MCM COMPUTERS SYSTEM 800

MCP-132 Printer

Users Guide

<u>MCP-132 Printer</u>

<u>U s e r s   G u i d e</u>

This manual contains a general description of the Micro Computer
Machines   MCP-132   printer,   along   with   specifications,
installation instructions and information on programming the
MCM/800 computer to produce both printing and plotting. The user
should have some knowledge of the MCM/800 computer and MCM/APL
before attempting to use this manual.

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INTRODUCTION

GENERAL DESCRIPTION

The MCP-132 is a compact, highly reliable printer for use with the MCM/800 series computer. It uses a high-quality medium speed serial impact printer mechanism, which is capable of sustaining continuous operation at speeds of up to 45 characters per second.

The MCP-132 will support a variety of applicatons. It can be used as a line oriented output device for the MCM/800, as a printer/plotter under control of the MCM/800 and as a high quality word processor in conjunction with an 8K or larger MCM/800 equipped with a second tape drive.

Packaged as a desk-top unit weighing only 15 kilograms (33 pounds), the MCP-132 offers an attractive yet functional package. A high efficiency power supply and built in OMNIPORT interface make it an ideal companion for the MCM/800 computer.

An extensive collection of utility functions is available on the Communication Subsystem tape/disk (Group 201) which is of use for both printing and plotting.

SYSTEM FEATURES

The MCP-132 features wide-carriage (132 character), impact printing with the APL character set (includng overstrikes). Many other character sets are available; changing them is a simple matter of snapping on a new print wheel daisy. Printing is automatically optimized by the software to take advantage of the capabilities of the print mechanism; APL overstrikes do not require the 'print - backspace - print' cycle found on some printers, rather the print hammer fires once for each character of the overstrike and then the print head moves. In addition, when two or more blanks occur together, the print head automatically tabs at high speed to the next position that requires a printed character. No time is wasted spacing at slow speed.

Each MCM/800 contains built in software drivers that provide full control of the MCP-132 printer. Printing an APL variable can be as simple as entering $\Box \leftarrow A$; conversion and formatting of numeric data, continuation of long lines, character spacing, line spacing, line counting, page counting and skipping at end - of - page are all handled automatically by the computer. Although the computer handles these automatically, it is possible to specify values other than the default ones for most print parameters (left margin, right margin,

In addition to this highly flexible automatic printing, it is possible for the user to control all aspects of the printer directly. This allows printing, plotting and an almost limitless variety of printed output since the MCP-132 can move the print head up and down to within 1/48 inch and left and right to within 1/120 inch.

SPECIFICATIONS

Print Speed: 45 Characters per second on
                                  average text.

Print Line   132 Columns.

Forms Width: 15 inches maximum.

Paper Thickness   Standard adjustment permits paper
                                  thickness up to .66 mm (.027").

Character fonts: Standard: APL
                                  Optional: Elite, Pica, Courier,
                                  Manifold, French, German, Scandia,
                                  Kana.

Character set: 96 printable characters.

Horizontal Tabulation: 120 positions per inch.

Horizontal Tab Speed: 300 ms. maximum for 132 columns.

Vertical Tabulation: 48 positions per inch.

Vertical Tab Speed: 4 inches per second plus 50 ms.
                                  settling.

Plotting Density: 5760 points per square inch
                                  maximum.

Ribbon: Snap-in cloth, single strike or
                                  multi strike carbon cartridge.

Line Voltage   117 Volts nominal.

Line Frequency   50 - 60 Hertz.

Power: 120 Watts average.

Height: 27 cm. (10.5 inches).

Width: 59 cm. (23.25 inches).

Depth: 44 cm. (17.3 inches).

Weight: 15 kilograms (33 pounds).

Ambient Temperature: -30 C. to +60 C. Storage
                                  +5 C. to +40 C. Operating.

Ambient Relative Humidity: 0 - 90% Storage.
                                  10 - 80% Operating (no
                                  condensation).

INSTALLATION

GENERAL

This section contains information and instructions for unpacking the MCP-132, installing it and preparing it for operation.

Upon receipt of the MCP-132, carefully inspect for any damages which may have been sustained in transit. Notify MCM and file a claim with the carrier if there is any such damage. All equipment is carefully inspected and tested before shipping.

UNPACKING

The printer should be unpacked as follows:
1) Remove the shipping straps and cargo wrap.
2) Remove the printer and attached baseplate from the box.
3) Remove the protective plastic shroud from the printer.
4) Detach the printer from the baseplate by removing the four screws used to secure it to the baseplate.
5) Place the printer on a desk or stand with both the line cord and the 40 conductor ribbon cable exiting behind the printer.
6) Remove the cable tie holding the print head assembly to the right side of the printer. The print head should now slide back and forth on its tracks easily.

POWER REQUIREMENTS

The MCP-132 has been designed to operate from a nominal line voltage of 117 volts AC at either 50 or 60 Hertz. The power switch is located on the back of the printer near the line cord. This switch should be turned off (down) and left off until the printer is plugged in and properly connected to the MCM/800 computer. Note that on some printers the power switch is located on the top left rear.

CONNECTION TO THE COMPUTER

The MCP-132 has a built in interface which contains all the electronics necessary to connect the printer to an MCM/800 computer. The connection to the computer is made by the 40 conductor ribbon cable from the MCP-132 which should be plugged into the 'OMNIPORT' socket on the MCM/800. If there are other peripherals attached to the computer then the MCP-132 should be connected to the 'OMNIPORT' socket on the last peripheral in the chain.

The OMNIPORT cable from the MCP-132 is keyed. It is important to check the connectors before attempting to attatch them to make sure they are oriented correctly. The socket in the computer (or other peripheral) has been keyed by clipping two of the pins; these must mate with the two corresponding protection keys which have been placed in the plug on the ribbon cable. If difficulty is encountered at any time when connecting peripherals, DO NOT FORCE THE CONNECTORS, rather pull the cable connector out of the socket and check for proper positioning. Forcing the cable plug into a socket against the keying may cause damage to the connectors or the peripheral. In addition to observing proper keying of the connectors, both the MCP-132 and the MCM/800 should be turned off when connecting or disconnecting the printer.

OPERATOR MAINTENANCE

GENERAL

This section describes the maintenance procedures required of the user during the course of normal operation of the MCP-132 printer. These procedures consist of performing the following:

1) Changing ribbon cartridge.

2) Changing print wheels.

3) Loading paper.

4) Adjusting for paper thickness.

5) Setting the impression control switch.

6) Cleaning the platen.

RIBBON CARTRIDGE REPLACEMENT

1) Turn the MCP-132 off.

2) Lift off the front cover to expose the print head.

3) Release the red catches on either side of the ribbon cartridge which hold it in place.

4) Lift out the old ribbon cartridge.

5) Insert the new ribbon cartridge, insuring that the ribbon is forward of the guides and print wheel.

6) Make sure the ribbon cartridge is secured at both catches.

7) Replace the front cover and turn the power back on.

CHANGING THE PRINT WHEEL

1)   Turn the MCP-132 off.

2)   Remove the ribbon cartridge as described above.

3)   Grip the black hammer case between thumb and forefinger and
      pull the carriage assembly back.

4)   Remove the print wheel by grasping and pulling the center
      hub.

5)   Align the drive key with the slot on the new print wheel.

6)   Snap in the new printwheel by pushing firmly on the center
      hub.

7)   Push the carriage assembly forward.

8)   Replace the ribbon cartridge.

WARNING! In step 6 above it is important that the printwheel be
      firmly and completly seated on the hub. If it is loose or
      or not properly seated then when it spins it may catch on
      the print hammer or ribbon, possibly destroying some of the
      character petals.

LOADING PAPER

1)   Release the friction feed on the platen by pulling forward
      the locking lever which protrudes through the printer cover
      on the right side of the paper guide.

2)   Release the platen roller guide by pulling forward on the
      left or right release lever.

4)   Pull about 10 inches of paper through the platen, and align
      the paper for straight feed.

5)   Re-engage the platen friction by pushing back the locking
      lever.

6)   Push the platen roller guide to its original position.

PLATEN ADJUST LEVER

The platen adjust lever on the upper left rear corner of the case is used to adjust the printer for different paper thickness. Move the lever all the way forward for single copies and progressively to the rear for 2 to 5 copies.

IMPRESSION CONTROL SWITCH

The impression control switch, inside the front cover on the right hand side, is used to control the impression strength. M is the normal setting; H is for darker impressions, and L for lighter.

CLEANING THE PLATEN

In the event that the platen or the paper guide accumulates ink from the ribbon cartridge, it is recommended that FEDTRON or other suitable cleaner be used. These should NOT be cleaned with alcohol since it hardens the rubber resulting eventually in paper feed problems. The platen cleaner should not, however, be used to clean other parts of the printer since these products are usually harmful to plastic. Alcohol can be used to clean the plastic parts of the printer.

CHECKING THE FUSE

The MCP-132 contains a 3 amp fast blow fuse. This fuse should not blow in normal operation of the printer. If the fuse does blow it should replaced only with another 3 amp fast blow fuse. The following section describes replacing the fuse and can also be used if it is necessary to check the fuse.

1) Turn off and unplug the printer. This is important since potentially lethal voltages may be exposed when the cover is removed.

2) Lift off the front cover to expose the print head.

3) Remove the platen by pressing down on the platen release levers located just outside and the the back of the platen itself.

4) Remove the upper housing shell. To do this pull the spring loaded housing clamps, located on either side of the housing, forward and lift up.

5) The fuseholder is located toward the left rear of the machine, just to the left of the platen adjust lever.

Programming for the MCP-132

GENERAL

This section contains information relating to programming the MCM/800 to produce printing and plotting on the MCP-132. Description and examples are provided for the various utility functions that pertain to the MCP-132. The information in this section provides an informal description of the facilities available on the MCP-132; a formal description of the communication subsystem and the MCP-132 control tables is given in the MCM COMMUNICATION SUBSYSTEM REFERENCE MANUAL.

PRINTING

The simplest way of using the MCP-132 is in the automatic mode. When used in this manner the MCM/APL system assumes all responsibility for formatting the output and for controlling the printer. The only things the user must do is to tell the computer that output is to go to the printer and to provide some data for it to output.

SELECTING THE PRINTER FOR OUTPUT

The MCM/800 has provision for up to 199 external peripheral units, numbered 1 to 199 (the built in display device is always unit zero). The

$$\Box OUT \; X$$

system function tells the computer that output should now be directed to the peripheral whose unit number is given by X. This function returns a three element result which is discussed below. Once this function is used all explicit output is directed to that unit until the computer is told otherwise or until it is turned off.

When the MCP-132 printer is shipped its unit address is set to one, therefore to select it to receive output the statement

$$\Box OUT \; 1$$

would do. There is, however, a preferred method of selecting the MCP-132. Although the unit address of the MCP-132 is set to one when it is shipped, it is possible to change its unit address (by rotating a switch inside the print mechanism) to any value from 1 to 15. If, at some future time, you change the unit address of your printer or you wish to run your programs which use the printer on someone else's system which has the MCP-132 set to an address other than one, then $\Box OUT \; 1$ would not work. What we need is some way of telling the computer, not to select a particular unit number, but rather to select a particular type of unit regardless of its unit number. This is exactly what the system function $\Box YA$ is for. Every MCM peripheral interface contains a unit address (which can be changed) and an answer back code (which is fixed for each type of device). The exact nature of the answer back code is discussed under 'Direct Device Access' in the SYSTEM FUNCTION section of the COMMUNICATION SUBSYSTEM REFERENCE MANUAL; however, it will suffice for the present to say that the answer back code is a number which identifies the kind of device that is attached.

The answer back code for all MCP-132's is 66. The function
$$□YA \ X$$
expects as its argument X an answer back code. It then examines all the units attached to the computer (starting with unit one) until it finds one whose answer back code is equal to X. When such a match is found it returns as its result the unit address of the device with a matching answer back code. If there is no unit with the matching answer back code then a zero is returned. For example if we had an MCP-132 attached and set at unit address 12, then executing $□YA$ 66 would return a result of 12, indicating that the unit at address 12 has an answer back code of 66 indicating that it is an MCP-132.

Combining $□OUT$ with $□YA$ we get:
$$□OUT \ □YA \ 66$$
which will select an MCP-132 if there is one attached to the system, otherwise the built in display is left active.

The result returned by the $□OUT$ function is a three element vector. The numbers in this vector are, from left to right:

- The number of the unit selected. This is the same as the argument except as noted below.

- The answer back code for the device selected. If no device is at that address then this will be zero.

- The current status of the device. This number depends on the device selected; the meaning of the status returned by the MCP-132 is detailed in the section 'Errors & Error Correction'.

The result normally returned by an MCP-132 printer set at address one is: 1 66 241.

If you do not wish to see the result of the $\square OUT$ function then simply place a null in front of it. For example

<div align="center">∘$\square OUT$ $\square YA$ 66</div>

will select the MCP-132 but will not display the result.

The $\square OUT$ function can be used to find out what device is currently selected, withouting changing anything. To do this simply use

<div align="center">$\square OUT$ ⍳0</div>

When used in this manner with ⍳0 it returns its usual result as it applies to the currently selected device. Thus it returns the unit number of the current device, its answerback code and the current status. Using this it is possible to make sure the current device is an MPC-132 (the answerback must be 66) and also to make sure that it is turned on and ready (status = 241). Using $\square OUT$ in this manner does not change the device selected for output.

OUTPUTTING ON THE PRINTER

Once the printer has been selected for output, printing data is simply a matter of saying

<div align="center">$\square \leftarrow X$</div>

where X is any valid APL expression that returns a result. It is important to note that only explicit output (assigning a value to quad) goes to the selected output device; implicit output (which occurs when a result is left unassigned at the left side of a line) and error messages still go to the built-in display. It is not possible to have implicit output and error messages appear on a device other than the built-in display.

When this automatic mode is used to output data, the APL system takes care of all formatting and control of the printer. Probably the most noticable aspect of this is its method of continuing long lines (try $\square \leftarrow ⍳100$). When the line to be printed

is full the computer places a continuation character ('ɑ') at
the end of the line and then indents the following lines to
indicate a continuation. Both the continuation character and the
indentation amount can be changed to suit the user's needs as
described below. This is just one of many automatic services
provided.

PRINT UTILITY FUNCTIONS

Group 201 of the Communication Subsystem Tape/Disk contains
functions which provide various services related to printing and
plotting on the MCP-132. The printing service functions can be
further subdivided into ones which change the parameters that
control the automatic printing of data, the ones which are
concerned with controlling paging of output and miscellaneous
other print functions.

PARAMETER CHANGING FUNCTIONS

The following functions change the print parameters as
noted below. It should be noted that all the parameters altered
by these functions can also be changed directly by using the
appropriate '☐Y' system functions. These utility functions are,
in general, easier to remember and provide conversion from
familiar units (inches, for example) into the values required in
the printer control table.

WIDTH   is used to set the print width, the continuation
               character, and the continuation indent.

PITCH   is used to set the number of characters per inch.

ROLL   is used to set the number of print lines per
               inch.

WIDTH

The calling syntax for this function is:

$$R \leftarrow WIDTH\ B$$

where R is the result produced by the function and 'B' is a numeric vector of one, two or three elements. If B contains only one element then only the print width is set, if B contains two elements the print width and continuation character are set, if B contains three elements then the print width, the continuation character and the continuation indent are set.

The first element of B is used to set the maximum width of the printed line and must be in the range 30 - 132.

The second element of B is used to specify the continuation character that appears at the end of long lines. This must be one of the following codes: 128 causes no continuation character to be printed at all, 129 causes the mnemonic form of the continuaton ('$CO') to be printed, while 130 causes the overstruck form of the continuation character ('α') to be printed.

The third element of B specifies the number of spaces that the computer is to indent continued lines. This value must be in the range 0 - 15.

The result returned by the WIDTH function contains the same number of elements as the B argument and indicates the settings that were in effect when the function was called.

The default values that are in effect when the MCP-132 is first selected are: 120 130 6; i.e., the print width is 120 characters, the overstruck continuation character is used, and continued lines are indented 6 spaces.

EXAMPLE 1: Set the print width to 65 without changing the
            continuation character or the indent amount.
                          WIDTH 65

EXAMPLE 2: Set the print width to 132, turn off the printing of a
           continuation character and have no indent on continued
           lines:
                          WIDTH 132 128 0

EXAMPLE 3: Set the print width to 120, set the continuation
            character to '$CO' and don't change the indentation
            amount:
                          WIDTH 120 129

<u>PITCH</u>

The calling syntax for this function is:

$$R \leftarrow PITCH\ B$$

where R is the result produced by the function and B is a number in the range 1 to 60 or an empty vector (ι0).

If B is a number in the range 1 - 60 then the number of characters to be printed per inch is set to B. If B is an empty vector then the pitch setting is not changed. In either case the result R is the pitch setting that was in effect when this function was called.

Since the printer moves horizontally in 1/120th inch steps it is not possible to produce printing at all of the character spacings between 1 and 60 characters per inch; in particular only those which require spacing that is a multiple of 1/60" can be produced exactly. Those which can be produced exactly are: 1 2 3 4 5 6 10 12 15 20 30 and 60 characters per inch. If PITCH receives a request for a character spacing other than one of the above it selects the next lower possible spacing.

Although not all spacings are possible the most common ones, pica (10) and elite (12), are available. The default value that the computer starts with is 10 characters per inch.

The result produced by the PITCH function is the pitch setting that was in effect when it was called.

<u>EXAMPLE 1</u>: Set the pitch to 12 characters per inch:

$$PITCH\ 12$$

ROLL

The calling syntax for this function is:

$$R \leftarrow ROLL\ B$$

where R is the result produced by the function and B is a number
in the range 1 to 48 or an empty vector ($\iota 0$).

If B is a number in the range 1 - 48 then the number of
lines to be printed per inch is set to B. If B is an empty
vector then the roll setting is not changed. In either case the
result R is the roll setting that was in effect when this
function is used.

Since the printer moves vertically in 1/48th inch steps it
is not possible to produce printing at all of the line spacings
between 1 and 48 lines per inch; in particular only those which
require spacing that is a multiple of 1/48" can be produced
exactly. Those wnich can be produced exactly are: 1 2 3 4 6 8 12
16 24 and 48 lines per inch. If ROLL receives a request for a
line spacing other than one of the above it selects the next
lower possible line spacing.

Although not all spacings are possible the most common ones
are, as shown below:

Lines per inch	Type of spacing
8	Compressed with no overlap.
6	Standard computer & typewriter spacing.
4	One and one half spacing.
3	Double spacing
2	Triple spacing.

The default value that the computer starts with is 6 lines
per inch.

The result produced by the ROLL function is the roll setting that was in effect when the function was called.

EXAMPLE 1: Set the roll to 8 lines per inch:

ROLL 8

PAGING FUNCTIONS

The following functions are used to establish and control pagination on the MCP-132. As with the parameter changing functions, these functions are simply a convenient interface between the user and the MCP-132 control tables.

PAGE   Turns paging on by establishing the logical and physical size of the page, and setting the line and page counters to zero.

NPG   Ejects to the top of a new page.

PFT   Prints a footing and then ejects to the top of a new page.

PAGE

The calling syntax for this function is

$$R \leftarrow PAGE\ B$$

where R is the result produced by the function and B is a two element numeric vector.

The first element of B specifies the number of lines to be printed on the page (the logical pagesize), while the second element of B indicates the physical length of the page in lines (the physical pagesize). For example standard 11" fanfold computer paper has an area for printing which is 10 inches long. At 6 lines per inch this yields a logical pagesize of 10x6=60 (indicating that there are 60 lines available for actual printing). Since the paper is 11 inches from fold to fold, the physical pagesize is 11x6=66.

This function sets up the MCP-132 control tables based on the values given in B and then sets the page and line counters to zero. For this reason it is important that the paper in the printer should actually be at the top of a page when the PAGE function is used. In most cases it is useful to issue a message on the display asking the user to position the paper.

The result R produced by this function is the previous settings of the logical and physical pagesize.

The MCM/800 uses a system function $\Box PC$ to access the page and line counters. The formal definition of this function is given in the 'System Function' section of the COMMUNICATION SUBSYSTEM REFERENCE MANUAL. Using this function with an empty vector as the right argument $\Box PC \iota 0$ will return a two element vector indicating the current page number and the current line number.

EXAMPLE 1: Set things up to print 48 lines on 8 1/2" paper at 6
           lines per inch:

PAGE 48,(8.5×6)

EXAMPLE 2: Set things up to print on standard 11 inch paper and
           then issue a message to the user:

'POSITION PAPER'∘PAGE (10×6),(11×6)

NPG

The calling syntax for this function is:

NPG

This function advances the paper in the MCP-132 to the top of
the next page. Before this function is used, paging must be
started with the 'PAGE' function. Once this function has been
used to advance the paper to the top of a page, it is then
possible to simply continue, or to issue a heading if one is
desired.

EXAMPLE 1: Advance the paper to the top of the next page:

NPG

EXAMPLE 2: A function which ejects to the top of the next page
           and then prints the heading B at the top of the page

```
     ∇ EJECT
[1]  ⎕←''∘⎕←B∘NPG
     ∇
```

<u>PFT</u>

The calling syntax for this function is

PFT

This function advances to the botton of the current page, prints
the argument B and then advances to the top of the next page. It
is useful when the page number or some other information is to
be placed at the bottom of each page. Paging must have been
turned on by the 'PAGE' function before this function is used.

MISCELLANEOUS FUNCTIONS

The following functions perform various services that are of use in conjunction with printing on the MCP-132.

ΔCR Formats and prints functions or entire groups.

UP   Rolls the paper up.

DOWN   Rolls the paper down.

PRT   Prints on the MCP-132 without altering the existing communication sub-system output tables.

ΔCR

The calling syntax for this function is:

ΔCR B

The argument B should be either a numeric vector or a character vector specifying the name(s) of APL objects. If a numeric vector is specified then this function will print the content of all the specified groups from the tape or disk on drive 1. (NOTE: AVS must be active). If the argument is a character vector containing one or more names seperated by spaces, or an array of names, one per row then only these items printed. This function can be used, therefore, to print anything from a single function to the entire contents of a tape or disk.

EXAMPLE 1: Print the function ZOT:

ΔCR $'ZOT'$

EXAMPLE 2: Print the contents of groups 4, 7 and 18 from unit one:

ΔCR 4 7 18

EXAMPLE 3: Print the entire contents of all groups from the tape or disk on unit 1:

ΔCR $\Box XN \iota 0$

UP

The calling syntax of this function is:

UP B

This function moves the paper in the MCP-132 up by the number of lines specified in B and also adjusts the line counter so it will reflect the actual position on the page. This function will not move you off the current page. If the B argument is large enough that it would move you onto the next page, then this function moves only as far as the last line on the current page.

EXAMPLE 1: Roll the paper in the MCP-132 up 10 lines:

UP 10

<u>DOWN</u>

The calling syntax of this function is:

DOWN B

This function rolls the paper in the MCP-132 down by the number of lines specified in the argument B and adjusts the line counter to reflect the current position on the page. This function will not move past the start of the current page. If the B argument is large enough that it would cause you to move past the beginning of the page, then this function will position the print head on the first line of the page.

<u>EXAMPLE 1</u>: Roll the paper in the MCP-132 down 25 lines and adjust the line counter:

DOWN 25

PRT

The calling syntax for this function is:

PRT B

This function is used to print on the MCP-132 when some other output unit is already selected and set up. This function saves the current communication subsystem output tables, sets up the MCP-132 for standard output, prints the argument B and then restores the output tables that were in effect when it was called. For example some applications may use a CRT as the main input/output device. If at some point after the CRT tables have been set up it is desired to direct some output to the MCP-132 you could simply expunge the existing tables then select the printer and direct output to it, however this process will cause the output tables for the CRT to be lost. The PRT function can be used to advantage in a case such as this since it saves and restores the output tables. Thus if the CRT is setup for output, we can print something on the MCP-132 using PRT without altering the CRT tables at all.

PLOTTING ON THE MPC-132

GENERAL

This section contains information concerning plotting on the MCP-132. In this context 'plotting' is taken to mean all operation of the printer other than standard line oriented printing. To produce plotting the user has the choice of either using the utility functions that provide various services relating to plotting, or controlling all aspects of the printer directly. Although most of the capabilities available through direct control can also be achieved using the utility functions, a section describing direct control is included for users who wish to understand exactly how the utility functions operate or who wish to write new functions of their own that perform special plotting operations.

It should be noted that the MCP-132 must be selected for output before either printing or plotting on it are possible. How to select the printer for output is discussed at the beginning of the section on printing; exactly the same procedure should be used to select the printer before attempting to plot on it.

All the plot functions for the MCP-132 are set up so that horizontal increments are specified in 1/120" and vertical increments are specified in 1/96", however the MCP-132 has a vertical resolution of 1/48", therefore when specifying vertical motion directly in terms of increments it is important that the numbers should be even for the MPC-132. The use of odd motion increments will cause cumulative error in the positioning of the print head and should therefore be avoided. This is also true for horizontal motion on MCP-132's based on the HyType I print mechainism.

PLOTTING UTILITY FUNCTIONS

The following functions are available on group 201 of the Communication Subsystem Tape/Disk which are of use when plotting on the MCP-132:

*P*Δ	Prints any number of points at arbitrary positions. This is a high speed routine that has most of the abilities of direct control.
HLINE	Prints a horizontal line of arbitrary length.
VLINE	Prints a vertical line of arbitrary length.
BOX	Prints a box of arbitrary dimensions.
POSITION	Moves the print head an arbitrary number of inches from its current position.
EQU	Evaluates an equation for plotting.
PLOT	Scales and plots data.
TITLE	Prints a title in dot matrix form.

P∆

The calling syntax for this function is

A P∆ B

The left argument A is the plot character and the numbers from the right argument B are used in pairs to direct the motion of the print head.

This function is used to move the print head around and print a plot character at the various points. When The numbers from the right argument B are then used in pairs to specify the X-Y locations at which characters should be printed.

The argument B can be any shape but the pairs are taken from it in ravel (,B) order. The first number of the pair specifies the X location and the second number specifies the Y location. If, for example, the first plot character is to appear one inch to the right of and one inch above the starting (0,0) point, then the first two numbers of the B argument should be 120 96. If the second plot character is to appear an inch above the axis and an inch to the left of it then the next two numbers in B should be ‾120 96. Two things are important here. First note that positive numbers specify locations to the right of or above the center while negative numbers specify locations to the left of or below the center. Also note that for the duration of this function all points are specified as absolute locations with respect to (0,0). If the next character was to appear two inches below and two inches to the left of the center, then the next two numbers in B should be ‾240 ‾194.

This function prints a plot character for each pair of numbers in B, except for the last pair, for which is simply moves the print head to the specified position without printing a character. This allows the print head to be returned to its starting position simply by incuding 0 0 as the last pair of numbers. It is also important to note that if the last pair of numbers is not 0 0 then the print head will be left at that location when the function returns. This feature allows the function to be used simply to move the print head some arbitrary amount.

EXAMPLE 1: Print three asterisks on a 45 degree angle to the right on a 1 inch grid and then return the print head to its starting position:

'*' $P\Delta$ 120 96 240 192 360 288 0 0

EXAMPLE 2: Print dots at the corners of a two inch square and leave the print head positioned at the lower right corner:

'.' $P\Delta$ 120 96 ‾120 96 ‾120 ‾36 120 ‾96

In the example above, the last position is given twice. If it was only given once then the print head would have moved to the proper position but a dot would not have been printed since the last position does not receive a character.

EXAMPLE 3: Move the print head three inches to the right and two inches up without printing anything:

' ' $P\Delta$ 120 96×3 2

HLINE

The calling syntax for this function is:

A HLINE B

This function draws a horizontal line. The right argument B should be a number which specifies the length of the line in inches. The left argument A should be a two element numeric vector. It is used to specify the offset, in inches, from the current position of the print head. The first element of A gives the number of inches that the print head should be moved left or right, while the second element of A indicates how many inches the print head should be moved up or down, before the printing of the line begins.

EXAMPLE 1: Move the print head 5 inches to the right, 3.5 inches down and then print a horizontal line 6.25 inches long:

5 3.5 *HLINE* 6.25

EXAMPLE 2: Print a horizontal line ten inches long starting at the current position of the print head:

0 0 *HLINE* 10

VLINE

The calling syntax for this function is

A VLINE B

This function is similar to the HLINE function above but it draws a vertical line B inches long starting at offset A from the current position of the print head.

BOX

The calling syntax for this function is

A BOX B

Both the left and right arguments must be two element numeric vectors. This function draws a box of arbitrary size at an arbitrary location.

The left argument A should be a two element numeric vector. It is used to specify the offset, in inches, from the current position of the print head to the lower left corner of the box to be printed. The first element of A gives the number of inches that the print head should be moved left or right, while the second element indicates how many inches the print head should be moved up or down before printing the box.

The right argument B is used to specify the size of the box in inches. The first element of B specifies the width while the second element specifies the height.

EXAMPLE 1: Print a box 3 inches wide by 1.5 inches high starting at the current position of the print head

0 0 BOX 3 1.5

EXAMPLE 2: Print a 5 inch square after moving the print head 3 inches to the right and 5 inches up:

3 ⁻5 BOX 5 5

POSITION

The calling syntax for this function is

POSITION B

This function simply moves the print head to the position specified in B, which must be a two element numeric vector. It is used to specify the offset, in inches, from the current position of the print head. The first element of B gives the number of inches that the print head should be moved left or right, while the second element indicates how many inches the print head should be moved up or down.

EXAMPLE 1: Move the print head 10 inches to the right, without moving it up or down:

POSITION 10 0

EXAMPLE 2: Move the print head up 2 inches without moving it left or right:

POSITION 0 2

EXAMPLE 3: Move the print head 7 inches to the left and 3 inches down:

POSITION ⁻7 ⁻3

TITLE

The calling syntax for this function is

A TITLE B

where A is a two element numeric vector and B is a character vector.

This function positions the print head to the position given by A and then prints B in large, dot matrix form.

The left argument A should be a two elment numeric vector. It is used to specify the offset, in inches, from the current position of the print head to the upper left corner of the title to be printed.

The right argument B can be any character vector but it should not be so long as to cause the printer to run past the right margin.

The exact size of the printed title is controlled by the setting of the variables 'HEI' and 'CPI' in line 5 of the function. These can be changed be provide different size titles. The default values are for a height of one quarter inch (.25) and 5 characters per inch.

EXAMPLE 1: Print the message 'THIS IS A TEST' in dot matrix form after moving the print head 3 inches to the right

3 0 TITLE 'THIS IS A TEST'

PLOT

The calling syntax for this function is

PLOT B

This function accepts as the right argument B, an n by 2 array of co-ordinates. Plot scales these co-ordinates to correspond to the height and width of the plot. In addition to the argument B, this function will request that the user input the plot character, the width and height (in inches) of the plot, and titles for the X and Y axis.

Note that the function 'EQU' is very useful for producing values to be plotted.

EQU

The calling syntax for this function is

$$R \leftarrow EQU$$

The result R produced by this function is formatted to be the argument 'PLOT'.

EXAMPLE 1: Generate the values required for a plot of F = X*2 over the range of X from 1 to 100:

$$R \leftarrow EQU$$

when the function asks you to enter the equation to be evaluated. In this case our equation is simply 'X*2'. The function then asks the user to define the independent variable. In this case our independent variable is 'X' and we want it to range from 1 to 100, therefore we would enter 'X←ι100'. The function then evaluates the expression and shapes it into an n by 2 matrix suitable for use by plot.

ERRORS & ERROR CORRECTION

This section discusses problems that may occur when using the MCP-132 and how to correct them.

The most common problem is something physically wrong in which case an error message appears on the display when output is directed to the MCP-132.

Problem	Possible Cause
'COMM TYPE ERROR'	Will occur if the omniport cable is disconnected after the printer has been selected for output. Check also for loose or damaged cables.
	The output tables may be set up for a different device. If you are outputting on another device and then wish to direct output to the MCP-132 the tables for the other device must be expunged before selecting the MCP-132 for output. The output tables for any device can be expunged by issuing 'O' □YX ﹒0
'COMM DEVICE ERROR'	Power may not be reaching the printer. Try moving the print head back and forth by hand (carefully since it may start unexpectedly). If it resists, the power is OK. If it moves easily, make sure the unit is plugged in and turned on. If the problem persists, check the fuse and replace if necessary (see OPERATOR MAINTENANCE).
	The printer may be 'crashed'. If the print head is driven into either end stop, the printer will go into the 'crashed' state and will not respond until a RESTORE

is performed. Issue:
$$\Box OUT \ (\Box YA \ 66),224$$
to restore the printer.

The printwheel may be stuck. This
can occur if it is not installed
properly. Turn the printer off
then make sure the printwheel is
firmly on the hub, and try again
(see CHANGING THE PRINTWHEEL under
OPERATOR MAINTENANCE).

$\Box YA$ 66 returns 0

Indicates that the computer can
not find the MCP-132 attached to
the onmiport. Make sure that all
OMNIPORT cables are undamaged and
properly installed. Also check to
make sure that no other device is
set to the same OMNIPORT address
as the printer.

Prints garbage

This will occur if the printwheel
gets out of sync - usually the
result of changing the printwheel
without turning the printer off.
Issue a restore:
$$\Box OU \ (\Box YA \ 66),224$$
to re-sync the printwheel.

CHECKING THE STATUS

When the printer is selected for output by $\Box OU$ $\Box YA$ 66, the third number returned indicates the status of the printer. This number represents various possible conditions which are encoded into a single number. The following expression:

$$(8\rho2)\top^{-}1\uparrow\Box OU \Box YA \ 66$$

returns an eight element vector. The conditions represented by these numbers are as shown below: (from left to right)

- Paper feed ready
- Carriage ready
- Character print ready
- Ribbon up
- Not used
- Not used
- Check condition (printer crashed).
- Printer powered and ready

In all cases if the number returned is a one, the condition is true; if the number is zero, the condition is false.

The normal status returned by the printer is 241 (decimal) or 11110001 (binary) indicating: paper feed ready, carriage ready, character print ready, ribbon up, printer powered and ready.

<u>DIRECT CONTROL</u>

<u>GENERAL</u>

This section contains information and examples pertaining
to controlling the MCP-132 printer directly. With the exception
of RESTORE and RIBBON TOGGLE most of the facilites described
here are available through the plot utility functions. It is
assumed that the reader of this section has a thorough
understanding of binary arithmetic.

<u>MCP-132 Command Format</u>

The MPC-132 is controlled by issuing to it a control word
which is 16 bits wide. Each time some action is required of the
printer a control word must be issued to it for example to move
the carriage, to print a character and so on. The MCM/800 system
commands []OUT and []BO are used to issue the necessary 16
bits to the printer.

When attempting direct control of the printer it is
necessary, as with standard printing, to select the printer by
using []OUT. In order to send a full 16 bit command to the
MCP-132 it is necessary to issue a []BO with the least
significant half of the command followed by a []OUT with the
printer address and the most significant half of the command. A
[]OUT is usually followed simply by the unit address of the
device to be selected, however when it is given two elements as
the argument the second number (which must be in the range 0 to
255) is used to specify the most significant 8 bits of the
command to the MPC-132.

Of the 16 bits that make up each command, the most significant 3 bits form a code that indicates the type of operation while the remaining bits are defined depending on the particular type of command involved. The following are the commands available on the standard MCP-132. The remaining commands are reserved for future use.

0 0 1 - Print   Causes a single character to be printed without moving the print head.

0 1 0 - Carriage   Causes the carriage to be moved left or right.

1 0 0 - Feed   Causes the paper to feed up or down.

0 1 1 - Ribbon Toggle   Causes the ribbon state to toggle.

1 1 1 - Restore   Causes the printer to perform the restore operation.

PRINT

This command causes the printer to print one character at the current position of the print head. The print head is not moved. The command format for this operation is

        0 0 1 0   0 0 0 0   C C C C   C C C X

where C...C is the code that represents the character to be printed (see Appendix A), and X represents bits that are ignored. Note that since the least significant bit is ignored the character values given in Appendix A must be doubled for use.

EXAMPLE 1: Print an asterisk at the current position of the print head:

                        □OUT (□YA 66),32∘□BO 80×2

EXAMPLE 2: Print a diamond at the current position of the print head:

                        □OUT (□YA 66),32∘□BO 96×2

CARRIAGE

This command causes the print head to be moved left or right. The command format for this operation is

        Ø 1 Ø X   D A A A   A A A A   A A A A

where D indicates the direction, A...A indicates the amount of motion in 1/12Ø" and X indicates bits that are ignored. It is important to note that since the amount of the move is given by 11 bits, it is split between the portion issued by ▯OUT and the portion issued by ▯BO. If the D bit is zero then the carriage moves to the right, if it is one then the carriage moves to the left.

EXAMPLE 1: Move the print head 12 increments to the right:

          ▯OUT (▯YA 66),64∘▯BO 12

EXAMPLE 2: Move the print head 513 increments to the left

          ▯OUT (▯YA 66),73∘▯BO 1

FEED

This command causes the paper to be rolled up or down. The command format for this operation is:

         1 Ø Ø X   D A A A   A A A A   A A A X

where D indicates the direction, A...A indicates the amount of motion in 1/48" and X indicates bits that are ignored. It is important to note that since the amount of the move is given by 10 bits, it is split between the portion issued by ⬚OUT and ⬚BO. It is also important to note that the least significant bit is ignored, thus to move 1/48", a motion amount of 2 must be issued. In effect you can consider that the motion amount can be specified in 1/96" as long as the amounts are even. If the D bit is zero then the paper is moved down, if it is one then the paper is moved up.

EXAMPLE 1:Move the paper down 1 inch (48 increments):

         ⎵OUT (⎵YA 66),128∘⬚BO 96

RIBBON TOGGLE

This command toggles the ribbon state. On printers equipped with single color ribbons, this causes the ribbon to drop, or to come back up if it was already down. On printer with two color ribbons this command causes the printer to switch ribbon colors. The command format for this operation is

$$0\ 1\ 1\ 1 \quad 0\ 0\ 0\ 0 \quad X\ X\ X\ X \quad X\ X\ X\ X$$

Since the low order 8 bits of this command are ignored, they can be omitted entirely.

EXAMPLE 1: Toggle the ribbon state:

       ⎵*OU* (⎵*YA* 66),112

RESTORE

This command causes the computer to reset the carriage to the left margin and clears all error flags. It is necessary to perform a restore operation after crashing the printhead into either end stop. Note also that a restore operation is performed automatically when the printer is turned on. The command format for this operation is:

1 1 1 X   X X X X   X X X X   X X X X

Note that since the 8 low order bits of this command are ignored, they can be omitted.

EXAMPLE 1: Restore the printer

□OUT (□YA 66),224

APPENDIX A

This appendix shows the print wheel codes for APL10 and ASCII Courier 10 print wheels. Note that these values should be multiplied by 2 when used with ⎕BO

0:W	32:•	64:¯	96:◇
1:W	33:¨	65:α	97:A
2:W	34:)	66:⊥	98:B
3:W	35:<	67:∩	99:C
4:W	36:≤	68:L	100:D
5:W	37:=	69:∈	101:E
6:W	38:>	70:_	102:F
7:W	39:]	71:∇	103:G
8:W	40:∨	72:Δ	104:H
9:W	41:∧	73:ι	105:I
10:W	42:≠	74:∘	106:J
11:W	43:÷	75:'	107:K
12:W	44:,	76:⎕	108:L
13:W	45:+	77:|	109:M
14:W	46:.	78:⊤	110:N
15:W	47:/	79:○	111:O
16:W	48:0	80:*	112:P
17:W	49:1	81:?	113:Q
18:W	50:2	82:ρ	114:R
19:W	51:3	83:⌈	115:S
20:W	52:4	84:~	116:T
21:W	53:5	85:↓	117:U
22:W	54:6	86:∪	118:V
23:W	55:7	87:ω	119:W
24:W	56:8	88:⊃	120:X
25:W	57:9	89:↑	121:Y
26:W	58:(	90:⊂	122:Z
27:W	59:[	91:←	123:{
28:W	60:;	92:⊢	124:⊣
29:W	61:×	93:→	125:}
30:W	62::	94:≥	126:$
31:W	63:\	95:-	127:¬

APL 10 Print wheel codes

```
 0:w          32:¢          64:@          96:`
 1:w          33:!          65:A          97:a
 2:w          34:"          66:B          98:b
 3:w          35:#          67:C          99:c
 4:w          36:$          68:D         100:d
 5:w          37:%          69:E         101:e
 6:w          38:&          70:F         102:f
 7:w          39:'          71:G         103:g
 8:w          40:(          72:H         104:h
 9:w          41:)          73:I         105:i
10:w          42:*          74:J         106:j
11:w          43:+          75:K         107:k
12:w          44:,          76:L         108:l
13:w          45:-          77:M         109:m
14:w          46:.          78:N         110:n
15:w          47:/          79:O         111:o
16:w          48:0          80:P         112:p
17:w          49:1          81:Q         113:q
18:w          50:2          82:R         114:r
19:w          51:3          83:S         115:s
20:w          52:4          84:T         116:t
21:w          53:5          85:U         117:u
22:w          54:6          86:V         118:v
23:w          55:7          87:W         119:w
24:w          56:8          88:X         120:x
25:w          57:9          89:Y         121:y
26:w          58::          90:Z         122:z
27:w          59:;          91:[         123:{
28:w          60:<          92:\         124:|
29:w          61:=          93:]         125:}
30:w          62:>          94:^         126:~
31:w          63:?          95:_         127:¬
```

ASCII Courier 10 Print wheel codes.

APPENDIX B

Supplies for the MCP-132

The following supplies are available from MCM for use with the MPC-132 printer. All current printers are equiped with the HyType II print mechanism however earlier models were equiped with the HyType I. The HyType II ribbons are held in place by two red snaps, located on either side of the ribbon cartridge, while the HyType I ribbons are held in place by a single clip that fastenes in the middle.

MCM Part Number	Description
117-0002	Multi-strike cloth ribbon for HyType I.
117-0007	Single strike carbon ribbon for HyType I.
117-0009	Multi strike cloth ribbon for HyType II.
117-0011	Single strike carbon ribbon for HyType II.
117-0004	APL 10 printwheel.
117-0005	Courier 10 ASCII printwheel.

The following non-standard printwheels are available on special order:

Pica 10	Manifold 10
Courier Legal 10	Prestige Elite Legal 12
Dual Gothic Legal 12	Courier 72
Courier Legal 10A	Pica Legal 10
Elite 12	French Prestige Cubic
German Pica 10	Scandia Elite 12
Kana Gothic Elite 12	Kana Gothic Pica 12
U.K. Courier 10	General Scientific Symbol 10