.1 For compatibility with NASCOM 1 keyboards the "@" key will act as a CONTROL key when unshifted and "@" when shifted.

5.2.2 The key combination CONTROL and ENTER will reverse the action of the shift key.

5.2.3 The key combination CONTROL and E will echo all following characters to the LST: device with no checking for control functions etc. This allows direct access to any special functions that may be supported on the printer eg. bold type. This mode is terminated when

ENTER is pressed.

5.2.4. The key combination SHIFT and Cursor right will invoke screen edit mode described in section 5.3.

### 5.3. Screen Edit Mode

A screen edit mode is provided to allow for speedy editing and re-entry of command lines. This mode is invoked by pressing SHIFT and Cursor Right. The cursor is changed to the edit mode cursor character and may be moved around on the screen by using the cursor control keys. SHIFT and Cursor right may be used to insert a character in a line and SHIFT and cursor left to delete one. CONTROL and X will delete the entire line.

When ENTER is pressed the complete line containing the cursor is entered. The prompts that CP/M issues are deleted from the lines entered eg. >A, >B etc and "\*\*\*", "- " and "£".

A CONTROL X character is issued as the first character following a screen edit to delete any characters already in the CP/M buffer. This feature may be disabled see section 6.1.

Any program using CONIN or BUFIN (BDOS functions 1 or 10) can make use of the screen edit function. NOTE the entire line is returned including any prompts except for the standard CP/M prompts detailed above. This may cause problems with some programs.

NOTE: The CP/M text editor ED.COM will not function correctly with screen edit when the line number appears as part of the prompt.

### 5.4. The Auto Load facility.

Provision is made for automatic execution of a file upon power up or cold start. The command SUBMIT AUTO is executed causing commands to be taken from the file AUTO.SUB. This file must contain valid command sequences as described in the CP/M documentation. Typically the file would contain the name of a single .COM file for direct execution eg MBASIC.

The selection of the auto load option is described in section 6.1

## 6. Configuration Utility - Rev 2.1.

### 6.0 Description.

With revisions 2.1 and later of CP/M a configuration program is supplied. This utility allows the user to customise the CP/M system to suit individual requirements. The utility is invoked by simply typing its name CONFIG followed by the ENTER key.

The options are presented as a series of questions in the form:-

#### **Option description (Alternatives) Default ?**

If the ENTER key is pressed then the default option is selected. Any inappropriate entry will result in the question being asked again.

The questions are presented in groups of related options. A group of question may be skipped with if no changes are required.

The options selected in the current system are read from the system tracks of the disk in drive A: (which must be a CP/M system disk) upon invocation of CONFIG.

After all the options have been selected the user is asked if all changes are complete. If not answer N and individual bytes in the configurable part of the BIOS may be changed. This is used mainly for patching in custom I/O drivers etc.

The final question that is asked gives the option of saving the changes made on the disk or simply returning to the CPM operating system.

The system must now be RESET to read the modified system of the disk.

NOTE: Typing control C as the first character of any answer will abort the program with no changes made.

Using the utility will not change the system copy within the MOVCPM.COM file. If the size of the CP/M system is changed at any time by using the MOVCPM and SYSGEN utilities then a system is created with the distribution default options selected.

### 6.1 Configuration options.

#### **Keyboard options (Y/N) N ?**

Answering Y to this question will allow changes to be made to the keyboard options.

#### **Initial delay (0-65535) 2048 ?**

This value determines the initial delay for the auto repeat key function. A lower value gives a decreased delay.

#### **Repeat speed (0-65535) 192 ?**

This value determines the repeat speed of the auto repeat function. A lower value gives increased speed.



**Lower case unshifted (Y/N) Y ?**

Answer Y if you require unshifted operation of keys A to Z to give lower case and shifted operation to give upper case. Answering N will reverse the SHIFT key operation. This can also be accomplished using CONTROL ENTER as described in section 5.2.2.

**Screen edit key (0-FF) 17 ?**

This selects the key combination required to enter the screen edit mode. The default is SHIFT and cursor right.

**Screen dump key (0-FF) 16 ?**

This selects the key combination required to initiate a screen dump to the LST: device. The default is SHIFT and cursor left.

**Echo to LST: device key (0-FF) 05 ?**

This selects the key combination required to initiate the echo to LST: function. The default is CONTROL E.

**Scan serial port (Y/N) N ?**

Answering Y to this question will cause the serial port to be polled for input along with the keyboard.

**Control X with screen edit (Y/N) Y ?**

This option if selected causes a control X to be sent as the first character after a screen edit is terminated see section 5.3

**Screen options (Y/N) N ?**

Answering Y to this question will allow changes to be made to the screen options.

**Cursor blink speed (0-65535) 640 ?**

This value controls the cursor blink speed, a lower value gives a faster blink.

**Normal cursor character (0-FF) 5F ?**

This options selects the normal cursor character, the default is an underline.

**Screen edit cursor character (0-FF) 0A ?**

This option selects the cursor character during screen edit, the default is three horizontal lines.

**Left margin width (0-16) 10 ?**

This option allows the position of the displayed text on the screen to be adjusted to a central position.

**NOTE:** Increasing this value will cause characters to be lost off the right hand side of the screen.

**Disk options (Y/N) N ?**

Answering Y to this question will allow changes to be made to the disk options.

**Number of disks (1-4) 4 ?**

Use this option to set the number of drives installed in the system. This allows for earlier detection of illegal drive names.

**Auto load option (Y/N) N ?**

Selecting this option will cause the command **SUBMIT AUTO** to be executed upon power up or RESET. If the option is selected then this file must be present and contain a valid set of commands as defined in the CP/M documentation describing the SUBMIT utility.

**Drive stepping rate (0-3) 3 ?**

The head stepping rate can be selected to allow the drives to be stepped at the maximum speed and hence minimize disk access time. The number corresponds to the following rates on a 5.25" double density system:-

|   |      |
|---|------|
| 0 | 6 ms |
| 1 | 12ms |
| 2 | 20ms |
| 3 | 30ms |

The drives currently supplied step at 10ms so step rate 1 should be selected. Some early drives however require a 30ms step. Repeated seek errors (code 10) will occur if too fast a step is used. However when a seek error occurs the the slow step is automatically selected to allow continued use of the system.

**LST: device output options (Y/N) N ?**

Answering Y to this question allows the options provided in the LST: device drivers to be changed.

**Printed lines per page (0-255) 62 ?**

This selects the number of printed lines per page for the TTY: and LST: devices. This option is only relevant if TTY: or LPT: form feed handling is enabled.

**Lines skipped at end of page (0-255) 4 ?**

This selects the number of lines skipped at the end of each page on the TTY: and LST: devices. This option is only relevant if TTY: or LPT: form feed handling is selected.

**TTY: handshake (Y/N) Y ?**

If selected the handshake protocol is observed for the TTY: device. Handshake is assumed to take place on BIT 7 of PORT 0, where a LOW input normally indicates device busy.

**TTY: READY active low (Y/N) N ?**

Answering yes will cause the TTY: device driver to wait for the READY line to go low before sending a character. Otherwise the driver waits for the line to go high. NOTE: This option only applies if TTY handshake is selected.

**TTY: form feed handling (Y/N) Y ?**

If selected then a form feed character is translated into the required number of line feeds by the device driver. Perforation skips are also performed when required. The internal line counter is initialised at each cold start so the printer paper should be set to the top of a page at this time.

**LPT: form feed handling (Y/N) Y ?**

This option is the same as the previous one but applies to the LPT: device.

**TTY: auto line-feed (Y/N) N ?**

If selected this option causes a line feed to be deleted if it follows a carriage return. This is useful for printers that insert a line feed following a carriage return.

**LPT: auto line-feed (Y/N) N ?**

Same as above but for LPT: device.

**Default device options (Y/N) N ?**

Answering Y to this question allows the device assignments selected after a cold start to be changed.

**Console (TTY: CRT: BAT: UC1:) CRT: ?**

If the default console device is to be changed then its name should be typed otherwise ENTER will leave the option unchanged.

NOTE: The colon must be supplied as part of the device name.

**Reader (TTY: PTR: UR1: UR2:) PTR: ?**

As above but for reader device.

**Punch (TTY: PTP: UP1: UP2:) PTP: ?**

As above but for punch device.

**List (TTY: CRT: LPT: UL1:) LPT: ?**

As above but for list device.

**User device vectors (Y/N) N ?**

Answer yes if the jump vectors for the user device drivers are to be changed.

**UC1 status (0-FFFF) 4C5F ?**

This is the address of the status routine for a user console device. The default is the Nascom keyboard status routine.

**UC1 input (0-FFFF) 4CD5 ?**

This is the address of the input routine for a user console device. The default is the Nascom keyboard driver.

**UC1 output (0-FFFF) 4D98 ?**

This is the address of the output routine for a user console device. The default is the CRT: driver routine.

**UL1 output (0-FFFF) 4DBB ?**

This is the address of the output routine for a user list device. The default is the TTY: device driver.

**UL1 status (0-FFFF) 4E37 ?**

This is the address of the status routine for a user list device. The default is the TTY: device driver.

**UP1 output (0-FFFF) 4DD0 ?**

This is the address of the output routine for a user punch device. The default is the TTY: device driver.

**UR1 input (0-FFFF) 4E18 ?**

This is the address of the input routine for the first user reader device. The default is the TTY: device driver.

**UR2 input (0-FFFF) 4E18 ?**

As above but for second user reader device.

**CRT: uses AVC external video ? (Y/N) N ?**

Answer yes if the Nascom 2 video output is routed via the AVC external video option.

**Are all changes complete (Y/N) Y ?**

Answering N to this question will allow individual bytes in the BIOS to be changed in order to patch in custom I/O drivers etc.

**Address to be changed (1600-16FF) 1600 ?**

Valid addresses are 1600-16FF. Any invalid address will terminate the modification sequence.

**New value (0-FF) 00 ?**

The new value required should be typed. ENTER will leave the old value.

**Save options on disk (Y/N) N ?**

Answering Y to this question will cause the options selected to be written to the disk. Any other reply will cause the program to terminate with no system changes.

## Appendix A

### CP/M with single drives

As has been mentioned it is possible to use a lot of CP/M features with a single drive. Obvious function that can't be used are those that require disk to disk copying. This will first be a problem in backing up the supplied system disk!

Backing up is possible as follows:

1. Formatting a disk can be done with one drive without problems (making sure that disks are swapped at the correct time!).

2. Once formatted the new disk can be made into a system disk as follows:

2.1 Load drive with the master disk.

2.2 Use SYSGEN, entering the source as drive A

2.3 Once the source function is complete, swap disks.

2.4 Now enter A as the destination drive. Once this function is complete the new disk is then a system disk.

2.5 Now the built in functions are available (DIR, ERA etc), however, the utility files (PIP etc) have to be copied across to the new disk from the master. These individual files can be copied using DDT:

#### **DDT filename.ext**

This loads the file named into memory and responds with:

```
NEXT  PC
  L    P
```

where L is the length (bytes) in hexadecimal and P is the program counter start address for the file.

2.6 The hexadecimal number must be converted into a decimal number of pages (i.e. 256 byte blocks) of memory. This can be performed by:

2.6.1 Knocking off the 2 trailing zeros from the hex number.

2.6.2 Converting the remaining number into decimal. e.g. 2a00 would go to 2a at stage 2.6.1, this converted to decimal is 42 (2 x 16 + 10 (a) x1).

2.7 Now change the disks - load the new disk.

2.8 Type GO, which will warm start the new disk to allow it to be written to.

2.9 Now use this converted number (D) as follows:

#### **SAVE D filename.ext**

This will save the file on the new disk. This same process needs to be done to back up all files.

## Appendix B

### NASCOM VDU control codes.

The following control codes are accepted by the NASCOM VDU running under CP/M 2.2 Rev 2.0 and later.

**08H CTRL H/BS Back Space -**

deletes the character to the left of the cursor.

**0AH CTRL J/LF Line Feed -**

moves the cursor down one line scrolling if required.

**0CH CTRL L/CS Form Feed -**

clears the screen and homes the cursor.

**0DH CTRL M/ENTER Carriage Return -**

moves the cursor to the first position on the line.

**12H CTRL R Erase to end of line -**

erases the character under the cursor and all the characters to the end of the line.

**13H CTRL S Erase to end of screen -**

erases the character under the cursor and all the characters to the end of the screen.

**16H CTRL V/Shift Cursor Left Delete character -**

deletes the character under the cursor and moves all the characters to the right of it one place to the left.

**17H CTRL W/Shift Cursor Right Insert character -**

moves the character under the cursor and all the characters to the right one place right. The last character on a line will be lost.

**18H CTRL X Delete line -**

delete the complete line containing the cursor.

**19H CTRL Y Home -**

home the cursor, line 1 column 1.

**1BH ESC Escape -**

Followed by "=" this initiates a cursor load operation, any other character is ignored. The "=" character should be followed by the desired row and column numbers plus 20 hex.

eg. from BASIC to set row R, column C

```
PRINT CHR$(27);"=";CHR$(R+32);CHR$(C+32);
```

Note: It is advisable to set the width to 255 to prevent the basic from inserting undesirable carriage return line feeds.

**1CH Cursor left -**

move the cursor one place to the left.

**1DH Cursor Right -**

move the cursor one place to the right.

**1EH Cursor Up -**

move the cursor up one line.

1FH Cursor Down -  
move the cursor down one line.



## Appendix C

### Useful BIOS patch locations.

Most patches required in the BIOS can be made using the CONFIG utility. However the following locations may be of use.

Any patches may be made in the current executing BIOS or in the MOVCPM.COM BIOS image.

To make permanent changes the MOVCPM image must be changed as follows using DDT:-

```
DDT MOVCPM.COM
```

Make any changes required

```
SAVE 41 MOVCPM.COM
```

The system should now be generated using SYSGEN.

To make temporary changes the current BIOS can be changed in memory.

The addresses to be changed are calculated as follows:-

In MOVCPM image :-  $\text{addr} = \text{offset} + 0A00h$

In current BIOS :-  $\text{addr} = \text{offset} + \text{bias} + 3400$

where addr is the address to be patched, offset is the offset from the CCP base and bias is the difference between the standard 20k CPM system and the current system size.

| Offset from<br>CCP base | Workspace | Name   |                        |
|-------------------------|-----------|--------|------------------------|
| 1633-41                 |           | DPB1   | Disk parameter block 1 |
| 1642-50                 |           | DPB2   | Disk parameter block 2 |
| 1651/2                  | FC50/1    | XLONG  | Initial repeat delay   |
| 1653/4                  | FC52/3    | XSHRT  | Repeat speed           |
| 1655/6                  | FC54/5    | XBLNK  | Cursor blink speed     |
| 1657                    | FC56      | XKOPT  | Shift reversal         |
| 1658                    |           | XPLPG  | Lines per page         |
| 1659                    | FC58      | ICUR   | Normal cursor          |
| 165A                    | FC59      | MARGN  | Margin width           |
| 165B/C                  | FC5A/B    | SUC1   | User console status    |
| 165D/E                  | FC5C/D    | IUC1   | User console input     |
| 165F/60                 | FC5E/F    | OUC1   | User console output    |
| 1661/2                  | FC60/1    | UL1    | User list output       |
| 1663/4                  | FC62/3    | UP1    | User punch             |
| 1665/6                  | FC64/5    | UR1    | User reader 1          |
| 1667/8                  | FC66/7    | UR2    | User reader 2          |
| 1669/A                  | FC68/9    | SUL1   | User list status       |
| 166B                    | F6CA      | SPEED  | Drive step rate        |
| 166C-1671               | F6CB-F670 |        | Spares                 |
| 1672                    |           | NDISK  | Number of disks        |
| 1673                    |           | XLSKP  | Lines skipped          |
| 1674                    |           | ECUR   | Edit cursor            |
| 1675                    |           | EDKEY  | Edit key               |
| 1676                    |           | IOBYT  | Initial I/O byte       |
| 1677                    |           | PTKEY  | Screen dump key        |
| 1678                    |           | LIKEY  | List echo key          |
| 1679                    |           | TTYHS  | TTY handshake          |
| 167A                    |           | HSEN   | Handshake sense        |
| 167B                    |           | TTYCS  | TTY form feed handling |
| 167C                    |           | LPTCS  | LPT form feed handling |
| 167D                    |           | TTYLF  | TTY auto line feed     |
| 167E                    |           | LPTLF  | LPT auto line feed     |
| 167F                    |           | CISRL  | scan serial port       |
| 1680                    |           | EDCX   | ↑X on screen edit      |
| 1681                    |           | AUTO   | Auto load option       |
| 1682                    |           | EXTN   | External video         |
| 1683                    |           | USRINI | User patches           |

The user may patch his own routines into the following area eg. special I/O drivers.

64 bytes are allowed for the routines starting at USRINI. Upon system initialisation USRINI is called to initialise the PIO. This code should be left if it is desired to use the PIO for a centronics type printer.

User patch area:-

```
1683 USRINI: CALL PLLINI    ;initialise the PIO
1686         RET

1687         DEFS 60         ;60 bytes for patches
16C3 ;BIOS code starts here
```

In addition a free memory pointer is maintained in page 0 at locations 40-41. This points to the bottom of free memory above the BIOS and should be updated if this memory is used for any purpose.

## Appendix D

### I/O routine writers guide.

The following specifications should be met by the user provided I/O drivers.

#### **Console input:-**

Function: Wait for character input  
Output: Character in A, MSB reset  
Input: None

#### **Console status:-**

Function: Sample console status  
Output: A=FF if character is ready  
A=0 if no character  
Input: None

#### **Console output:-**

Function: Output character to console  
Output: None  
Input: character in C

#### **List output:-**

Function: Send character to list device  
Output: None  
Input: character in C

#### **List status:-**

Function: Sample list device status  
Output: A=FF if ready to accept character  
A=0 if not ready  
Input: None

#### **Reader input:-**

Function: Read character from a reader device  
Output: A=character  
Input: None

#### **Punch output:-**

Function: send character to punch device  
Output: None  
Input: Character in C

These routines may be patched into the BIOS in which case the respective jump vectors should be changed using CONFIG.

Alternatively the auto load function may be used to download a file containing the I/O drivers. In this case the program should set the jump vectors in workspace RAM.

NOTE: If the second method is used then the drivers should load at 100H and copy themselves up to spare RAM above the BIOS. The RAM should have been reserved for this by using MOVCPM to create a system smaller than the available memory.

## Appendix E

### Double/Single sided drive compatability

Although double and single sided drives may be mixed in a system the media is incompatable. ie Double sided disks may not be read on a single sided drive and visa versa. All Nascom CP/M software is distributed in single sided format with the exeption of the CP/M system disk which is available in both.

A utility SINGLE.COM is provided to allow single sided disks to be read on a double sided drive. The utility is invoked by typing:-

**SINGLE**

followed by the drive letter when asked for

**Drive ?**

The drive selected will behave as a single sided drive until the next RESET.