Lucas Microcomputers

CP/M 2.2 Rev 3.2

Manual

Lucas

Microcomputers for education, science and business

Contents

1. STARTING CP/M

1.1 Starting the system

Turn on the Lucas Nascom computer and associated disk drives and monitor if separate. After an initial warm up period a sign on message should appear on the screen.

CP/M 2.2 Boot Rev x.y
Insert disk
Press RESET

Now insert the system disk into the drive A: and close the door. In a Nascom 3 system drive A: is the one on the right and in the LUCAS LX system it is the uppermost drive.

There will now be a brief period of disc activity followed by a further sign on message.

Digital Research nnk CP/M vers 2.2
Lucas Microcomputers - rev x.y
A: aaak B: bbbk C: ccck D: dddk

nn is the system memory size.
aaa,bbb,ccc and ddd are the disk drive capacities (374k for single sided and 760k for double sided drives).

If the auto function has been activated by the use of the CONFIG utility (see section 8), a further period of disc activity will follow with the display showing in sequence the names of the programs or utilities preselected and stored within the AUTO.SUB file.

Finally the CP/M system prompt ´A>´ will be diplayed and the computer is ready for use.

1.2 Disk backup

The first process once the system has been started for the first time is to make a copy of the received system disk using the following procedure.

Insert a blank diskette into drive B and format it as shown below:-
(Refer to section 6.1 for more details)

A>FORMAT <ENTER>
Disk formatter Rev x.y

Which drive (A-D or ENTER to quit) ? B **<ENTER>**
Formatting Single Sided Disk
Skew Value (1-5) ? 3 **<ENTER>**

Formatting side 1
 10 6250
Checking side 1
 T 1 2 3 4 5 6 7 8 9 10

0 total retries

Which drive (A-D)? <ENTER>

Copy the supplied system disk onto the formatted disk.

A>**DCOPY**

Disk Copy Rev x.y

Source Drive ? **A**
Destination Drive ? **B**

Copying from Drive A: to Drive B: OK ? **Y**

Track 76

Insert system disk and press ENTER **ENTER**
A>

Now keep the original disk somewhere safe and insert the copy into
drive A:

1.3 Configuring CP/M

If the CP/M was purchased as part of a complete system then is should
already be configured for the memory available on the machine. If it is
necessary to reconfigure the CP/M then use the MOVCPM utility. Details
of this can be found in chapter 5 of your Osborne CP/M User Guide.

If any resident utilities (eg. Winchester disk, Virtual disk or AVC
Terminal support) are to be installed then the relevant section should
also be consulted. Resident utilities are supplied for AVC terminal
handling, Winchester and Virtual disk support.

2. SPECIAL KEY FUNCTIONS

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

2.1 The Control key

For compatability with Nascom 1 keyboards the "@" key will act as a CONTROL key when unshifted and "@" when shifted.

2.2 Shift Lock

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

2.3 Echo to LST: device

The key combination GRAPH 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.

2.4 Screen edit

A screen edit mode is provided to allow for speedy editing and re-entry of command lines. This mode is invoked by pressing **GRAPH and S** on a Nascom 3 computer or the **EDIT** key on the Lucas LX system. The terminal will enter local edit mode allowing the screen contents to be changed using the control and escape functions.

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 "#".

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

3. DEVICE ASSIGNMENTS

The following physical I/O device drivers are provided with provision for the user to add further drivers that may be required.

The Console device CON:

TTY: Serial Input/Output port.
Send seven bits with even parity.
Receive seven bits parity ignored.

** CRT: Lucas Nascom 48*16 Video screen and keyboard.

BAT: as TTY:

UC1: as CRT: with user vector.
If the AVC 80/40 column option is installed then UC1: is the 80/40 column screen.

The Reader device RDR:

TTY: Serial Input port.
Receive seven bits parity ignored.

** PTR: Serial Input port.
Receive all 8 bits.

UR1: as TTY: with user vector

UR2: as TTY: with user vector

The Punch device PUN:

TTY: Serial Output port.
Send seven bits with even parity.

** PTP: Serial Output port.
Send all 8 bits.

UP1: as TTY: with user vector

UP2: NULL device, data ignored.

The List device LST:

TTY: Serial output.
Sends seven bits with even parity.
Device ready handshake provided.

CRT: Output to Lucas Nascom 16*48 screen.

** LPT: Parallel output for a Centronics style printer.

UL1: as TTY: with user vector

** Indicates Distribution default values

4. ERROR MESSAGES

Several error messages may be seen when using CP/M. Some of these are standard CP/M error messages and some are Lucas Nascom CP/M messages inserted to provide additional diagnostic information.

4.1 System load errors

The following error messages may be displayed when the system is being loaded from the diskette.

Hardware error

This message will be displayed if the computer cannot correctly write to or read from the FDC card. This fault is normally caused by the FDC card not set up correctly, not present or faulty. This fault must be corrected before proceeding further.

Bad read

This message indicates that the computer was unable to correctly read the system tracks of the diskette. The most likely causes are a faulty FDC card, a bad diskette or a faulty disk drive.

Not a system disk

This message indicates that an atempt has been made to boot the CP/M system from a diskette which does not have a system installed on it. To install a CP/M system on a diskette see the SYSGEN option (chapter 5 of your CP/M User Guide) . It is advisable to install a CP/M system on all diskettes to avoid this problem since disk space is always reserved for this purpose.

If the system loaded from a diskette is configured for more memory than is present in the system being used then a total system failure will result since the operating software is loaded into non existant memory. This crash may show itself as spurious characters on the screen or a continuous display of the sign on message:

CP/M 2.2 Boot Rev X.Y
Insert disk

4.2 Standard CP/M Errors

The standard CP/M error message concerning disk operations is:

Bdos Err On d: error

where d is the drive number, and ´error´ is the specific error that occured.

Following any BDOS error exept a bad sector (see below) pressing any key will cause a warm start of the system.

Bdos Err On d: Select

This message will be displayed if an attempt is made to access a disk

drive that does not exist on the system. Any keyboard input causes a
warm boot. See section 6.1 for details of how to configure your system
for the number of drives present.

Bdos Err On d: File R/O

A File read only error occurs if an attempt is made to write to a file
that has been write protected. The write protect or read only attribute
may be altered by the use of the **STAT** command, details of which will be
found in chapter 3 of your Osborne CP/M User Guide.

Bdos Err On d: Disk R/O

This error may occur if the diskette in the drive in question has been
changed at an inapropriate time. The drive is set to read only to
prevent data being written to the wrong diskette. This may be avoided
by performing a warm start **CTRL C** each time a diskette is changed
although care is still required to avoid removing a diskette that may
be in use.

Bdos Err On d: Bad Sector

This error means that the required information could not be correctly
read from or written to the diskette. After printing this message, the
computer waits for a key to be pressed. If the response is anything
other than CTRL C, then the error is ignored and disk operations
continue. CTRL C will perform a normal CP/M warm start and is the
usual response.

4.3 Lucas Nascom CP/M Error

When a disk read or write error occurs additional diagnostic
information is displayed to identify the type of error, the drive and
the position on the disk when the error occured.

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

D is the drive number (00=drive A:, 01=drive B: etc).
T is the track number.
S is the sector number.

C is the error code supplied directly by the disk controller. The error
code is the sum of the individual errors detected as shown in the table
below.

Code	Description
80	Drive not ready
40	Write protected diskette
20	----
10	Seek error
08	CRC error
04	Lost data
02	----
00	----

Code 80 indicates that no data could be read from the drive in question and is normally caused by no diskette being present in the drive.

Code 40 means that an attempt was made to write to a diskette that was write protected by the presense of a write protect tab. This can be easily rectified by removing the write protect tab from the diskette.

Code 1F is a special case indicating a drive select failure. This occurs when the drive is being accessed for the first time and either no diskette is present or the diskette has not been formatted.

There are three acceptable responses to this message:

Y (Yes) – Initiate a further re-try.

CTRL C – Warm starts CP/M.

N (No) – Pass control to the normal CP/M error handling routines which will respond with the BDOS Bad Sector error message.

5. TERMINAL CONTROL CODES

The following control codes are accepted by the Lucas Nascom VDU runing under CP/M 2.2 Rev 2.0 and later.

CTRL H   Backspace [08H],[8]   **BS**

The cursor is moved left one position. The character now under the cursor is erased. If the cursor is in the home position then the code is ignored.

CTRL J   Linefeed [0AH],[10]   **LF**

The cursor is moved down one line If the cursor is already on the bottom line then the screen is scrolled up one line and the bottom line erased.

CTRL L   Form feed/Clear screen [0CH],[12]   **CS**

The cursor is moved to the home position and the screen is cleared.

CTRL M   Carriage return [0DH],[13]   **ENTER**

The cursor is moved to the first position in the current line.

CTRL R   Erase to end of line [12H],[18]

The character under the cursor and all the characters to the right of it in the current line are erased.

CTRL S   Erase to end of screen [13H],[19]

The character under the cursor and all the characters to the right of it and below it are erased.

CTRL T   Delete line [14H],[20]   **SHIFT/UP ARROW**

The cursor line is erased and all the lines below it scrolled up. A blank is inserted at the bottom of the screen.

CTRLU   Insert line [15H],[21]   **SHIFT/DOWN ARROW**

The cursor line and all the lines below it are scrolled down. A blank line is inserted and the bottom line is lost.

CTRL V   Delete character [16H],[22]   **SHIFT/LEFT ARROW**

The character under the cursor is deleted and all the characters to the right of it are shifted left one place a space being inserted in the last character position.

CTRL W   Insert character [17H],[23]   **SHIFT/RIGHT ARROW**

The cursor character and all the characters to the right of it are shifted right one place The last character on the line being lost. A space is inserted at the current cursor position

CTRL X   Erase line [18H],[24]

The line containing the cursor is erased and the cursor moved to the first position in the line.

CTRL Y   Cursor home [19H],[25]   CH

The cursor is moved to the first row and column in the screen.

CTRL [Escape [1BH],[27]

First character of an escape sequence. When followed by an "=" a cursor load operation is initiated, any other character is ignored. The row and column numbers follow, offset by 32.

eg. From BASIC to move cursor to row R column C

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

NOTE: To ensure that this will always work set the line width to 255 from within BASIC to prevent undesirable new lines being inserted.

CTRL \   Cursor left [1CH],[28]   LEFT ARROW

The cursor is moved one position to the left. If it is at the start of a line then it is moved to the end of the line above. If it is in the home position then no action is taken.

CTRL]   Cursor right [1DH],[29]   RIGHT ARROW

The cursor is moved one position to the right. If it is at the end of a line then it is moved to the start of the next line. The screen is scrolled up if required.

CTRL ^   Cursor up [1EH],[30]   UP ARROW

The cursor is moved up one line. If it is on the top line then no action is taken.

CTRL _   Cursor down [1FH],[31]   DOWN ARROW

The cursor is moved down one line. If it is on the bottom line then no action is taken.

6. THE FORMAT UTILITY

6.1 Description

Before a diskette may be used on a Lucas Nascom CP/M system it must be formatted. This process puts information onto the disk dividing it into logical blocks of data. The operating system is then able to efficiently locate specific data items when required.

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.

6.2 Using FORMAT

The FORMAT utility is invoked in the standard way by typing **FORMAT** followed by the **ENTER** key whenever the CP/M prompt "A>" appears on the screen:

The sign on message will now be displayed followed by a request for the drive letter containing the diskette to be formatted:

Disk formatter Rev x.y

Which Drive (A-D or ENTER to quit) ?

Respond to this with relevant drive letter (A-D) and the press ENTER (FORMAT is aborted if an invalid drive letter is used).

NOTE: You can format a diskette in drive A but be sure that the system disk is removed and a blank disk inserted before proceeding further otherwise ALL the information on the diskette 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: The number of sides for each drive and the number of drives included in the system are software selectable via the use of the CONFIG utility (See section 8). So if the drive selected is double sided and designated as double sided then a double sided disk will be formatted.

The system will now request a skew value of between 1 and 5. The standard value used is 3. A small improvement in speed of operation may be made by experimenting with this value depending upon the application.

Skew value (1-5) ?

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

The formatting process will now begin. 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. This information is for diagnostic use only.

Formatting side 1
 10 6250

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

Once the disk has been formatted the information written to the disk is checked to ensure that the disk has been correctly formatted. Each track and sector is individually verified in sequence.

Checking Side 1

T   1 2 3 4 5 6 7 8 9 10

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 the number of retries required to correctly read the information from the disk is displayed. If this is not zero then the disk is suspect but may be used.

0 total retries.

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

The system will now request another diskette to be formatted. To abort formatting process press ENTER or control C when requested for the drive name or skew value.

6.3 FORMAT Errors

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.

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 unsuccesful tries to read a sector the format will terminate with an error message.

Failure to format a diskette indicates that the media is either damaged or unsuitable for use with the Lucas Nascom disk system. If several diskettes fail to format on the same drive then either the type of diskette or the drive should be suspected.

Miscellaneous errors

Other errors are indicated with the message :-

Format error code E

see section 4.2 for details of the error codes.

7. DISK COPY UTILITY

The disk copy utility will make an identical copy of a disk. This is
faster than using the CP/M PIP utility if the disk has a significant
number of files on it. DCOPY will also copy the CP/M system onto the
new disk similar to SYSGEN. The only restriction on use is that the
source and destination disks must be of the same type and therefore the
same capacity. The format of the disk copy command is shown below.

A>dcopy
Disk copy Rev x.y

Source drive ? **Source drive letter**
Destination drive ? **Destination drive letter**

Copying from drive S: to drive D: OK ? Y

Track 5

Insert system disk and press ENTER

Before typing ˜Y˜ to start the copying operation ensure that the
correct disks are inserted changing them if required. If the same
drive was specified for both source and destination the system will
prompt you to insert the source or destination disk as required. When
the copying is complete insert the system disk before pressing ENTER.

If the drives specified are not of the same type the system will
respond with the message

Drives not matched

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User Guide.

8. THE CONFIGURATION UTILITY

8.1 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.

8.2 Configuration options

The options are presented as a menu in the form:-

CP/M Configuration utility rev x.y

        1   **Keyboard options**
        2   **Screen options**
        3   **Disc options**
        4   **LST: devise output options**
        5   **Default device options**
        6   **User device vectors**
        7   **AVC CRT: option**
        8   **Patch in custom i/o**
        9   **Exit**
     Your selection

Any primary selection from 1 to 9 inclusive will produce a further
secondary selection of options relating to the particular group chosen.

The secondary group 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 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.

On completion of each of the first 8 group options the program returns
to the above menu for another primary selection. In contrast selection
9 can only result in exiting to CP/M.

If after saving the modified options onto a valid disk you wish to
impliment the modifications, the system must now be RESET with the
modified disk in drive A.

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.

8.2.1 Keyboard options
This selection allows modification to some keyboard characteristics.

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 acomplished 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

8.2.2 Screen options
This selection allows modification to the screen edit and display characteristics.

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 option 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.

8.2.3 Disk options
This selection allows modification of the disk drive characteristics.

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. Only the number of drives selected here will be offered for the single/double sided option shown below.

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 chapter 3 of your CP/M User Guide 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 6ms so step rate 0 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.

Drive A: double sided (Y/N) N ?

This should be set according to the type of disk drive installed as drive A:.

NOTE: Take great care when changing this paramater as file compatability is not maintained. See notes on single/double sided disk compatability (Appendix C).

Drive B: double sided (Y/N) N ?

This should be set according to the type of disk drive installed as
drive B:.

Drive C: double sided (Y/N) N ?

This should be set according to the type of disk drive installed as
drive C:.

Drive D: double sided (Y/N) N ?

This should be set according to the type of disk drive installed as
drive D:.

8.2.4 LST: device options
This selection allows modification of the LST: device drivers.

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 cariage return. This is useful for printers that insert a line feed following a cariage return.

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

Same as above but for LPT: device.

8.2.5 Default device options
This selection allows the device assignments selected during 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.

8.2.6 User device vectors
This selection allows modification of the jump vectors for the user device drivers.

UC1 status (0-FFFF) 4C5F ?

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

8.2.7 AVC CRT: option
This selection allows modification of the video mode.

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

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

8.2.8 Patch in custom i/o
This selection allows 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. ENTER will initiate the change procedure of the displayed address as shown below.

New value (0-FF) 00 ?

The new value required should be typed. ENTER will leave the old value unchanged and automatically display the following address for change.

8.2.9 Exit
This selection leads to the exit from the configuration utility.

Save options on disk (Y/N) N ?

Answering N or ENTER to this question will cause the program to terminate with no system changes recorded on any disk. A Y answer will lead to a further question about the destination for the modified system.

Destination drive (A-P) A ?

An ENTER responce will select and save modified system onto drive A. Any other valid entry i.e. a-p or A-P will first check to see if the chosen drive is included within the current system before saving. If it is not, the program will respond as follows: (X = Your entry)

X Drive not selected
Destination drive (A-P) A ?

An invalid entry will cause the **Destination drive** question to be asked
again.

9. RESIDENT SYSTEM UTILITIES

A facillity is provided to allow extensions to the standard CP/M system to be provided using Resident System Utilities (RSU´s) loaded from disk. These utilities differ from the standard CP/M utilities such as PIP,STAT etc in that they remain in memory after they have been loaded and are therefore known as resident utilities.

Once an RSU is loaded it resides in reserved memory above the CP/M operating system. The programs load in the normal way into the TPA at 100H but then copy themselves into the reserved area of memory. A pointer to the reserved memory is maintained in locations 40H-41H and is updated each time by the RSU loaded. The utility files are special relocatable modules and contain a loader to copy the utility to its target execution address in reserved memory.

```
FFFFH   ----------------      --------------      --------------
        | Workspace &  |      | Workspace &  |    | Workspace &  |
        | Video RAM    |      | Video RAM    |    | Video RAM    |
F800H   |--------------|      |--------------|    |--------------|
        |   EPROM      |      |   EPROM      |    |   EPROM      |
F000H   |--------------|      |--------------|    |--------------|
        |  Reserved    |      |  Reserved    |    |  Resident    |
        |  Memory      |      |  Memory      |    |  Module      |
xxxxH   |--------------|      |--------------|    |--------------|
        |   BIOS       |      |   BIOS       |    |   BIOS       |
        |--------------|      |--------------|    |--------------|
        |   BDOS       |      |   BDOS       |    |   BDOS       |
        |--------------|      |--------------|    |--------------|
        |   CCP        |      |   CCP        |    |   CCP        |
        |--------------|      |--------------|    |--------------|
        |              |      |              |    |              |
        |              |      |--------------|    |              |
        |              |      |  Resident    |    |              |
        |   TPA        |      |  Module      |    |   TPA        |
        |              |      |--------------|    |              |
        |              |      |   LOADER     |    |              |
0100H   |--------------|      |--------------|    |--------------|
        |   SCRATCH    |      |   SCRATCH    |    |   SCRATCH    |
0000H   ----------------      --------------      --------------
```

NOTE: xxxxH is the generated CP/M system size

Memory map during loading of RSU

Memory must be reserved for the RSU´s by using MOVCPM to create a CP/M system smaller than the memory available. The size of system to be created can be calculated as follows:-

Calculate the total memory required by the RSU´s round up to the next kilobyte (multiple of 1024) and then subtract it from the memory available. Create a CP/M system of this size using MOVCPM as described in chapter 5 of your Osborne CP/M User Guide.

10. VIRTUAL DISK

10.1 Description

The Virtual Disk utility when used in conjunction with a 256 kilobyte memory card provides 192 kilobytes of FAST access simulated disk storage. This allows files to loaded in fractions of second and greatly enhances the performance of programs such as WORDSTAR which rely heavily upon disk overlays.

10.2 Using the Virtual Disk

The Virtual disk is enabled by simply typing **MDISK** and then pressing **ENTER**. The sign on message will be printed on the screen and you may now use the drive. If the Virtual disk has been loaded before and the data is still present then the files will still be available. However if the disk is corrupted or being used for the first time then the disk will be initialised and a message to this effect displayed.

The Virtual Disk is installed as drive M: on the system. This may be used exactly like any other disk drive.

Care must be taken however if drive M: is being used for data storage to ensure that the data is copied onto a physical disk before the system is switched off.

An example of how to use the virtual disk to speed access to the system is given below. Although WORDSTAR is used for the example the principle may be applied to many apllications programs.

Log on to drive M:

A>M:

Copy all the WORDSTAR files to drive M:.

M>A:PIP M:=A:WS*.*

Now use wordstar as normal preferably with the text files on a drive other than M: for greater data security.

10.3 Error messages

The following error messages may be encountered whilst the MDISK software is installing itself.

INSUFFICIENT MEMORY RESERVED

This message would result if insufficient memory has been reserved above the CP/M operating system for the MDISK control software.

MDISK ALREADY INSTALLED

This message would result if the MDISK was already in use.

A. 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 :-   addr = offset + 0A00h

In current BIOS :-   addr = offset + 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**

CCP base	Workspace	Name	Description
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 vector
165D/E	FC5C/D	IUC1	User console input vector
165F/60	FC5E/F	OUC1	User console output vector
1661/2	FC60/1	UL1	User list output vector
1663/4	FC62/3	UP1	User punch vector
1665/6	FC64/5	UR1	User reader 1 vector
1667/8	FC66/7	UR2	User reader 2 vector
1669/A	FC68/9	SUL1	User list status vector
166B	F6CA	SPEED	Drive step rate
166C-1671	F6CB-F670		Spares
1672		NDISK	Number of disks
1773		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		HSSEN	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	Control X with 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 this starting at USRINI. Upon system initialisation USRINI is called to initialise the PIO. This code should be left as it is if it is desired to use the PIO for a centronics type printer.

User patch area:-

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

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

In addition a free memory pointer is maintained in locations 40-41 hex. This points to the bottom of free memory above the CP/M BIOS and must be updated if this memory is used for any purpose.

B. I/O DRIVER 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

Any additional I/O drivers required may be patched into the BIOS in using CONFIG or DDT in which case the respective jump vectors should be changed to suit the size of system to be created. If MOVCPM is later used to create a different sized system then the jump vectors must again be changed. The jump vectors in MOVCPM itself must be changed not the copy in workspace.

An alternative method which is used by the AVC Terminal handler etc is
to create a Resident System Utility (RSU) see section 9. Using this
method the driver is loaded from a file usually using the auto load
facility and sets its own jump vectors as part of its initialisation
procedure. In this case it is the copy of the jump vectors in workspace
which must be modified.

C. DOUBLE/SINGLE SIDED DRIVES

Although double sided and single sided drives may be mixed on one
system the disk formats are incompatible i.e. a disk recorded on a
double sided drive may not be read on a single sided drive and visa
versa.

Two utilities SINGLE and DOUBLE are provided to allow the format of a
drive to be changed. To execute either utility simply type

SINGLE X <ENTER>

Where X is the drive to be converted and <ENTER> means press the ENTER
key. If the drive name (A-D) is not included in the command line, the
utility will ask the name of the drive to be converted. The drive will
then read and write in the new format until the next RESET.

CP/M software supplied by LUCAS is available in both formats single
sided being supplied unless otherwise specified.

D. INSTALLING CP/M

The following procedure should be followed to install CP/M on an
existing Nascom 2, Nascom 3 or Lucas Nascom LX computers The
instructions assume that a Lucas Nascom disc system and associated
controller card has already been installed.

D.1 Setting up the CPU card

The following changes must be made to the Nascom 2 CPU card which is
present in all the above systems.

D.1.1 Switch pack settings

Switch packs LSW 1 and LSW 2 should be set up as shown below to select
the following options.

LSW1/0	DOWN	No wait states
LSW1/9	UP	CPU clock internal
LSW1/8	DOWN	4k memory decode
LSW1/7	DOWN	4k memory decode
LSW1/6	UP	50 Hz/625 line video
LSW1/5	UP	1 Stop bit
LSW1/4	DOWN	Restart address F000 hex
LSW1/3	DOWN	Restart address F000 hex
LSW1/2	DOWN	Restart address F000 hex
LSW1/1	DOWN	Restart address F000 hex

LSW2/0	UP	4MHz clock frequency
LSW2/9	UP	Auto alpha/graphics
LSW2/8	UP	External port addressing
LSW2/7	**	
LSW2/6	**	
LSW2/5	**	
LSW2/4	**	
LSW2/3	**	
LSW2/2	**	
LSW2/1	**	

** Switches LSW2/1 to LSW2/6 should be set as required for any serial
device that is being used (see the Lucas Nascom Hardware Manual).

D.1.2 Boot loader

The standard monitor EPROM on the Nascom CPU card (NAS-SYS 1 or NAS-SYS
3) must be changed for a CP/M BOOT EPROM. Upon reset the BOOT EPROM
will read the CP/M operating system off the system disk and pass
control to it.

D.1.3 Memory decode

The standard Nascom memory map must be changed to allow operation of
CP/M. This is accomplished by replacing the standard N2MD PROM IC47
with the special CP/M N2MD PROM. The header LSK1 must also be changed
for the one supplied as shown below.

```
      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     C000-CFFF
      RAM GATE2 5    | |   12     D000-DFFF
      BLOCK B   6    | |   11     E000-EFFF
      XROM      7    | ---10     F000-F7FF
      BROM      8     ----9      F800-FFFF
```

The memory card being used in the system should be set up to provide a
minimum of 20k contiguous memory from 0. The relevant memory board
hardware manuals should be consulted as to how to achieve this.

D.2 Disk Drives

From one to four disk drives may supported by CP/M. Single sided drives
give 374 kilobytes of storage per drive and double sided drives give
760 kilobytes.