

Qume
A Subsidiary of ITT

Manual

**The QUME CONNECTION
Centronics Model 1
Interface**

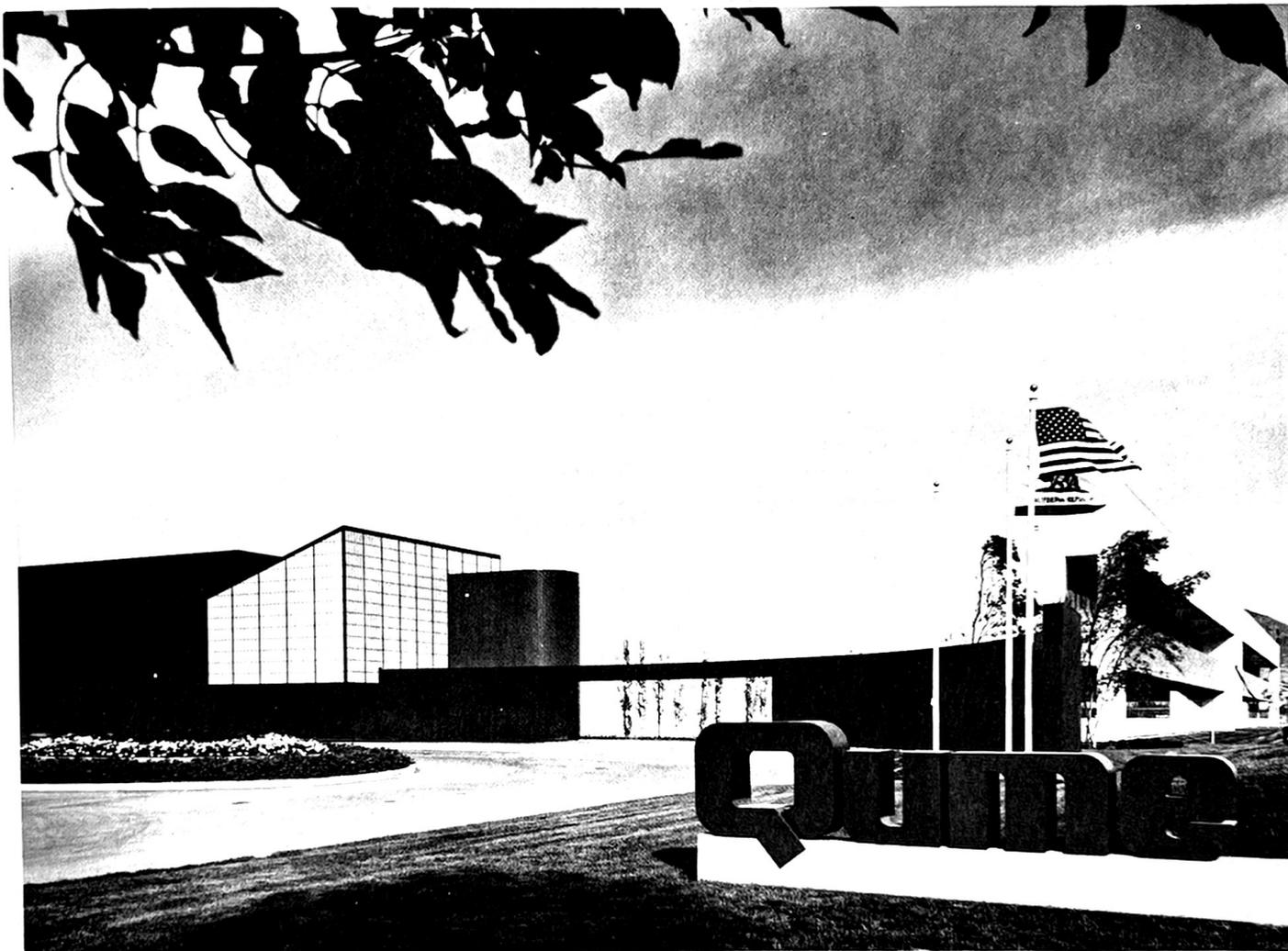
February 1983



Reorder Number 32085

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FOREWORD

The QUME CONNECTION CENTRONICS module is designed for use with a variety of Qume printer products. Consequently, this manual makes no attempt to describe the operation of your Qume printer. Refer to the following publications for questions related to the operation or maintenance of your printer:

Publication

Reorder Number

SPRINT 11 PLUS Operator Manual	32026
SPRINT 11 PLUS Field Maintenance Manual	32077
Supplies Catalog	38012
Printers and Accessories Catalog	33032

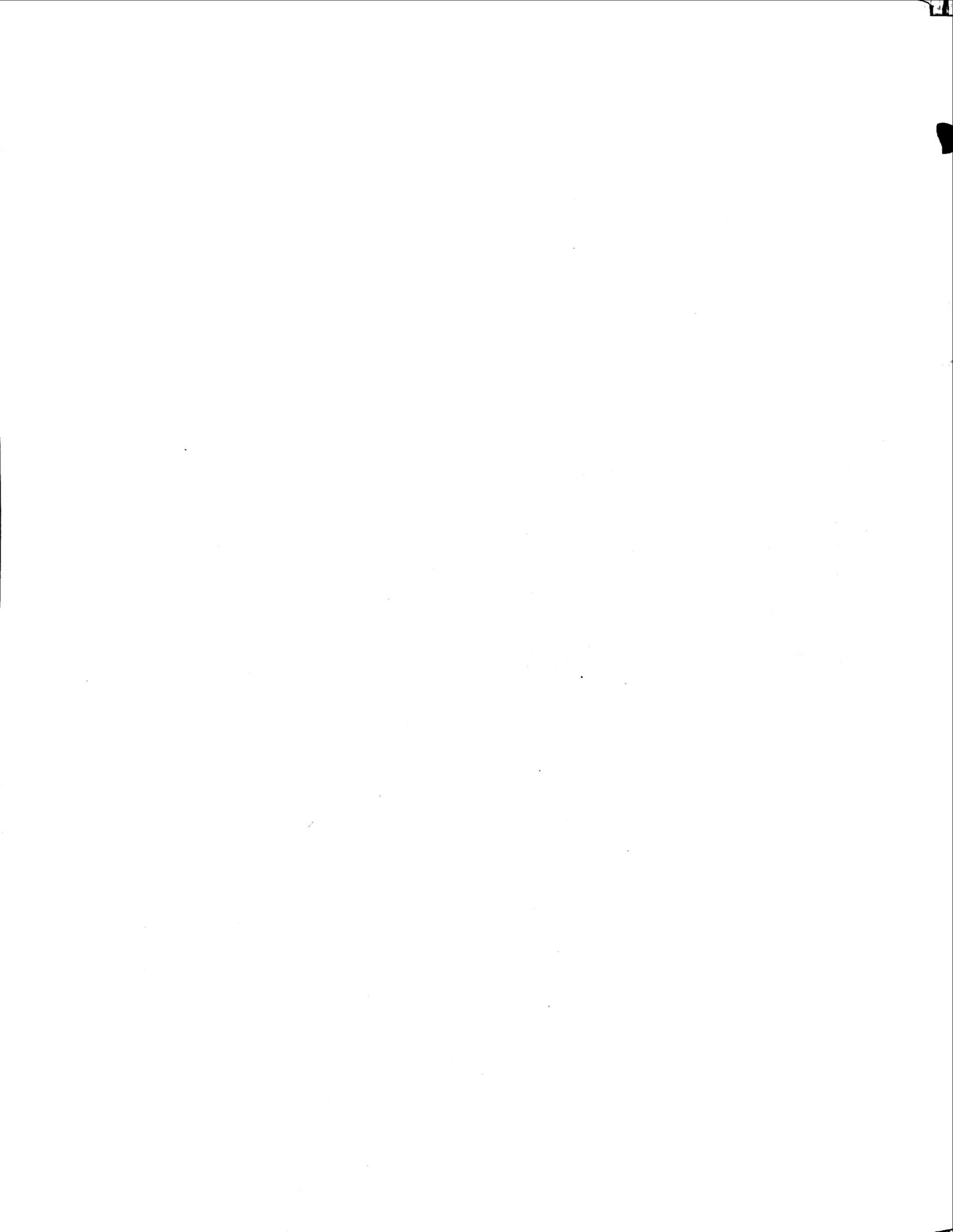


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PREFACE

This manual describes the installation and operation of the QUME CONNECTION Centronics module. The Centronics module is one of a series of QUME CONNECTION modules designed to interface Qume printers to a wide variety of computer systems. The module easily plugs into the 50-pin edge-board connector mounted on the back of your Qume printer. Then the module's 36 pin Amphenol connector is attached to the Centronics port on your computer. Once these connections are made and the DIP (Dual Inline Pack) switches on the printer and on the QUME CONNECTION are correctly set, your computer can communicate with the Qume printer.

The QUME CONNECTION interface is based on the "Centronics interface," a parallel data hardware interface developed by the Centronics Data Computer Corporation. Although the Centronics interface is not an official industry standard, the signal conventions are used by many computer and printer companies. If you unplug a Centronics dot matrix printer from your computer and plug in a Qume letter quality printer equipped with the QUME CONNECTION, the Qume printer will work.

The first section of this manual, **INSTALLING THE QUME CONNECTION**, describes how to install the QUME CONNECTION in the Qume printer and set the switches for proper operation with your computer system.

The second section, **COMPUTER - PRINTER OPERATION**, will help you get a character from your computer into the printer and onto paper.

The third section, **PROGRAMMING THE QUME CONNECTION**, discusses the compatibility of the QUME CONNECTION command set with existing Qume and Diablo command sets.

The fourth section, **COMMAND SET**, describes each of the QUME CONNECTION program commands. Not everyone, of course, needs to understand these commands in a detailed fashion. If you only intend to use your Qume printer to print documents that you may have created with a canned word processing program (e.g., WORDSTAR™), you may never need to worry about the Qume command set. The appropriate commands will have already been incorporated in your word processing software. However, if you intend to write your own software, would like to format your program listings, or are interested in the plotting and graphics capability of the printer, we recommend you read this section.

The **APPENDICES** contains the following technical information: an ASCII code chart, a sample basic formatting program, program mode carriage commands, a decimal/hex/ASCII conversion chart, a summary of the command set, and a description of the Centronics interface signals.

The following registered trademarks are used in this manual:

Centronics is a registered trademark of Centronics Data Computer Corporation.

Apple II is a registered trademark of Apple Computer Corporation.

CP/M is a registered trademark of Digital Research.

IBM is a registered trademark of IBM Corporation.

Microsoft is a registered trademark of Microsoft Corporation.

Radio Shack and TRS-80 are registered trademarks of Tandy Corporation.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be clearly documented and supported by appropriate evidence. This ensures transparency and accountability in the financial process.

Furthermore, it is crucial to review these records regularly to identify any discrepancies or errors. Promptly addressing these issues helps in maintaining the integrity of the data and prevents the accumulation of mistakes over time.

In addition, the document highlights the need for clear communication between all parties involved. Regular updates and reports should be provided to ensure that everyone is on the same page and aware of the current status of the project or operation.

It is also important to establish a consistent system for recording and organizing information. This system should be easy to use and accessible to all relevant personnel, facilitating efficient data management and analysis.

Finally, the document stresses the importance of confidentiality and security. Sensitive information should be protected at all times, and access should be restricted to authorized individuals only. This helps in preventing data breaches and maintaining the trust of stakeholders.

In conclusion, effective record-keeping and communication are essential for the success of any organization. By following these guidelines, you can ensure that your operations are well-documented and transparent, leading to better decision-making and overall performance.

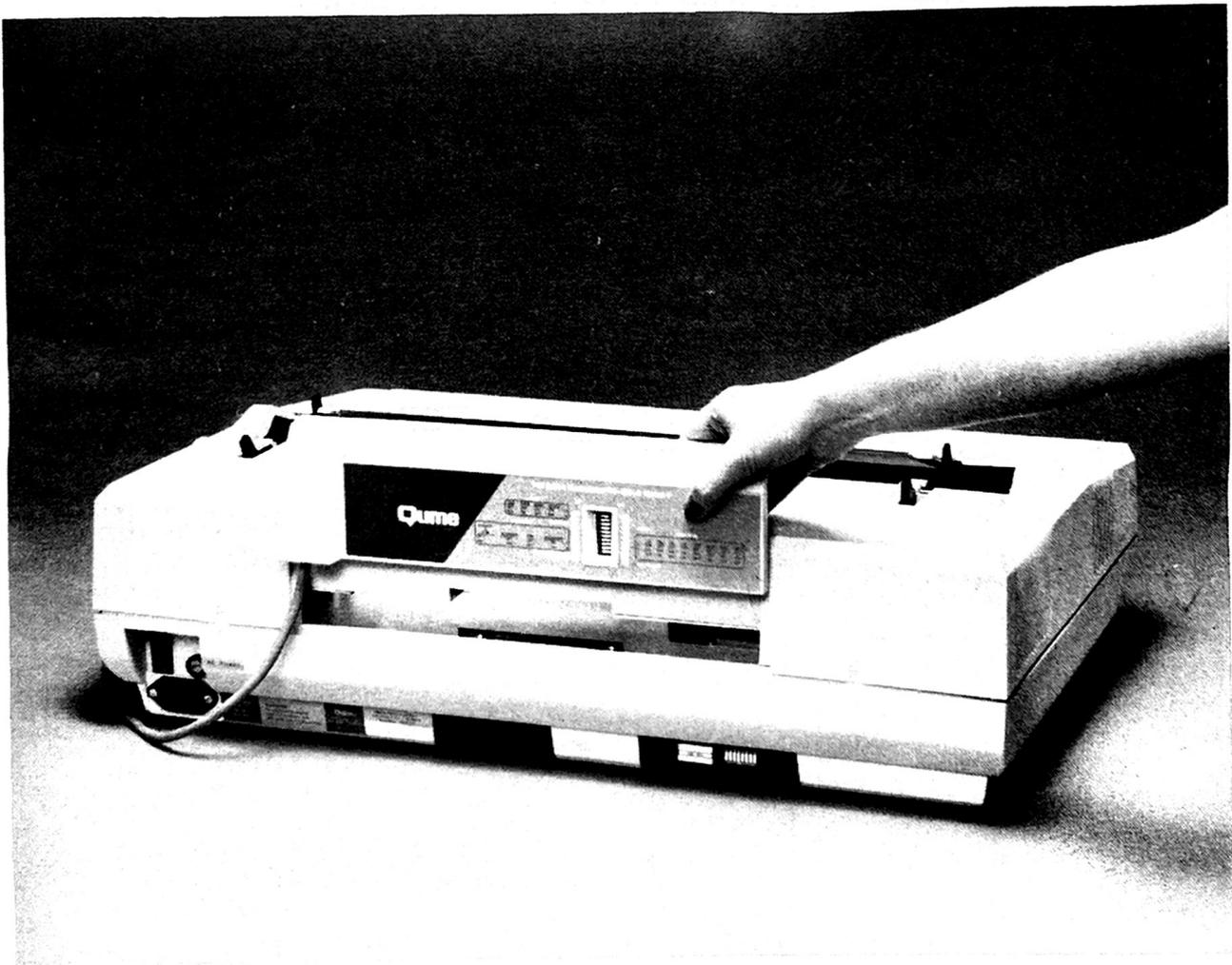
INSTALLING THE QUME CONNECTION - CENTRONICS MODEL 1

Instructions for unpacking the Qume printer are provided with the printer. Follow those instructions and unpack the printer.

CAUTION

Make sure the metal shipping strap and the two mounting screws on the bottom of the printer, and the plastic carriage restraint (on the carriage rail) are removed before you operate the printer.

Make sure the AC power to the printer is turned off. Install The QUME CONNECTION in the printer. Do not connect the computer to the printer at this time--the printer will be tested by itself first. The QUME CONNECTION module plugs into the rear of the printer, as shown in the illustration below. Power is supplied to the QUME CONNECTION from the printer.



0103

Figure 1. Installing the QUME CONNECTION in the Printer

master microcomputer and exercises the printing mechanism and supporting electronics in your Qume printer. To initiate Printer Self Test, turn on the power to the printer while pressing the Form Feed switch. The Qume printer will perform an initialization sequence (you will see the carriage move to the left) and then will begin continuously printing lines of all of the characters on the printwheel in a "barber pole" swirl.

Note that the barber pole printing will always be in 10 pitch (10 characters per inch). Once the printer begins printing, you can release the Form Feed switch. The printer will continue printing until power is turned off or until the Form Feed switch is pressed and held as the printer completes a line of characters.

Terminal Self-Test

The Terminal Self-Test is a more extensive diagnostic test than the Printer Self-Test. Terminal Self-Test is executed entirely by the QUME CONNECTION's control microcomputer. Not only are the printing mechanisms exercised, but the terminal microcomputer and supporting circuits are also tested. Hence, successful completion of Terminal Self-Test indicates that both the printer and the QUME CONNECTION are functioning properly.

CENTRONIC VERSION 1.2

```

MODULE DIP SWITCH: 1111111111      MAIN BOARD DIP SWITCH: XX111111      FRONT PANEL DIP SWITCH A: 1111      SWITCH B: 0111
0: ON      1: OFF      X: DON'T CARE
INV. DATA STROBE: OFF
INHIBIT SEL/DESEL: OFF
INHIBIT DELETE: OFF
AUTO CR on LF or FF : OFF
STOP PRINT ON PAPER OUT: OFF
INHIBIT PRIME: OFF
AUTO CR & LF ON RIGHT MARGIN: OFF
BIDIRECTIONAL PRINTING: OFF
TWINTELLECT: OFF
LINES PER INCH: 6
AUTO LF on CR : OFF
FORM LENGTH: 11"
CHARACTER SPACING: 10
    
```

```

|!#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[*]° °abcdefghijklmnopqrstuvwxyz$%t~
|!#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[*]° °abcdefghijklmnopqrstuvwxyz$%t~
|!#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[*]° °abcdefghijklmnopqrstuvwxyz$%t~
|!#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNPOQRSTUVWXYZ[*]° °abcdefghijklmnopqrstuvwxyz$%t~
    
```

690-A

Figure 3. Character Printout from Terminal Self-Test

INSTALLING THE QUME CONNECTION

You can initiate a Terminal Self-Test by pressing and holding the Pause switch while the power to the printer is turned on. Once the Self-Test begins, release the switch. When the QUME CONNECTION's microcomputer receives a Self-Test command via the PAUSE switch, the module's microcomputer commands the printer microcomputers to execute an initialization sequence (the carriage should move to the left side of the printer). The terminal microcomputer then tests its Read Only Memory (ROM) with a checksum routine and tests its Random Access Memory (RAM) by writing bit patterns into memory and reading them back. If an error is detected in either ROM or RAM, the terminal's audible alarm will sound continuously and the test will halt.

The printer will then print the software version number, the current DIP switch settings, the current options selected, and finally lines of all the characters on the printwheel. Note that the binary representation of the module and the main board DIP switches begins with the highest switch (e.g., switch 10 on the module DIP switch; switch 8, "X", on the main board DIP switch) and ends with the lowest (switch 1). The printout for front panel DIP switches A and B begins with switch 1 and ends with switch 4.

The character printout will continue until the power is turned off or until the PAUSE switch is pressed twice. Now, connect the printer to your computer system as described in the next section.

HOOKING UP THE PRINTER TO YOUR COMPUTER

The QUME CONNECTION - Centronics Model 1 interface module accepts ASCII data in seven-bit parallel bytes (the printer ignores the eighth bit). The electrical connections are the same as those used in most Centronics-type interfaces. If you have a "Centronics-type" interface, the QUME CONNECTION should work without any hardware modifications of your computer system. Plug your computer interface into the QUME CONNECTION. You now need to set switches on the QUME CONNECTION and on the Qume printer.

The identification and timing of the parallel interface signals are described in Appendix G. You need this information if you have to make a connecting cable or if you are designing an interface.

SWITCH SETTINGS

There are three sets of DIP switches which need to be set to configure the printer to your computer system:

1. The switches on the QUME CONNECTION module set functions which are unique to the Centronics-type interface. They primarily affect communications with your computer. If you cannot get the printer to work with your computer, these switches may not be set correctly for your system.
2. The switches on the rear of the printer set printing functions. For most printing, turn on switch 5 (Bidirectional Printing) and leave the other switches off.
3. The switches behind the front panel (remove the operator access panel)

set line and character spacing, form length, and automatic line feed when a carriage return is received. These are the functions most frequently changed. The common settings are: 11 inch form length, 12 pitch, 6 lines per inch spacing, and Auto Line Feed Off.

There are two important rules the printer follows with these switches:

1. The printer needs to be reset (power-up or software reset command) before the switches are read by the printer. If you change switch settings, the printer will not read the new setting until the printer is reset. PITCH, AUTO LF, and 6 or 8 LINES/INCH are the only exceptions to this rule; the printer reads the status of these switches constantly.
2. Many switch functions can also be overridden by a command sequence. For example, the Auto Line Feed function can be turned on or off either by one of the DIP switches or by your computer issuing the proper command. Commands from your computer will override the switch settings. When a function command is received from your computer, the printer does not have to be reset. Usually you will set the function by switch. But some application software may also set or change the function during a program.

QUME CONNECTION DIP Switches

INVERTED DATA STROBE (switch 10) - The QUME CONNECTION module has a set of 10 DIP switches. The top switch is used to set the polarity of the strobe pulse which latches data from your computer into the QUME CONNECTION. This pulse is normally active TTL low. (The pulse goes from high to low and back to high). Set the DIP switch in the OFF position for a normal low-going pulse. If your computer sends an active high pulse as a strobe, change the setting of the DIP switch. The printer will not work if this switch is incorrectly set. Try the normal setting first. If that doesn't work, try the inverted setting. If neither setting works, there is some other problem.

INHIBIT SELECT/DESELECT (switch 9) - When this switch is OFF, the printer is selected or deselected whenever it receives the character 11H (DC1) or 13H (DC3) respectively. With this switch in the ON position, the 11H and 13H characters are interpreted as data rather than select/deselect characters. This switch is normally placed in the ON position.

INHIBIT DELETE (switch 8) - This switch selects the fate of a DELETE character when it is received by the QUME CONNECTION. DELETE may be ignored (Inhibit Delete ON) or DELETE may be used to reset the QUME CONNECTION (an internal software reset -- the printer will not lose a downloaded Twintellect table but all of the printing parameters such as tabs will be lost). Most letter quality printer software applications do not use the DELETE character. However, some software written for a dot matrix printer may use DELETE to reset the printer.

AUTO CR ON LF OR FF (switch 3) - When this function is selected, the printer performs a Carriage Return (move the carriage to the left margin) when a Line Feed or Form Feed is received. Some software applications do not issue a Carriage Return when a Line Feed or Form Feed is issued.

INSTALLING THE QUME CONNECTION

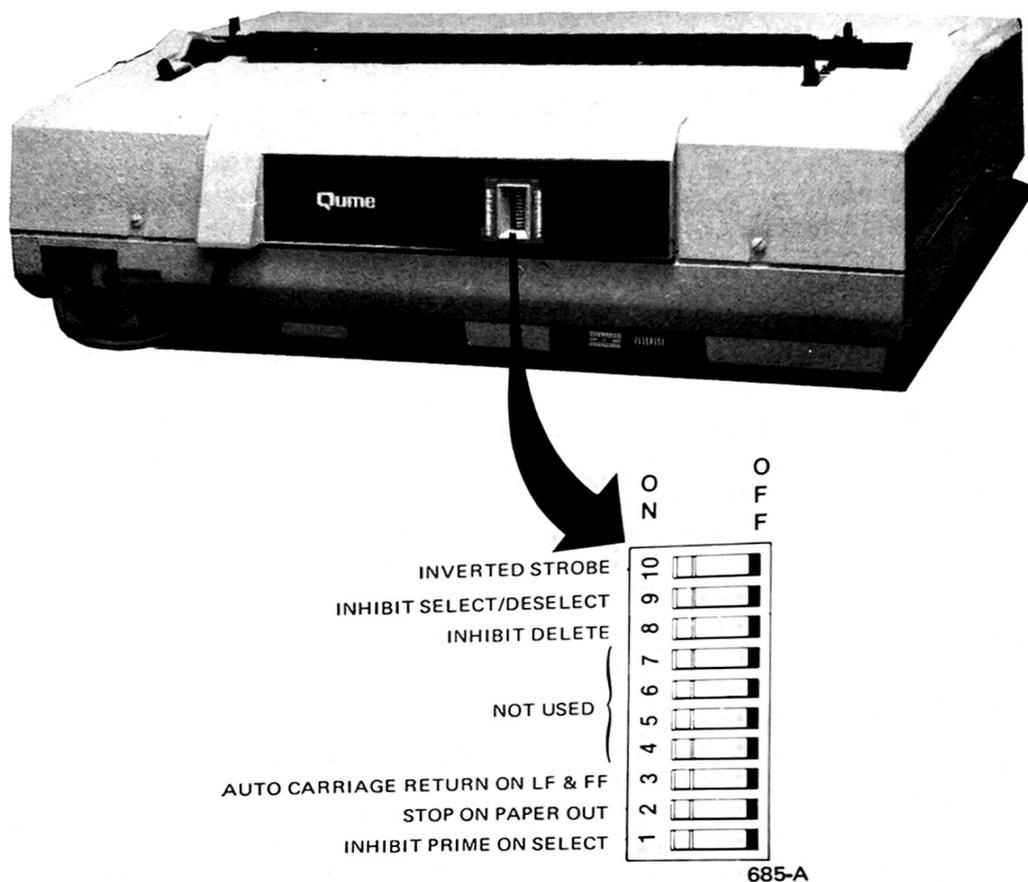


Figure 4. QUME CONNECTION DIP Switches

STOP ON PAPER OUT (switch 2) - A paper out sensor must be installed (on a bidirectional tractor or sheet feeder accessory). If a paper out sensor is not installed, this switch and function will be ignored by the QUME CONNECTION and printer.) When selected, printing will stop when the paper supply runs out. When not selected, printing will continue when the paper supply runs out. Regardless of switch position, an audible alarm will sound momentarily when the paper supply runs out and pin 12 on the Interface Connector will go high.

INHIBIT PRIME (switch 1) - The Prime or reset signal performs a printer initialization (the same as power-up). When this switch is OFF and switch 9 (INHIBIT SELECT/DESELECT) is OFF, the printer will be reset when selected by the computer (i.e., Printer Select is active). If this switch is ON (Inhibit Prime), the printer will not be reset when the printer is selected. Obviously, if switch 9 (INHIBIT SELECT/DESELECT) is ON, the setting of the INHIBIT PRIME switch is immaterial; the printer simply ignores the PRIME. Note that when the printer is initialized, all of the printing parameters are reset (e.g., margins are set to zero, etc.)

Printer DIP Switches

There are three sets of DIP switches (one 8 position and two 4 position) which are used to configure the printer for the requirements of the host computer system. Figure 5 shows the location and function of these switches.

TWIntelLECT SWITCHES - These switches allow printwheels with special character sequences to be used. For most English language WP and WPS type printwheels, these four switches should be OFF. Select Twintellect only if you are using a special sequence printwheel. For details refer to the Printer Program Mode discussion in the COMMAND SET section.

AUTO BIDIRECTIONAL PRINTING - When selected (on), the printer will automatically print bidirectionally (in both directions across the paper). This allows for the fastest print speed. Your computer sends text the same way for bidirectional printing as it does for printing in one direction. All of the bidirectional work is done by the printer.

AUTO CR/LF - When selected (on), and when the printer carriage reaches either the right margin or right side of the printer frame, a carriage return/line feed will be automatically generated by the printer. If not selected, the carriage will remain at the right side until the computer sends a CR/LF. (Only one line feed will be generated if this function and Auto LF are both selected.)

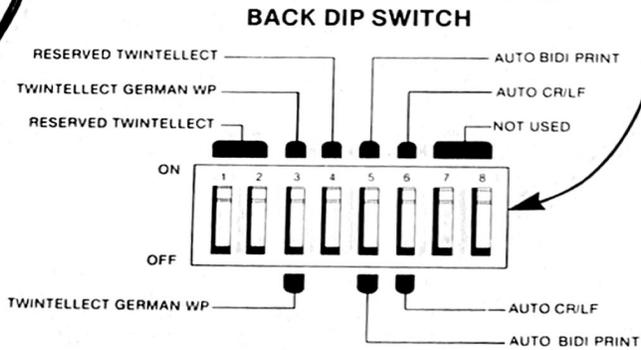
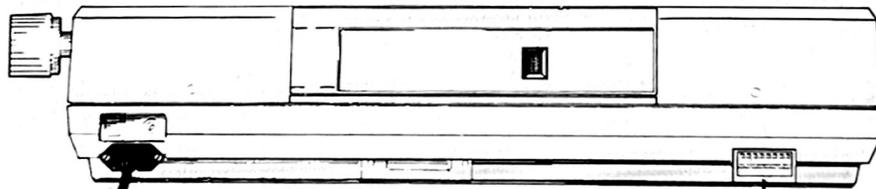
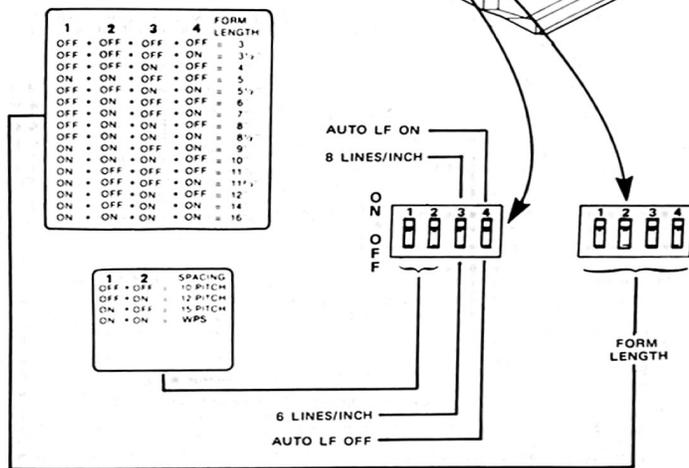
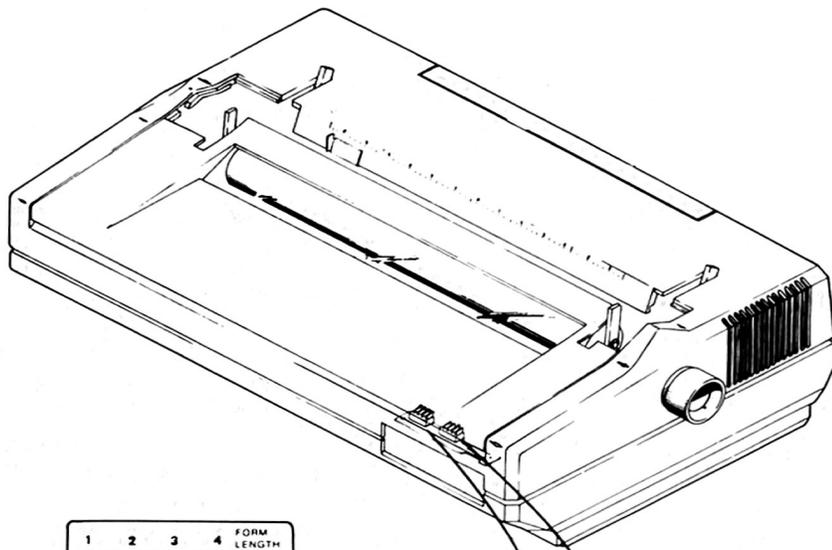
SPACING - These two switches determine the character spacing. There are four choices available: 10, 12, and 15 characters per inch (pitch) are used for fixed spacing printwheels (WP type), and WPS for proportional spacing printing. In fixed spacing printing each character occupies the same amount of space (1/10, 1/12, or 1/15 inch, as selected). In proportional spacing, the width of a character determines how much space it requires. For example, a W requires more space than a l.

LINES PER INCH - Selects 8 or 6 lines per inch vertical spacing. 6 lines per inch is common for 12 pitch printwheels.

AUTO LF - Some software programs end a line of printing with a carriage return (CR) only. Unless a line feed (LF) is also issued to the printer, the paper will not advance. When Auto LF is selected (on), the printer will advance the paper one line whenever a carriage return is received--the printer adds the Line Feed. Select this function only if the text sent by your computer does not advance the paper at the end of a line (i.e., all the lines print on top of each other).

FORM LENGTH - These four switches are set to the form length. Set this to 11 inches for a standard size business letter.

All WP printwheels, used for fixed spacing printing, have their characters arranged in the same sequence on the printwheel. WPS printwheels, used for proportional spacing, have their characters arranged in a different sequence. Therefore, WP printwheels must be used with 10, 12, and 15 pitch settings and WPS printwheels must be used with the WPS settings. A WPS printwheel used with WP (fixed) spacing (and vice versa) will cause the printing to be gibberish.



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Figure 5. Printer DIP Switch Functions

COMPUTER - PRINTER OPERATION

There are so many different computers on the market that it is impossible to give specific instructions on getting characters from the computer to the printer. However, here are some general suggestions which may help you:

1. The computer has to have a Centronics-type interface port to interface with the QUME CONNECTION. (Presumably, that's why you bought the QUME CONNECTION Centronics module).
2. Most of the popular operating systems for computers (CP/M, Apple DOS, TRS-DOS, MS-DOS, to name a few) have software for a "printer port" or "listing device". The operating system should have been customized for your particular computer by the manufacturer or dealer so that when you tell the computer to print, the operating system knows where in your computer system to send the output.

When you receive an operating system with your computer, you usually also receive some type of "set-up" or "configure" program which allows you to set-up and customize the printer output port. Check your computer reference manual for information on changing and configuring your computer for the proper output port for the printer.

If you have a Centronics interface port on your computer and you know it works (e.g., you already have a working dot matrix printer and are adding a Qume letter quality printer), you should have no hardware or software problems. Skip the rest of this page and move on to the section on Qume printer commands.

If you have a Centronics interface port on your computer but have never used it (e.g., this is your first printer), connect the Qume printer to your computer as described in the previous section of this manual and read your computer manual to learn how to send output to the printer. If you have one of the following computers or software, the commands listed below commonly cause a character to be sent to the computer's parallel printer port:

Apple II Plus: **PR#1** (slot 1 in the Apple) is commonly used for printer output; After you enter **PR#1**, the output will all be sent to slot number 1 in the Apple. The output may or may not also be sent to the monitor screen. **PR#1** can be a direct command or a command within Basic. Remember that although the Qume printer is capable of printing upper and lower case characters, the Apple II requires additional software to generate lower case characters for the printer.

CP/M Systems: Control-P toggles the printer port on and off. After entering **Control-P** once, everything you subsequently type on the keyboard should be sent to both the monitor screen and the printer. Enter Control-P again and the output only goes to the monitor screen.

The printer is probably configured as a LST: device. Find out how the printer is configured into CP/M from the dealer who sold you your computer and CP/M or from the computer manuals. Printer driver software is not supplied by Digital Research as a part of CP/M.

Microsoft Basic: **LLIST** or **LPRINT** are commands for line printer output. Output or program listings go to the printer port instead of the terminal or monitor screen. Microsoft Basic does not know anything about your particular computer printer port. It sends the character for printing to your operating system (e.g., to CP/M), which sends it to the printer port.

When Microsoft Basic is initialized, it assumes a default printer width of 80 characters. If you expect to print more than 80 characters across the paper (the Qume printer will print more), issue the following command (direct or in a program):

WIDTH LPRINT 255 (This turns off the default printer width)

IBM Personal Computer: Pressing the **Control** and **PrtSc** keys sends output to the printer as well as the monitor screen. The parallel port is generally the default printer port. Consult your IBM manuals for more information.

3. Try printing something simple, such as the following line (written in Microsoft Basic), and see if the computer actually sends characters to the printer:

LPRINT "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG'S BACK"

(Note: In Microsoft Basic, LPRINT causes the output to be sent to the computer's printer port.)

If everything is working in the computer, the printer should print the line. Move on to the Programming the QUME CONNECTION discussion if the printer successfully

If you cannot get the printer to print anything, you either have a computer problem (the computer hardware or software is not working right), or you may be using the wrong computer commands.

If you ran the Terminal Self-Test and it ran OK, the chances are very slim that the problem is in the QUME CONNECTION or Qume Printer.

If you tried to print and nothing happened but you can still enter commands (i.e., the computer is not hung up), the operating system probably ignored the print command or couldn't find a printer port. This is most likely computer-software related or else the QUME CONNECTION is ignoring the data. Make sure the computer printer strobe is going to the QUME CONNECTION strobe line.

If you tried to print and the computer hangs up (i.e., no key works except Reset on the computer), it probably means that the computer found the printer port, but that it is reading the Printer Ready line as "Not Ready" and waiting. This is most likely hardware-interface related. Compare the interface connector information in Appendix G with the printer port specifications in your computer reference manual to make sure that the pin the computer expects to see as Printer Ready is the QUME CONNECTION Printer Ready.

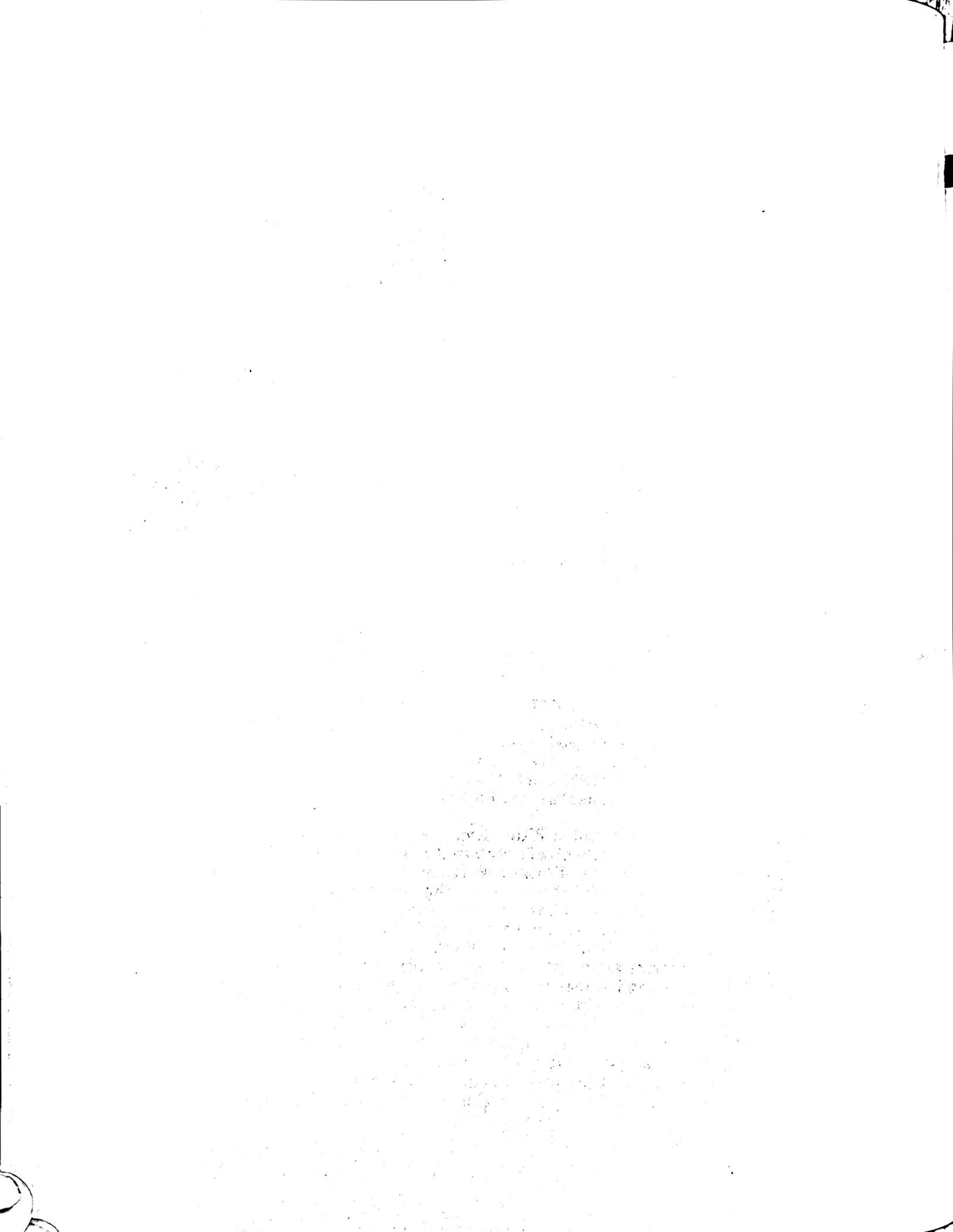
PRINTING CHARACTERS

A 96 character Qume printer has a printwheel with 96 characters. When your computer sends the printer any of the 94 ASCII codes 21 through 7E hex, the corresponding character is printed. For example, 41 hex prints an upper case. The two remaining ASCII codes, SPACE (20 hex) and DELETE (7F hex), are unique; SPACE is really a motion command and DELETE is frequently used to reset the printer. Consequently, a two code ESCape sequence is used to print the characters located at position 002 and 004 on the printwheel. See Special Character Printing in the COMMAND SET discussion for details.

THE QUME CONNECTION AND OTHER PRINTER COMPATIBILITY

The following table describes the compatibility between the QUME CONNECTION and various other printers:

<u>Printer</u>	<u>Compatibility</u>
Other Qume printers: Sprint 5 Sprint9/45-55	The QUME CONNECTION will work properly with software written for the Sprint 5 and Sprint 9/45-55. Unlike Qume's serial printers, the QUME CONNECTION Centronics module cannot respond to STATUS REQUEST commands. Several new commands have been added to the command set of the QUME CONNECTION as described in the following section.
TTY: (e.g. Teletype Corp. Model 33)	QUME CONNECTION will print all letters, numbers, and standard symbols (such as !@#\$%&*()+="?'/.,). Most special control codes are ignored (see the QUME CONNECTION DIP switch section for details).
Dot Matrix printers:	QUME CONNECTION will print all letters, numbers, and standard symbols. SPACE, LINE FEED, CARRIAGE RETURN, and FORM FEED are recognized. All other dot matrix special commands (such as elongated character printing) are ignored or used for different functions by Qume.
Diablo printers: (such as Model 630)	QUME CONNECTION uses some of the same commands, but some are different. In general, you cannot use a software driver written for a Diablo printer with a Qume printer. In the description of the command set, a notation is given after each command which indicates whether the Qume command is also used by the Diablo 630 "Generic daisy wheel software" is frequently written which uses commands common to both Qume and Diablo.



PROGRAMMING THE QUME CONNECTION

QUME PRINTER COMMANDS AND SOFTWARE COMPATIBILITY

The command set used in the QUME CONNECTION is an expanded version of the commands used in Qume Sprint 5 and Sprint 9/45-55 terminal printers. Any software which drives any of these printers will run without modification on the QUME CONNECTION.

To take advantage of the extensive command set in the QUME CONNECTION, the computer software needs to know the commands.

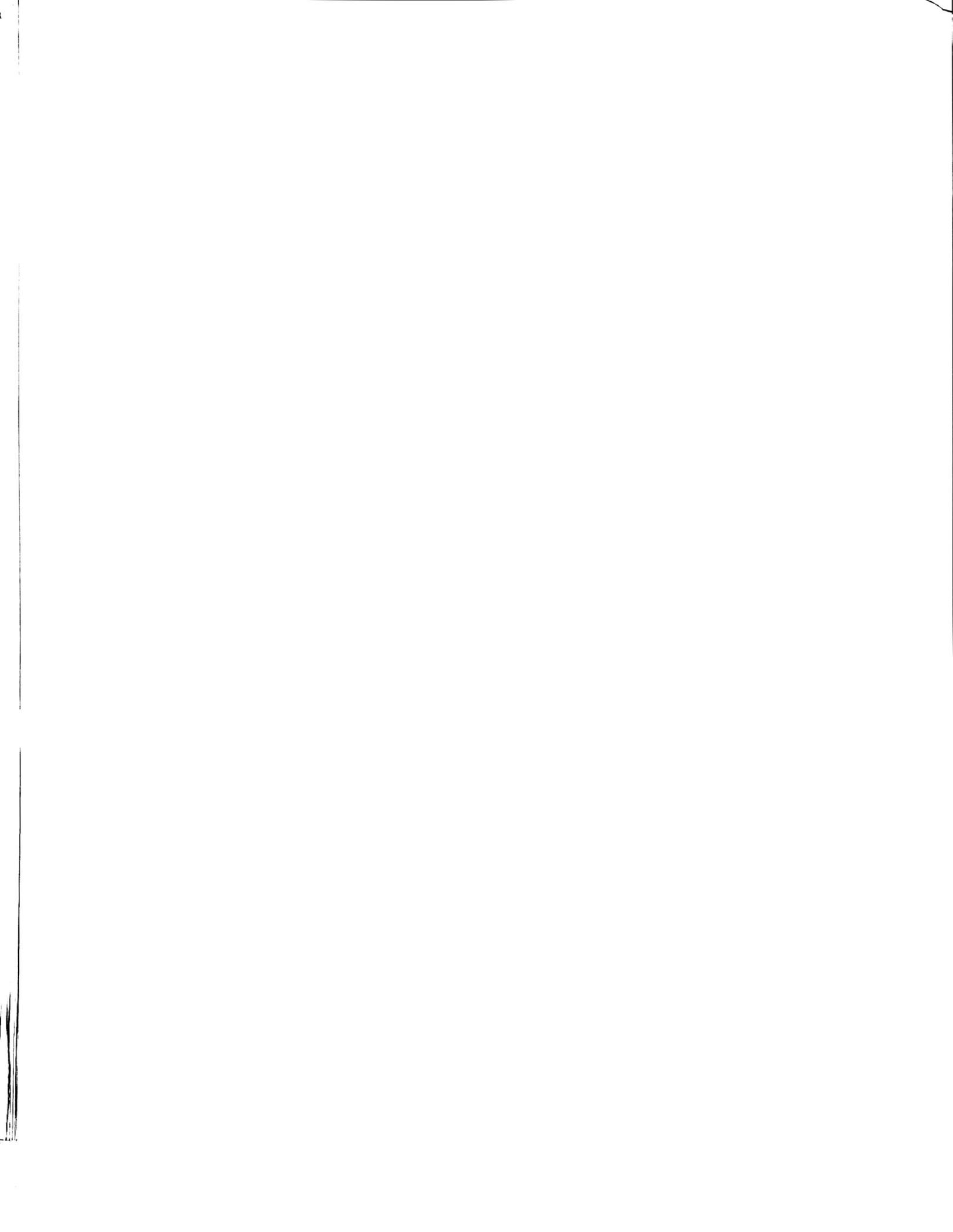
If you are primarily an end user of software, you may be able to "customize" your software to use some of the QUME CONNECTION commands. It is unlikely you will be able to make any major changes unless you have the source code to the software. Consult the software program manual to find out if the software can be customized. You would first run an installation program and select the Qume option (Sprint 5 or Sprint 9/45-55). That procedure initializes your software with the basic Qume Sprint 5 or Sprint 9/45-55 commands, which are subsets of the QUME CONNECTION command set. After that, if possible, you may be able to add several of the QUME CONNECTION commands. The commands which are not used by the Sprint 5 are identified in the Command Index on page 16 with asterisks (*) by the commands.

If you write software, the command set is described in the next section. A notation is given at the end of each command indicating the compatibility of the command with Qume Sprint 5 and Sprint 9/45-55 terminal printers as well as Diablo 630 printers. The format is as follows:

- 9 - The command is used by the Qume Sprint 9/45-55 terminal printer.
- 5 - The command is used by the Qume Sprint 5 terminal printer.
- D - The command causes the same function to happen on the Diablo 630.

If there is no notation (e.g., the 5 is missing), it means the command is not used by that printer. A missing "D" for Diablo also means that the command may be used by Diablo for another printer function.

For example, (9,D) means that the command is used by the Qume Sprint 9/45-55 and Diablo 630 printers, but not by the Qume Sprint 5.



THE COMMAND SET

This section describes in detail the Qume Connection program commands. As mentioned in the PREFACE, your application may not require a working knowledge of these program commands. For example, if you are using a prepackaged word processing program, the software manufacturer may have already incorporated those commands required to drive the printer. Many of you, however, will use your Qume printer for a variety of applications and will want to know how to select special printing features such as bold printing and graphics. If you fall into this latter category, study the following sections carefully.

In addition to the printable characters, there are over eighty commands which are recognized by the Qume Connection, ranging from SPACE to AUTOMATIC UNDERSCORE. Commands may be a single code, e.g., LF (line feed). Commands may also be sequences of two, three, four or more (e.g., relative motion commands, tab lists, downloads) codes. For the multiple code commands, you would send the printer the ESCAPE code (hex 1B) followed by one or more codes which tell the printer what to do. Some examples are:

- ESC + The two code command for setting the top margin.
- ESC SUB I A three code command for initializing the printer.
- ESC F d1 d2 A four code command for setting form length. You supply two codes, **d1** and **d2**, to tell the printer the length.

Most commands begin with the ESCape character (1B hex, 27 dec). The ESCape character tells the printer that the next character or two are special commands. The third and possibly fourth codes are variables which pass printer parameters such as vertical and horizontal distances. These are identified as **d1**, **d2**, **n1**, etc.

When commands are sent, the printer can distinguish between upper and lower case. If the command calls for upper case, the computer must send the code for an upper case letter. ESC E is not the same as ESC e.

COMMAND FORMAT

Commands are presented in three forms:

1. ASCII CODES: **ESC +** means that the ASCII ESCape code is sent, and then a plus sign character is sent. These symbols may appear on your keyboard. To clarify our examples we show a space between characters; do not send this space as part of the command.
2. DECIMAL CODES: The equivalent decimal values for the command are given. This is useful for Basic programmers. ESCape is 27 decimal, and a plus sign is 43 decimal. A program using Microsoft Basic conventions would send these values (the **ESC +** command) to the printer as follows:

```
LPRINT CHR$(27);CHR$(43);
```

3. HEX CODES: Hex values for the command are given. For **ESC +** the hex codes are **1B** and **2B**.

Commands are organized in this manual according to the following table. Some commands are repeated because they logically fall into more than one category. An asterisk (*) indicates that the command is not used by the Qume Sprint 5.

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MARGIN COMMANDS

<u>COMMAND:</u>	<u>ASCII CHAR:</u>	<u>HEX / DECIMAL</u>
SET TOP MARGIN: ESC +		1BH,2BH/27,43
SET BOTTOM MARGIN: ESC -		1BH,2DH/27,45

These commands establish the top and bottom margins anywhere within the form length (the top margin cannot go below the bottom margin, obviously).

When the printer is powered up or initialized, the printer assumes the paper is at the top of form (the top edge of the paper); the default bottom margin is the form length set by the printer DIP switches. To set the top margin, the computer system sends a series of line feed commands which move the paper until the desired top margin line (the first line of actual printing) has been reached. Then the computer issues a SET TOP MARGIN command. For example, if the top margin is to be 12 lines down from the top of the paper, the computer sends 12 Line Feeds to the printer then sends a SET TOP MARGIN command. Appendix B provides a simple Basic formatting program that shows how to set the margin.

To set the bottom margin, the computer sends a series of line feeds which correspond to the maximum number of lines to be allowed on a page (assuming we are starting from the top margin, just set.) That moves the paper to where the bottom margin (last line of print) should be. Now the computer sends a SET BOTTOM MARGIN command. When the printer receives a paper feed command (including FORM FEED) which would advance the paper to the bottom margin, the printer will automatically advance the paper to the next top margin. It is not possible to print on the bottom margin.

SET TOP MARGIN and SET BOTTOM MARGIN commands are not affected by line spacing commands. (9)

SET LEFT MARGIN: ESC 9	1BH,39H/27,57
SET RIGHT MARGIN: ESC Ø	1BH,30H/27,48

These commands set the left and right margins in the same way the top and bottom margins are set. The computer first issues a CARRIAGE RETURN command to move the carriage to the left most printing position (column 0), if the carriage is not already there from a power up. Then the computer sends horizontal move commands (such as SPACE) to move the carriage to the desired column and sends a SET LEFT MARGIN command.

To set the right margin, the computer sends horizontal move commands (such as a SPACE) to move the carriage to the desired column for the right margin and then sends a SET RIGHT MARGIN command.

At power-up or printer initialization, the left margin is the leftmost printing position (column 0), and the right margin is the right sideframe. The carriage will return to the left margin following a CARRIAGE RETURN, but the carriage can still be moved beyond the left margin with BACK SPACE and other leftward carriage move commands.

SET LEFT MARGIN and SET RIGHT MARGIN commands are not affected by character spacing commands. (5,9,D)

RIGHT MARGIN CONTROL ON: ESC O (letter)
RIGHT MARGIN CONTROL OFF: ESC Y

1BH,4FH/27,79
1BH,59H/27,89

If Right Margin Control is ON, the carriage will automatically perform a CARRIAGE RETURN after reaching the right margin Hot Zone.

The Hot Zone is a space equal to 5 character spaces preceding the right margin. A CARRIAGE RETURN and LINE FEED will be executed as soon as the first SPACE occurs within the Hot Zone. If a SPACE is not encountered in the Hot Zone, then the CARRIAGE RETURN and LINE FEED will execute as soon as a SPACE occurs after the right margin. If no SPACE occurs, then the CARRIAGE RETURN and LINE FEED will execute upon reaching the end of the platen. Note that the right margin location is not affected by the horizontal space increment definition (column width, pitch).

RIGHT MARGIN CONTROL commands are not affected by the AUTO LF mode. (5,9)

LINESPACING (VERTICAL) COMMANDS**DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS: ESC L d1 d2**

1BH,4CH/27,76

Normally, the line feed distance is set by the printer which reads the DIP switches (6 or 8 lines per inch) upon power up or printer initialization. However, line feed distance may also be set by a software command from the computer.

This four code command is used to define the line feed distance in 1/48 inch increments. To find **d1** and **d2** you must first know the line feed distance in 1/48 inch increments. For example, 3 inches = 144/48 inches.

d1 is the hex equivalent of the tens; **d2** is the ones.

In the example above, there are 14 tens in 144. (The integer of 144/10 is 14.) 14 decimal = E hex. Hence, **d1** is E. **d2** is 4. Consequently, the computer sends the printer ESC L E 4, a sequence of four ASCII characters. When the line feed distance is 99/48 inch or less, no hex conversion is necessary since 0 to 9 is the same in hex or decimal.

Invalid parameters are ignored; maximum distance is 159/48 inches. If either **d1** or **d2** is zero, the digit 0 must be entered. You must, for example, send 09 and not 9. (5,9)

This command does not affect the margins or the absolute value of the form length.

**DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS,
ALTERNATE: ESC RS (distance + 1)**

1BH,1EH/27,30

This command provides another method of defining line spacing, but the maximum distance is 125/48 inch.

For example, 1/4 inch = 12/48 inch. Add 1 to 12 = 13. The computer sends ESC RS (13), or 1B 1E 0D hex.

The equivalent Basic command would be **LPRINT CHR\$(27);CHR\$(30);CHR\$(13);**
(5,9,D)

SET FORM LENGTH: ESC F d1 d2

1BH,46H/27,70

Normally, form length is set by the printer DIP switches, which are read on power-up or printer initialization. However, the form length may also be set by software command from the computer.

Form length may be a distance of $1/6$ inch to $127/6$ inches ($21 \frac{1}{6}$ inches). **d1** and **d2** are determined the same way as the LINE FEED INCREMENTS above, except that $1/6$ inch increments are used, not $1/48$ inch.

d1 represents the hex character of the tens. **d2** is the ones. For example, a form length of 17 inches = $102/6$ inches. 102 has 10 tens and 2 ones. Therefore, **d1** = A (the hex equivalent of 10 decimal), and **d2** = 2. The computer sends ESC F A 2.

Whenever the form length is changed, the current vertical position is set as the top of form and the top margin. The bottom margin is set at the end of form.

Note that before the SET FORM LENGTH command is sent, you should physically adjust the paper to the top of form because the printer is going to assume the current paper location is top of form. (5,9)

AUTO CARRIAGE RETURN/LINE FEED ON: ESC W 1BH,57H/27,87
AUTO CARRIAGE RETURN/LINE FEED OFF: ESC Z 1BH,5AH/27,90

Normally, this function is selected by a printer DIP switch. The computer may also select or change this function.

Selecting AUTO CARRIAGE RETURN/LINE FEED (on) will cause the printer to automatically perform a CARRIAGE RETURN and a LINE FEED when the carriage reaches the right margin (or right printer side if right margin is not set).

If the printer is in either Graphics mode, the Auto Carriage Return/Line Feed mode is ignored. (5,9)

AUTO LINE FEED ON: ESC comma 1BH,2CH/27,44
AUTO LINE FEED OFF: ESC period 1BH,2EH/27,46

Normally, this function is selected by a printer DIP switch. The computer may also select or change the function.

When AUTO LINE FEED is selected (ON) and the printer receives a CARRIAGE RETURN, the printer will also perform a LINE FEED. This is an extremely useful function if the computer sends only a CARRIAGE RETURN at the end of a line. If this function is selected and the computer sends a CR and LF, the printer will add another LF and double space the print. (5,9)

CHARACTER SPACING (HORIZONTAL) COMMANDS**DEFINE HORIZONTAL SPACE INCREMENTS: ESC E d1 d2**

1BH,45H/27,69

This command changes the distance the carriage moves after a character is printed or whenever the computer issues a SPACE or BACKSPACE command. This distance is normally determined by the pitch setting from the printer DIP switches. For 10 pitch (10 characters per inch) printwheels, the carriage moves 1/10 inch. In WPS mode carriage movement is proportional to the width of the character, and SPACE and BACKSPACE commands always cause the carriage to move 1/12 inch.

The distance of this horizontal movement is changed by the computer when a DEFINE HORIZONTAL SPACE INCREMENT command is issued. This command will override the previous setting (DIP switch or command). A maximum increment of 159/120" is possible.

d1 and **d2** are determined in the same way as the line feed spacing, except that the distances are in 1/120 inch instead of 1/48 inch.

d1 represents the hex character of the tens; **d2** is the ones.

Since this command defines spacing, it will also affect the location of tabs. For further important information on this subject, refer to the HORIZONTAL TAB STOP command description. (5,9)

DEFINE HORIZONTAL SPACE INCREMENTS**ALTERNATE: ESC US (distance + 1)**

1BH,1FH/27,31

This command defines the SPACE distance the same way the ALTERNATE VERTICAL SPACING (LINE FEED) INCREMENT, ALTERNATE works. The horizontal distance is measured in 1/120 inches. This command allows a maximum increment of 125/120". Refer to the DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS, ALTERNATE section for details on calculating the distance parameter in this command. (5,9,D)

WPS ON: ESC \$

1BH,24H/27,36

WPS OFF: ESC %

1BH,25H/27,37

Normally, pitch (character spacing) is determined by the setting of the printer DIP switches. The pitch must match the type of printwheel used. WP printwheels use 10, 12, or 15 pitch; WPS printwheels are used for proportional space printing and must use the WPS setting. Proportional spacing means that the space a character occupies depends on the width of the character. For example, the letter M is wider than the number 1; therefore, the carriage moves more for an M than for a 1. Using these commands, your computer can turn WPS on or off. Note that these commands take precedence over the setting of the pitch DIP switches.

Columns are established and defined at 12 pitch or according to the DEFINE HORIZONTAL SPACING INCREMENTS command. (9,D)

TAB COMMANDS

SET HORIZONTAL TAB STOP: ESC 1
 CLEAR HORIZONTAL TAB STOP: ESC 8

1BH,31H/27,49
 1BH,38H/27,56

The Qume printer has electronic tabs in the same way a typewriter has mechanical tab stops. The computer may set or clear the tabs by command. Tabs are column dependent, and their physical position across the page will be a function of the pitch setting (character spacing). For example:

- At 10 pitch there are a total of 132 possible tabs.
- At 12 pitch there are a total of 158 possible tabs.
- At 15 pitch there are a total of 197 possible tabs.

Tabs will always track the pitch setting. A tab set at column 50 will always be at column 50. If a tab is set for column 150 at 12 pitch, and the pitch is changed to 10 characters per inch, the tab will be moved beyond the right end of the platen since there are only 132 tab positions at 10 pitch. In this case, a tab to column 150 will cause the carriage to move to column 132, or the last column on the page. You should anticipate this effect when changing pitch (character spacing). Remember that the printer stores the tabs as column numbers and not as physical locations. The maximum number for a tab stop column is 200. Columns after number 200 cannot be used for tab stops.

To set a tab stop, the computer moves the carriage to the desired column and then issues the SET HORIZONTAL TAB STOP command. To clear an individual tab stop, a CLEAR HORIZONTAL TAB STOP is sent instead of the SET command. (5,9,D)

CLEAR ALL HORIZONTAL TAB STOPS: ESC 2

1BH,32H/27,50

This command will clear all horizontal tab stops. The printer clears the tab stops by erasing a table in its memory. Tab stops will also be cleared following a restore command or when the printer is powered up. (5,9,D)

SET TAB LIST: ESC (list
 CLEAR TAB LIST: ESC) list

1BH,28H/27,40
 1BH,29H/27,41

This command allows the computer to set or clear up to 159 tabs at one time. To implement the SET TAB LIST function, the computer transmits ESC (, and then follows with a series of two digit values from 00 to F9, where the first character is the hex equivalent of the tens and the second is the ones. This value is not a hex value (e.g., F0 is NOT 240 decimal) but the same value used in the vertical line spacing command. Each value represents a column where a tab is to be set. After each value, the computer must transmit an ASCII comma, and the last value must be followed by an ASCII period.

THE COMMAND SET

For example:

- Set tab stops at columns 05, 43, 79 104, 109 (all decimal).
- The characters to be sent will be 05, 43, 79, A4, A9.
- The command is ESC (0 5 , 4 3 , 7 9 , A 4 , A 9 .
- In Basic, the command would be as follows:

```
LPRINT CHR$(27);CHR$(40);"05,43,79,A4,A9.";
```

Tab stops set in this manner are subject to the same factors that affect the SET HORIZONTAL TAB STOP command. Refer to that command description for important details. Tab stops set in this manner may be listed in any order. (5,9)

PAPER MOVEMENT (VERTICAL MOTION) COMMANDS

LINE FEED: LF 0AH/10

Paper is moved one linespace. The line feed distance is determined by one of the following:

- LINE SPACE switch setting
- DEFINE VERTICAL SPACE INCREMENT - ESC L (d1) (d2)
- DEFINE VERTICAL SPACE INCREMENT, ALTERNATE - ESC RS (n)

In both GRAPHICS ON modes (1/60" and 1/120") LINE FEED distance equals 1/48". (5,9,D)

NEGATIVE LINE FEED: ESC LF 1BH,0AH/27,10

This command will cause the paper to move backward to the previous line. The negative line feed distance is determined by the same commands which define the line feed distance. In both GRAPHICS ON modes (1/60" and 1/120") negative line feed distance equals 1/48". (5,9,D)

1/2 LINE FEED: ESC U 1BH,55H/27,85

Paper is moved one-half linespace. This command is frequently used for subscripts. If the line feed distance has been defined as an odd number of 1/48 inch increments, then a 1/2 LINE FEED command will move paper half the line feed distance rounded down to the next lowest 1/48" increment. (5,9,D)

NEGATIVE 1/2 LINE FEED: ESC D 1BH,44H/27,68

Paper is moved one half linespace in the direction opposite to a LINE FEED operation. This command is frequently used for superscripts. If the line feed distance has been defined as an odd number of 1/48 inch increments, then a NEGATIVE 1/2 LINE FEED command will move paper one half the line feed distance rounded down to the next lowest 1/48" increment. (5,9,D)

AUTO CARRIAGE RETURN/LINE FEED ON: ESC W 1BH,57H/27,87
AUTO CARRIAGE RETURN/LINE FEED OFF: ESC Z 1BH,5AH/27,90

The AUTO CARRIAGE RETURN/LINE FEED ON command causes the printer to automatically issue a carriage return/line feed when the printer carriage reaches either the right margin or right side of the printer frame. If this command is turned OFF, the carriage remains at the right side of the printer frame until the computer sends a CR/LF. Note that only one line feed is generated if both this function and AUTO LF are both selected.
(5,9)

ABSOLUTE VERTICAL TAB TO A LINE NUMBER: ESC P d1 d2

1BH,50/27,80

This command moves paper either up or down to a line number specified by **d1 d2**, a two digit number which can define a maximum of 127 line locations. **d1** and **d2** are the hex value of the tens and the value of the ones, respectively (the same as the LINE SPACE INCREMENT value used earlier). Line numbering begins at the Top of Form, Line 00. For example, to move the paper to Line 117:

d1 is 11 tens, or B in hex; **d2** is 7. The command is **ESC P B 7**.

This command is directly or indirectly affected by the following:

- LINE SPACE switch setting
- DEFINE VERTICAL SPACE INCREMENT: ESC L d1 d2
- DEFINE VERTICAL SPACE INCREMENT, ALTERNATE: ESC RS (n)
- FORM LENGTH switch settings
- SET FORM LENGTH: ESC F d1 d2
- SET BOTTOM MARGIN: ESC -
- SET TOP MARGIN: ESC +

(5,9)

**ABSOLUTE VERTICAL TAB TO A LINE NUMBER
ALTERNATE: ESC VT (distance + 1)**

1BH,0BH/27,11

This method of moving the paper to a line number uses the same method as the alternate method of specifying the line spacing used earlier. The command defines a maximum line number of 125.

For the example, to move the paper to line 117, the Basic command is

LPRINT CHR\$(27);CHR\$(11);CHR\$(118);

This command is directly or indirectly affected in the same manner as the ABSOLUTE VERTICAL TAB TO A LINE NUMBER: ESC P d1 d2 command. (5,9,D)

RELATIVE VERTICAL (PAPER FEED) MOTION: ESC V n1 n2 n3

1BH,56H/27,86

This command moves paper up or down in increments of 1/48", to a maximum of 1791/48" (37.3"). **n1 n2 n3** is the hex value of the distance represented by 3 ASCII characters. The characters used for the hex value are offset by an ASCII bias:

1. **n1** is the number of 256's plus: ASCII '@' (40 hex), for right or up; ASCII 'P' (50 hex), for left or down.
2. **n2** is the number of 16's plus ASCII '@' (40 hex).
3. **n3** is the number of ones plus ASCII '@' (40 hex). (5,9)

Our example will show how to move the paper up a distance of 10 inches (from its current line number).

1. First determine the number of 1/48" in 10": 480.
2. $480 = (\underline{1} \times 256) + (\underline{14} \times 16) + (\underline{0} \times 1)$. The three values will be based on the underlined numbers 1, 14, and 0.
3. Convert 1, 14, and 0 decimal to hex base: 1=1, 14=E, 0=0. These two steps converted 480 decimal to 1E0 hex.
4. Add 40 hex: 1+40=41 (the n1 value). E+40=4E (the n2 value); 0+40=40 (the n3 value).
5. The command is ESC V A N @, or hex: 1B 56 41 4E 40

FORM FEED: FF

0CH/12

This command moves paper to the next top of form. If top and bottom margins are set, the paper will move to the top margin of the next form. The form length distance is determined by one of the following:

- FORM LENGTH switch setting (printer DIP switches)
- SET FORM LENGTH: ESC F d1 d2 program command.

A FORM FEED will terminate the Underscore mode.

If Qume's Mechanical Sheetfeeder is installed on the printer, a FORM FEED command will automatically eject the sheet of paper currently in the printer, load the next sheet of paper, and move the loaded sheet of paper to the desired print position. (5,9,D)

CARRIAGE MOVEMENT (HORIZONTAL MOTION) COMMANDS**HORIZONTAL TAB: HT**

09H/9

This command causes the carriage to move to the first set tab stop to the right.

If no tab stops have been set to the right of the current carriage position, the carriage will move to the end of the platen. (5,9,D)

ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER: ESC C d1 d2

1BH,43H/27,67

This command works the same way as the ABSOLUTE VERTICAL TAB TO A LINE NUMBER command. This command moves the carriage to a specific column with the range of 0 to 159. **d1 d2** is a two digit number that can represent any column in this range. **d1** is the hex value of the tens; **d2** is the value of the ones. As an example, to move the carriage to column number 130:

d1 is 13, which is hex C. **d2** is 0.

The command is ESC C C 0. In Basic: **LPRINT CHR\$(27);"CC0";**

Columns are space distant dependent. An ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER is therefore affected by the same switches and set-up and define commands that affect the SPACE command. Refer to the SPACE command for detailed information. Any attempt to tab to a column number beyond the right end of the platen will cause the carriage to move to the right end of the platen.

In the WPS mode, columns are defined at 12 pitch or according to the DEFINE HORIZONTAL SPACING INCREMENTS command.

HORIZONTAL TAB commands are affected by, or affect, the following:

- SET HORIZONTAL TAB STOP: ESC 1.
- TAB SET LIST: ESC (list
- DEFINE HORIZONTAL SPACING INCREMENTS: ESC E d1 d2
- DEFINE HORIZONTAL SPACING INCREMENTS, ALTERNATE: ESC US n
- PITCH switch
- Motion minimization
- AUTO UNDERSCORE mode. (5,9)

ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER
ALTERNATE: ESC HT (column number + 1)

1BH,09H/27,9

This command moves the carriage to a specific column within the range of 0 to 125. For example, the following Basic commands move the carriage to column 56.

DISTANCE = 56 + 1
LPRINT CHR\$(27);CHR\$(9);CHR\$(DISTANCE); (5,9,D)

RELATIVE HORIZONTAL CARRIAGE MOTION: ESC H n1 n2 n3

1BH,48H/27,72

This command works the same way as the RELATIVE VERTICAL MOTION command. This command moves the carriage left or right any number of 1/120" increments between 0/120" and 1584/120". Refer to the examples in the RELATIVE VERTICAL MOTION command to determine **n1 n2 n3**.

Commands which would cause the carriage to move beyond the platen limits are ignored. Motion minimization is in effect. (5,9)

BACKWARD PRINT: ESC 6

1BH,36H/27,54

This command reverses the normal carriage motion direction. The BACK SPACE will cause the carriage to move from left to right. The HORIZONTAL TAB, RELATIVE HORIZONTAL CARRIAGE MOTION, and ABSOLUTE HORIZONTAL TAB commands are not affected. In addition, this command does not alter any vertical motion direction.

This command is terminated by the FORWARD PRINT command or a CARRIAGE RETURN command. If the CARRIAGE RETURN is used to terminate backward printing, the carriage will return to the left margin. (5,9,D)

FORWARD PRINT: ESC 5

1BH,35H/27,53

This command is used to terminate the BACKWARD PRINT mode commands. (5,9,D)

AUTO BIDIRECTIONAL PRINTING ON: ESC <
AUTO BIDIRECTIONAL PRINTING OFF: ESC >

1BH,3CH/27,60
 1BH,3EH/27,62

These commands place the printer in the Automatic Bidirectional Printing mode. This function is normally selected by a DIP switch, but the function may also be selected or changed by the computer.

The printer is more efficient if it prints in both directions. To do this received characters are stored in a buffer in the printer until a CARRIAGE RETURN or LINE FEED character is received (indicating the end of a line of text). Then the printer actually prints the line. For the bidirectional mode to work the printer buffer has to be kept partially full. If the printer processes all of the characters in the buffer, it will move the carriage back to the left margin when it finds the CARRIAGE RETURN character. None of this work is of any concern to your computer system; it is all done inside the printer. Bidirectional printing may be turned off either by the DIP switch on the printer or by this command.

The AUTO BIDIRECTIONAL PRINTING command takes precedence over the setting of the AUTO BIDIRECTIONAL PRINTING switch. Also note that when UNDERSCORE ON or tabs are used, the carriage moves only from left to right. (9)

SPACE: SP

20H/32

This is the standard command which moves the carriage one space (between words, for example). There is nothing complicated about the command but the printer follows rules in determining how far and in what direction the carriage is going to be moved:

- The PITCH switch determines the distance of a column width. In 10 pitch the distance will be 1/10 inch; for 12 pitch 1/12 inch; for 15 pitch 1/15 inch; for WPS (proportional spacing) 1/12 inch.

DEFINE HORIZONTAL SPACING INCREMENT commands will override the pitch switch or the previous setting.

- A SPACE in the BACKWARD PRINT mode will move the carriage to the left.
- Commands which affect the SPACE distance and direction are:

AUTO CARRIAGE RETURN/LINE FEED switch
 AUTO BIDIRECTIONAL PRINTING switch
 AUTO BIDIRECTIONAL PRINTING ON: ESC <
 BACKWARD PRINT: ESC 6, or FORWARD PRINT: ESC 5
 AUTO CARRIAGE RETURN/LINE FEED ON - ESC W
 GRAPHICS ON 1/60": ESC 3, or GRAPHICS ON 1/120": ESC G
 RIGHT MARGIN CONTROL ON: ESC 0

(5,9,0)

BACKSPACE: BS

08H,8

This command causes the carriage to move one space in the opposite direction of SPACE. Normally BS moves the carriage to the left (except in backward print mode). Back space distance and direction are affected by the same control switches and commands as the SPACE command. Note that in the WPS mode, all backspace commands are fixed at 1/12". Do not confuse backspace with DELETE or RUBOUT. (5,9,D)

BACKSPACE 1/120": ESC BS

1BH,08H/27,8

This command causes the carriage to move 1/120" (normally to the left). Setting the horizontal increment to 1 and using BACKSPACE provides equivalent movement. (5,9,D)

CARRIAGE RETURN: CR

0DH/13

This is the standard "end of line" command. This command causes the carriage to move to the left margin. The CARRIAGE RETURN command terminates the following printer modes:

GRAPHICS ON, 1/60": ESC 3
 GRAPHICS ON, 1/120": ESC G;
 BACKWARD PRINT: ESC 6

The CARRIAGE RETURN affects, or is affected by, the following functions:

AUTO CARRIAGE RETURN/LINE FEED switch and command
 AUTO BIDIRECTIONAL PRINTING switch and command
 RIGHT MARGIN CONTROL ON: ESC 0
 UNDERSCORE ON: ESC I.

Refer to the appropriate control switch or command description for more detailed information. (5,9,D)

PRINTING COMMANDS

UNDERSCORE ON: ESC I
UNDERSCORE OFF: ESC J

1BH,49H/27,73
 1BH,4AH/27,74

In the Underscore (underline) mode, the printer will automatically underscore characters, words, phrases, sentences, paragraphs, etc. as identified by the host system.

When the Underscore mode is turned ON, the printer will underline all text following the UNDERSCORE ON command until the UNDERSCORE OFF command is received.

The printer does not underline each character as received but waits until it receives a Carriage Return, any paper motion command, or UNDERSCORE OFF and goes back and underlines all of the text which is to be underlined.

The following functions will also occur:

- Horizontal space that is tabbed over will be underscored.
- Bold Overprint mode ON will cause multiple strike underscores.
- Moving the carriage to the left of the Underscore mode "start" point before causing underscore execution may have unexpected results.
 (5,9)

BOLD OVERPRINT ON: ESC K d
BOLD OVERPRINT OFF: ESC M

1BH,4BH/27,75
 1BH,4DH/27,77

This command will cause the print hammer to fire **d** times for each printed character before the carriage is moved to the next character's position. **d** is a number between 1 and 4. The procedure for overprinting text three times is:

- Send an ESC K 3, or LPRINT CHR\$(27);CHR\$(75);"3";
- All of the text will be overprinted 3 times until BOLD OFF is sent or until **d** is changed.

SHADOW PRINT ON: ESC Q
SHADOW PRINT OFF: ESC R

1BH,51H/27,81
 1BH,52H/27,82

This command will cause all characters to be printed twice, with the second printing occurring 1/120" from the first. The darker headings in this manual are printed with shadow print. What word processors and similar software call "bold" may actually be shadow print.

After SHADOW PRINT ON is sent, all text will be printed with shadow print until SHADOW PRINT OFF is received.

The printer observes the following rules:

WPS mode: Spacing is not adjusted to accommodate the additional 1/120" displacement. Consequently, a line of WPS text will be longer when SHADOW PRINT is ON than when SHADOW PRINT is OFF.

Non-WPS mode printing: Character spaces will be reduced to maintain column integrity.

Backward Printing mode: The primary character is printed first, then the shadow character.

In Bold Overprint mode and Shadow Print Mode: The first character will overprint, the second will single print.

(9)

NO PRINT ON: ESC S
NO PRINT OFF: ESC T

1BH,53H/27,83
1BH,54H/27,84

The NO PRINT ON command will inhibit the firing of the print hammer and the operation of ribbon feed and printwheel motors during the printing of characters, without affecting any other function. NO PRINT is used to mask passwords, etc. NO PRINT OFF is normal. (5,9)

GRAPHICS COMMANDS

Qume's letter quality printers are typically used for preparing text. However, the printer can also be used for graphics. It recognizes a set of graphics commands which allows resolution of 60 or 120 points per inch horizontally and 48 points per inch vertically (5760 points per square inch). Use of the Bidirectional Tractor enhances printer registration. The basic graphics commands are as follows:

GRAPHICS ON 1/60: ESC 3 Horizontal movements of 1/60 inch.
1BH,33H/27,51
GRAPHICS ON 1/120: ESC G Horizontal movements of 1/120 inch.
1BH,47/27,71
GRAPHICS OFF: ESC 4 Ends both graphics modes; normal print.
1BH,04H/27,4 (5,9,D)

The printer follows these rules in the graphics modes:

1. SPACE and BACKSPACE move the carriage 1/60 or 1/120 inch horizontally, as selected by the GRAPHICS ON command.
2. LINE FEED and NEGATIVE LINE FEED commands move paper 1/48 inch vertically regardless of the horizontal mode.
3. CHARACTER PRINTING commands will not move the carriage after the character is printed. AUTO LF and AUTO CR/LF modes are ignored.

All other commands, including set up and define commands, are unaltered.

To program in GRAPHICS MODE, first select the horizontal step (1/60 or 1/120 inch). The four carriage movement commands can be used as "cursor control" to move the paper and carriage to the desired location: SPACE (right movement), BACKSPACE (left), LINE FEED (down), and NEGATIVE LINE FEED (up). After the correct position is reached, the printer is sent a character (typically a period to print a dot). The paper and carriage are not moved. Thus, you must program (1) paper and carriage movement, and (2) printing in the graphics mode.

Graphic mode is terminated by GRAPHICS OFF, CARRIAGE RETURN, or INITIALIZE PRINTER commands, or by turning the printer power off and on.

NO CARRIAGE MOVEMENT ON NEXT CHARACTER ONLY: ESC N

1BH,4EH/27,78

This command is used to inhibit carriage motion after printing a character. This command is useful for underscoring, slashing zeroes (0), forming composite symbols or foreign language characters, etc. When using proportional spacing, send the wider of the two characters first. The ESC N command must be sent before the character that is to have its automatic spacing inhibited. ESC N is obviously affected by the graphics commands as the carriage never moves after printing a character in graphics mode; carriage motion must be separately programmed.

For example, the following Basic line will cause a zero to be printed with a slash through it: **LPRINT CHR\$(27);"NO/";** The carriage will then move to the next position on the paper. (5,9)

PRINTER PROGRAM MODES

When the printer receives a character for printing, it has an internal look-up table which indicates the (1) Hammer Intensity, (2) Ribbon Advance, (3) Carriage Motion, and (4) Printwheel Position. For most users and most applications, this standard printing mode is used. There are some unique applications where it is necessary to program these four parameters. For example, if special character sequence printwheels are used, the printer must be told where characters are located on the printwheel.

There are three do-it-yourself modes available:

1. Program Mode - You specify the hammer intensity, ribbon advance, carriage distance and direction, and the ASCII code for each character to be printed. The chart in Appendix C may be used to identify correct values.
2. Secondary Program Mode - The same as Program Mode except that the carriage distance and direction are determined from the pitch setting and are not controllable.
3. Twintellect - Similar to Program Mode with two important differences. First, you specify hammer intensity, ribbon advance, character code, printwheel position, and character width (not carriage motion). Second, the values are loaded into the printer once (usually during printer set-up routines) and the printer stores the values in a lookup table. Before a character is printed, the printer looks up the parameters in the table in its memory. In the Program Mode you must send these parameters in a separate byte after each character. In the Twintellect mode the parameters are loaded into a table in the printer's memory.

PROGRAM MODE

SHIFT TO PROGRAM MODE: ESC S0
RETURN TO NORMAL MODE: ESC SI

1BH,0EH/27,14
1BH,0FH/27,15

This command places the printer in the Program mode and allows the host system to explicitly control the following functions for every character to be printed:

HAMMER INTENSITY. Intensities can be programmed from a minimum value of 1 to a maximum value of 7. A value of 0 defaults the intensity to the printer's normal internal value.

CARRIAGE MOTION. Distance can be from 0/120 inch to 15/120 inch.

PRINTWHEEL POSITION. As determined by the ASCII code.

This mode permits the use of special nonstandard sequence printwheels. The information necessary for: (1) locating a specific character spoke on the printwheel, (2) setting the proper hammer intensity, and (3) providing the proper character spacing, must be derived from data supplied with the special printwheel.

To implement this mode, the user must:

1. Enter the Program mode by sending the ESC S0 command to the printer.
2. Send the ASCII code for the character to be printed.
3. Refer to the Appendix and derive the desired hammer intensity, and carriage spacing programming ASCII character.
4. Send the special programming ASCII character.

As an example of the use of Appendix C, assume that the character requires a hammer intensity of 4 and a spacing increment of 12/120". The special programming mode character will be an L. After entering the Program Mode (ESC S0), the computer sends the character followed by the printing information (L) for that character, then another character followed by its print information, and so on. (5,9,D and 5,9)

SECONDARY MODE

ENTER SECONDARY PROGRAM MODE: ESC #
RETURN TO NORMAL MODE: ESC SI

1BH,23H/27,35
1BH,0FH/27,15

This mode is similar to the Program Mode except that ribbon movement can be programmed independently, and carriage motion cannot be programmed. Carriage motion in this mode must be commanded using the PROGRAM MODE CARRIAGE COMMAND (US d). After entering the Program Mode an alternate method can be used to control printing parameters:

HAMMER INTENSITY. Relative hammer intensity can be selected from a minimum of 1 to a maximum of 7. If an intensity of zero is selected, the printer defaults to its normal hammer intensity value.

RIBBON ADVANCE. Relative increment value can be selected from a minimum of 2 to a maximum of 5.

CARRIAGE MOTION. Not programmable within this mode. Derived from the defined value for character spacing as determined by the setting of the PITCH switch, or by the DEFINE HORIZONTAL SPACING INCREMENTS commands.

PRINTWHEEL POSITION. As determined by the ASCII code.

To implement this mode the following example shows the use of a hammer intensity of 4 and a ribbon advance of 4:

Enter the Program mode by transmitting the ESC S0 command.
 Enter the Secondary Program mode by transmitting the ESC # command.
 Send the ASCII code for the character to be printed.
 Refer to Appendix C. A hammer intensity of 4 and a ribbon advance of 4 gives a special ASCII character of "K", "L", or "M".
 Send one of the special programming characters ("K", "L", "M").

This command terminates the Right Margin Control mode. (5,9)

PROGRAM MODE CARRIAGE MOTION: US d for right movement

1FH/31

This command is only used when the printer is in one of the Program modes. This command causes the carriage to move either left or right between 1/120" and 63/120". **d** is the distance in 1/120 inch for RIGHT movement; for movement to the left, **d** is the distance to be moved plus 64 (decimal).

As an example, for a carriage move command of 12/120 inch to the RIGHT, the Basic command is

```
LPRINT CHR$(31);CHR$(12);
```

For a movement of 12/120 inch to the LEFT, the Basic command is

```
LPRINT CHR$(31);CHR$(76);
```

(5,9)

RETURN TO NORMAL MODE: ESC SI

1BH,0FH/27,15

This command terminates the SHIFT TO PROGRAM MODE, ENTER SECONDARY PROGRAM MODE, and USER TEST MODE. (5,9)

TWIntellect/Download Commands

The download capability is a function unique to the Qume Connection and to the Qume SPRINT 11 PLUS series of printers.

All printwheels of one type (e.g., WP) have their alphanumeric characters arranged in the same sequence so that the printer knows where to find the character on the printwheel, how hard to fire the hammer, how far to move the ribbon, and in the case of WPS printwheels, how far to move the carriage. This information is in an internal table in the printer's Read Only Memory (ROM).

Some printwheels (e.g., non-English language characters) have a nonstandard sequence of characters and the printer must be programmed to know printwheel spoke position, ribbon advance, hammer force, and character width for these special printwheels. Examples of special sequence printwheels are Deutschland WP and Deutschland WPS. The capability for the Qume printer to use nonstandard sequence printwheels is called Twintellect, and this function may be selected by a printer DIP switch.

Because there are too many different sequences to practically store in the printer's memory, special commands allow the printer to accept and store (for as long as the printer power is turned on) a table of information for a special sequence printwheel. The table may be modified, enabled, or disabled by commands from the computer.

Normally, the printer is operated with Twintellect not selected (off). When Twintellect is selected on power-up, or if there is an error in downloading, the Deutschland WP or WPS table will be loaded by default, depending on the position of the DIP switch.

There are three TWINTELLECT/DOWNLOAD commands: (1) Enable the use of the Twintellect table, (2) Disable the use of the Twintellect table, and (3) Load or Modify the Twintellect table. These commands are discussed in greater detail in the paragraphs that follow.

ENABLE TWINTELLECT DOWNLOAD TABLE: ESC a e 1BH,61H,65H/27,97,101
DISABLE TWINTELLECT DOWNLOAD TABLE: ESC a d 1BH,61H,64H/27,97,100

These commands select or turn off the Twintellect function, overriding the printer switches. A table that has been downloaded can be accessed and used only after the ESC a e command has been received. If no table has been downloaded, this command will enable a default table (WPS if Twintellect is OFF, Deutschland WPS if Twintellect is ON). This default table from ROM is automatically placed into the download RAM table when the printer is powered up. Please note that while this will access all of the WPS printwheel information, it will not turn on the carriage proportional spacing algorithm; consequently, all printout will be in monospace. The printer's configuration switches must always be set to correspond to the pitch requirements of the installed printwheel.

The DISABLE command disables, but does not destroy, the download table.

DOWNLOAD OR MODIFY A TWINTELLECT TABLE: ESC a <data> 1BH,61H,3C...,3EH/
 27,97,60...,62

This command allows a whole or partial table to be downloaded to the printer. For each printwheel character a field of five elements of information (ASCII character code, printwheel spoke position, ribbon advance, hammer intensity, and character width) is required. To download a table, a user would use the following sequence of information:

1 2 3 4 5 1 2 3 4 5
 ESC a <ASCII POS RIB HAM WID, ASCII POS RIB HAM WID,....:CHKSUM >

An ASCII comma is used to separate each field. The space shown between elements in a field is not required. The table of values in the printer corresponds to the five pieces of information for each character on the printwheel. The download format is best explained with an illustration.

Assume that for character code 42 hex the printwheel spoke location is 14 hex, the ribbon advance is 5, the hammer intensity is 4, and character width 7. (These values would be obtained from tables available from your local Qume Supplies Distributor.) The checksum calculated for all the values is 0BF hex. You would then send the printer the DOWNLOAD command followed by ASCII **42145407**, (the ASCII comma is sent after each group of five; character width requires a leading zero be sent). In Basic, the command is:

```
LPRINT CHR$(27);"a<42145407,"; next sequence of five and ":BF>"
```

where BF is the hex value of the checksum. Notice that the colon is sent instead of a comma after the final group of five values. When all the items in the table are entered an optional : **<checksum>** may be added to validate the data in the download operation. The checksum is calculated by taking the Exclusive Or of each ASCII character after the "<" up to and including the byte before the ":". Commas are included in the checksum calculation. Although legal values for character width cannot exceed 0FH, two bytes are always required. The additional byte is reserved for future applications. Similarly, some ribbon advance and hammer intensity parameters are reserved for future use. Table 2 below shows the legal hex values which may be loaded into the Twintellect table.

Table 2. Size and Value Parameters for Twintellect Table

ELEMENT	BYTES REQUIRED	LEGAL VALUES (HEX)
ASCII Code	2	20 to 7F
Printwheel Spoke Position	2	00 to BE
Ribbon Advance	1	3 to 7
Hammer Intensity	1	1 to 6
Character Width	2	00 to 0F

Values for any printwheel character are easily modified without changing the entire table. Simply enter the modified values into a download command. Note that all five elements of the field must be included (eight bytes plus a comma). The ASCII character code will ensure that the new values are correctly located within the table.

All three commands cause the printer to read all of the DIP switches and the set the following parameters:

- The carriage is moved to column 0.
- The printwheel is synchronized with the printer's electronics.
- The right margin is set at the right most column (right side frame).
- The left margin is set at column 0.
- All tab stops are cleared.
- The top margin is set at the top of form position.
- The bottom margin is set at the position defined by the form length switch.
- Both Graphics modes OFF.
- Forward Print mode ON.
- Both Program modes OFF.
- Right Margin Control mode OFF
- Underscore, Bold Overprint, Shadow Print, and No Print modes OFF.
- User Test mode OFF.

SHEET FEEDER COMMANDS

These commands control the Qume Cut Sheet Feeder, which is an accessory. These commands are unique to Qume. If Qume's Mechanical Sheet Feeder is installed on the printer, a FORM FEED command will eject the paper currently in the printer, load a new sheet of paper, and move that sheet of paper to the desired print position. If the FORM FEED command is used in this fashion, the following commands may not need to be used. Please note, however, that if you only use the FORM FEED command, you cannot eject a page without inserting another page.

SHEET INSERT FROM TRAY ONE: ESC i

1BH,69H/27,105

This command instructs the printer to insert a sheet of paper from tray one of the Cut Sheet Feeder. As a platen driven, mechanical device, the Cut Sheet Feeder is only operational when the printer receives the appropriate commands from the computer. If the Cut Sheet Feeder is not installed, an ESC i command will be ignored by the printer.

SHEET EJECT: ESC e

1BH,65H/27,101

This command instructs the printer to eject a sheet of paper to the collection bin of the Cut Sheet Feeder.

TEST COMMANDS**TERMINAL SELF TEST: ESC SUB S0**

1BH,1AH,0EH/27,26,14

The Terminal Self Test routine is a comprehensive test of the printer's mechanical and electronic functions. Once the Self Test routine is initiated, all further commands will be ignored until the test is completed. (5,9)

USER TEST MODE COMMANDS**ENTER USER TEST MODE: ESC @ T**

1BH,40H,54H/27,64,84

The User Test mode allows the host computer to program the printer to perform a test program of any length up to a maximum of 500 characters.

To utilize the user test mode:

1. The computer sends **ESC @ T**. (5,9)
2. Up to 500 characters are entered into the printer buffer.
3. The computer sends an **EOT** when the program is entered. (5,9)
4. To run the test one time, send **STX** (PERFORM USER TEST ONCE). (5,9,D)
5. To run a continuous test, send **SOH** (PERFORM USER TEST CONTINUOUSLY). (5,9,D)
6. To halt the continuous test, send **ENQ** (HALT CONTINUOUS USER TEST). (5,9)
7. To leave the User Test Mode and erase it, send **ESC SI** (RETURN TO NORMAL MODE).

SPECIAL CHARACTER PRINTING

PRINT CHARACTER AT PRINTWHEEL POSITION 004:
 PRINT CHARACTER AT PRINTWHEEL POSITION 002:

ESC SP 1BH,20H/27,32
 ESC / 1BH,2FH/27,47

There are two positions on all printwheels which do not correspond to a single standard ASCII character code. The reason for this is that of the 96 ASCII codes from 20 hex to 7F hex, two are special: SPACE and DELETE. SPACE is really a motion command and DELETE may have special functions, including resetting the printer. These special characters, though not necessarily the same for all printwheels, usually are:

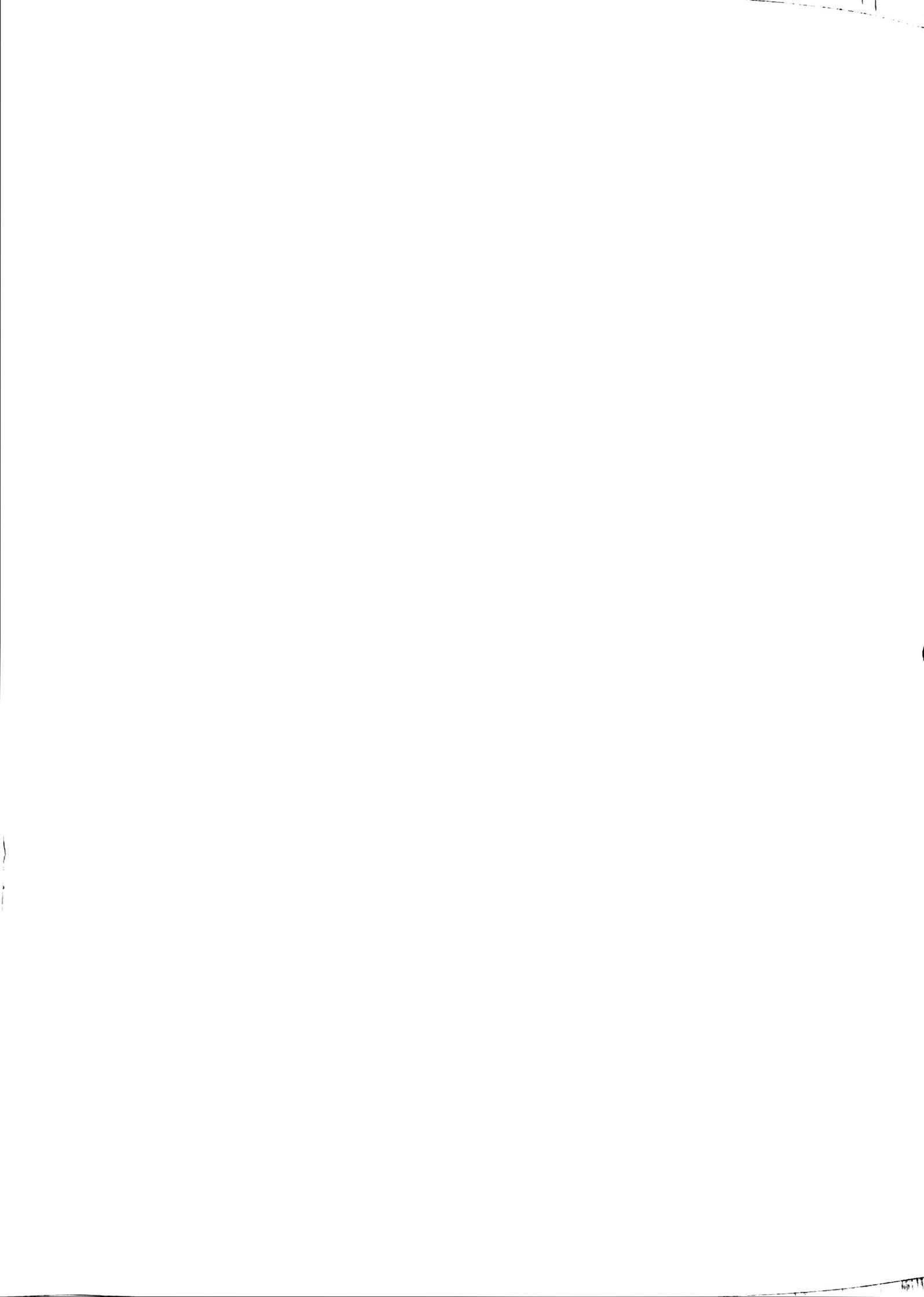
¬ or = located at position 002

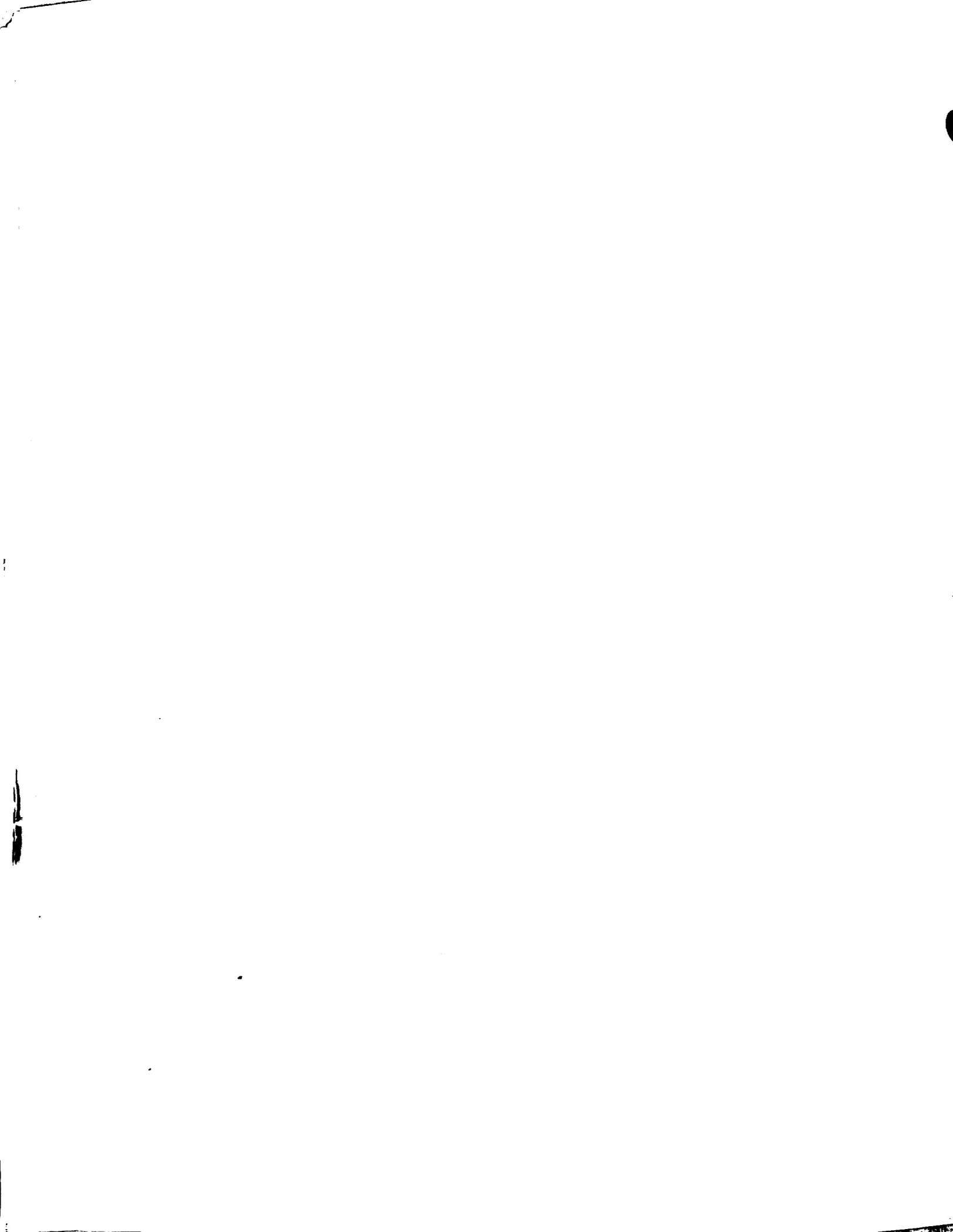
¢ or | located at position 004.

APPENDIX A ASCII CODE CHART

					0	1	2	3	4	5	6	7			
					0	1	2	3	4	5	6	7			
b6	b5	b4	b3	b2	b1	Column	Row								
0	0	0	0	0	0	0	0	NUL	DLE	SP	0	@	P	'	p
0	0	0	0	1	1	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	0	2	2	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	0	3	3	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	0	4	4	4	EOT	DC4	\$	4	D	T	d	t
0	1	0	1	0	5	5	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	0	6	6	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	0	7	7	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	0	8	8	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	0	9	9	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	0	A	:	:	LF	SUB	*	:	J	Z	j	z
1	0	1	1	0	B	;	;	VT	ESC	+	;	K	[	k	{
1	1	0	0	0	C	<	<	FF	FS	,	<	L	\	l	|
1	1	0	1	0	D	=	=	CR	GS	-	=	M	]	m	}
1	1	1	0	0	E	>	>	SO	RS	.	>	N	^	n	~
1	1	1	1	0	F	?	?	SI	US	/	?	O	-	o	DEL

HEXIDEcimal = ASCII COLUMN + ROW





**APPENDIX E
COMMAND SET SUMMARY**

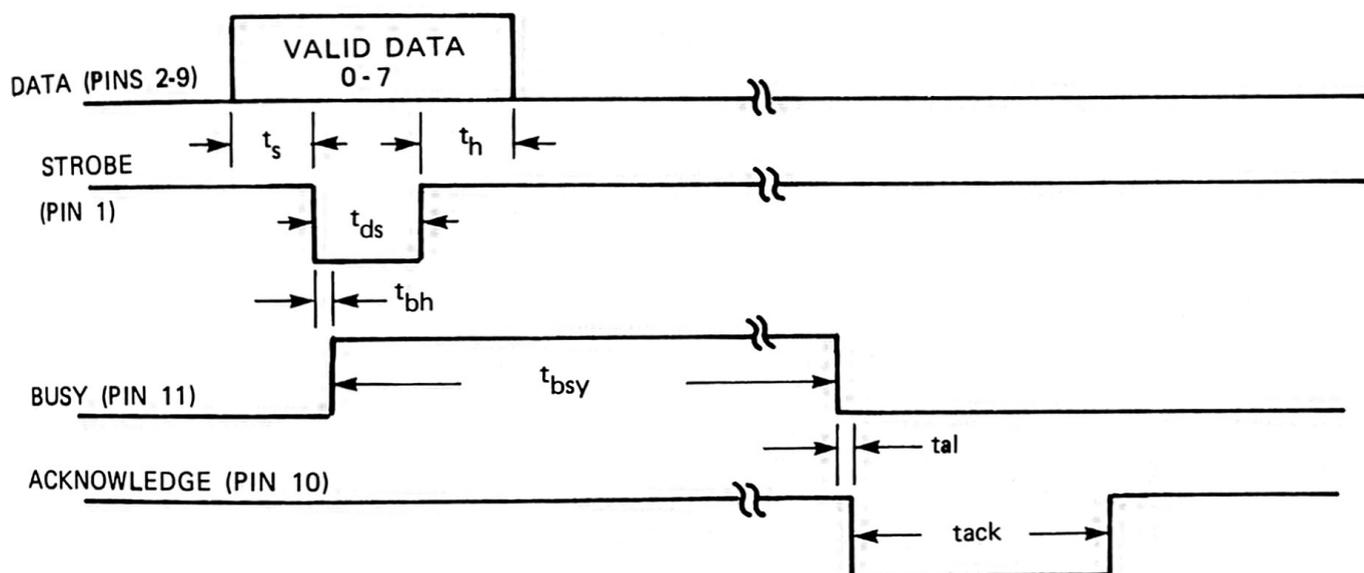
	<u>ASCII</u>	<u>HEX</u>	<u>DECIMAL</u>
MARGIN COMMANDS			
Set Top Margin:	ESC +	1B,2B	27,43
Set Bottom Margin:	ESC -	1B,2D	27,45
Set Left Margin:	ESC 9	1B,39	27,57
Set Right Margin:	ESC 0	1B,30	27,48
Right Margin Control On:	ESC 0	1B,4F	27,79
Right Margin Control Off:	ESC Y	1B,59	27,89
LINESPACING (VERTICAL) COMMANDS			
Define Vertical Spacing Increments:	ESC L d1 d2	1B,4C	27,76
Alt. Define Vert. Spacing Increments: (distance + 1)	ESC RS	1B,1E	27,30
Set Form Length:	ESC F d1 d2	1B,46	27,70
Auto Carriage Return/Line Feed On:	ESC W	1B,57	27,87
Auto Carriage Return/Line Feed Off:	ESC Z	1B,5A	27,90
Auto Line Feed On:	ESC comma	1B,2C	27,44
Auto Line Feed Off:	ESC period	1B,2E	27,46
CHARACTER SPACING (HORIZONTAL) COMMANDS			
Define Horizontal Space Increments:	ESC E d1 d2	1B,45	27,69
Define Horizontal Space Increments Alt.:	ESC US(dis+1)	1B,1F	27,31
WPS On:	ESC \$	1B,24	27,36
WPS Off:	ESC %	1B,25	27,37
TAB COMMANDS			
Set Horizontal Tab Stop:	ESC 1	1B,31	27,49
Clear Horizontal Tab Stop:	ESC 8	1B,38	27,56
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Line Feed:	LF	0A	10
Negative Line Feed:	ESC LF	1B,0A	27,10
Half Line Feed:	ESC U	1B,55	27,85
Negative Half Line Feed:	ESC D	1B,44	27,68
Auto Carriage Return/Line Feed On:	ESC W	1B,57	27,87
Auto Carriage Return/Line Feed Off:	ESC Z	1B,5A	27,90
Absolute Vertical Tab to a Line Number:	ESC P d1 d2	1B,50	27,80
Absolute Vertical Tab to a Line Number ALT.:	ESC VT (dis+1)	1B,0B	27,11
Relative Vertical (Paper Feed) Motion:	ESC V n1 n2 n3	1B,56	27,86
Form Feed:	FF	0C	12
CARRIAGE MOVEMENT (HOR. MOTION) COMMANDS			
Horizontal Tab:	HT	09	9
Absolute Horiz. Tab to a Column Number:	ESC C d1 d2	1B,43	27,67
Absolute Horiz. Tab to a Column Number Alternate):	ESC HT (dis+1)	1B,09	27,9
Relative Horizontal Motion:	ESC H n1 n2 n3	1B,48	27,72
Backward Print:	ESC 6	1B,36	27,54
Forward Print:	ESC 5	1B,35	27,53
Auto Bidirectional Printing On:	ESC <	1B,3C	27,60

	<u>ASCII</u>	<u>HEX</u>	<u>DECIMAL</u>
Auto Bidirectional Printing Off:	ESC >	1B,3E	27,62
Space:	SP	20	32
Backspace:	BS	08	8
Backspace 1/120":	ESC BS	1B,08	27,8
Carriage Return:	CR	0D	13
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Underscore On:	ESC I	1B,49	27,73
Underscore Off:	ESC J	1B,4A	27,74
Bold Overprint On:	ESC K d	1B,4B	27,75
Bold Overprint Off:	ESC M d	1B,4D	27,77
Shadow Print On:	ESC Q	1B,51	27,81
Shadow Print Off:	ESC R	1B,52	27,82
No Print On:	ESC S	1B,53	27,83
No Print Off:	ESC T	1B,54	27,84
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Shift to Program Mode:	ESC S0	1B,0E	27,14
Enter Secondary Mode:	ESC #	1B,23	27,35
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Return to Normal Mode:	ESC SI	1B,0F	27,15
Enable Twintellect Download Table:	ESC a e	1B,61,65	27,97,101
Disable Twintellect Download Table:	ESC a d	1B,61,64	27,97,100
Download or Modify Twintellect Table:	ESC a (data)	1B,61,3C27,97,60...62	
PRINTER COMMANDS			
Bell:	BEL	07	7
Force Execution:	ESC x or ESC X	1B,78	27,120
Initialize Printer (Restore):	ESC SUB I or ESC CR P	1B,1A,49 1B,0D,50	27,63,73 27,13,80
SHEET FEEDER COMMANDS			
Sheet Insert From Tray One:	ESC i	1B,69	27,105
Sheet Eject:	ESC e	1B,65	27,101
TEST COMMANDS			
Terminal Self-Test:	ESC SUB S0	1B,1A,0E	27,26,14
Enter User Test Mode:	ESC @ T	1B,40,54	27,64,84
Perform User Test Once:	STX	02/2	
Perform User Test Continuously:	SOH	01/1	
Halt Continuous User Test:	ENQ	05/5	
Return to Normal Mode:	ESC	1B/27	
SPECIAL CHARACTER PRINTING			
Print Position 004:	ESC SP	1B,20	27,32
Print Position 002:	ESC /	1B,2F	27,47

APPENDIX F INTERFACE SIGNAL TIMING

The following timing diagram represents the various interface signals used by the QUME CONNECTION. These are important if you are designing your own interface circuit. Otherwise, they are the same as is used on most Centronics interfaces.

The QUME CONNECTION uses 7417 open collector drivers for output signals. These signals must be pulled up externally. Most computer systems with Centronics-type interfaces do this. QUME CONNECTION signal inputs use standard TTL receivers with pull-up resistors.



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TIMING PARAMETERS - QUME CONNECTION CENTRONICS INTERFACE

<u>Signal</u>	<u>Minimum</u>	<u>Maximum</u>
t_s - Setup time	1.0 usec	-
t_h - Hold time	1.0 usec	-
t_{ds} - Data strobe length	1.0 usec	500 usec
t_{bh} - Delay to busy high	-	<0.1 usec
t_{bsy} - Busy length	0.1 usec	10 seconds
t_{al} - Delay to acknowledge low	-	<0.1 usec
t_{ack} - Acknowledge pulse length	2.5 usec	5.0 usec (5.0 usec typical)

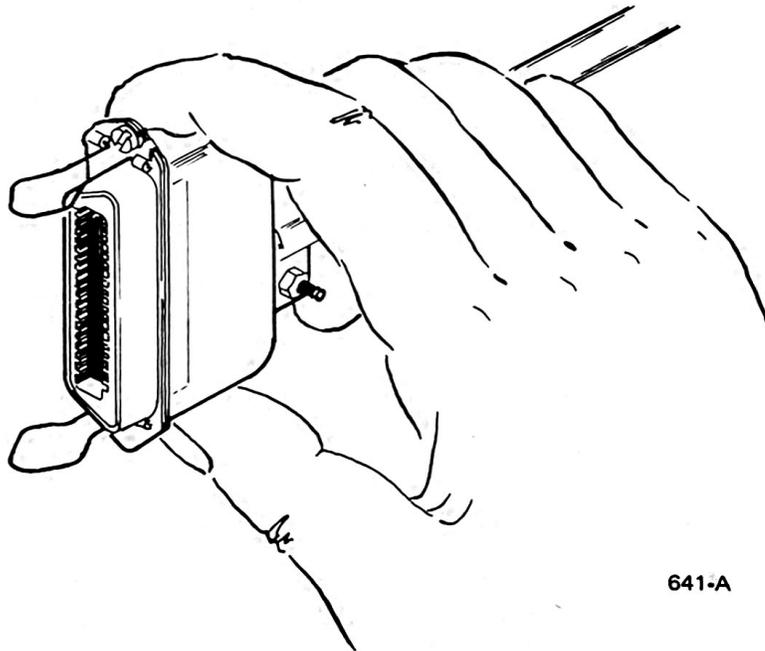
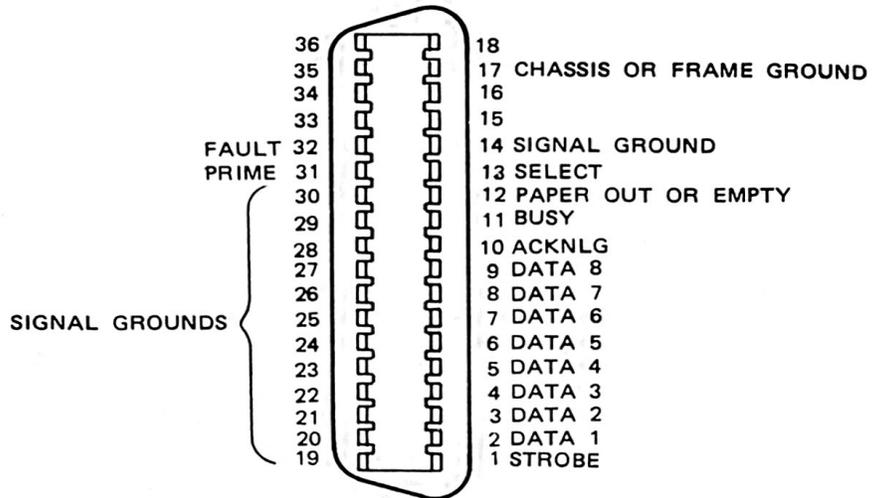


APPENDIX G INTERFACE CONNECTOR AND SIGNALS

The following table lists the interface signals and describes their function. Logic 1 is high (i.e., 2.4 to 5.0 Vdc). Logic 0 is low (i.e., 0.0 to 0.4 Vdc). The functions assigned to the pin numbers are the same as used on generic Centronics-type interfaces, although the signal names may differ.

<u>Pin Number</u>	<u>Signal</u>	<u>Description</u>
1	STROBE	Input to printer. A strobe pulse latches data into the printer. Pulse width: from 1.0 to 500 microseconds. May be either active high or low, switch selectable. Strobe must be sent 1.0 1.0 microsecond (min.) after valid data.
2	DATA 1	Input data to printer.
3	DATA 2	Data 8 = LSB (Least Significant Bit)
4	DATA 3	Data 1 = MSB (Most Significant Bit).
5	DATA 4	ASCII codes normally use Data 1-7.
6	DATA 5	Data 8 not used. Logic 1 high (2.4-5.0 Vdc).
7	DATA 6	Logic 0 low (0 to 0.4 Vdc).
8	DATA 7	
9	DATA 8	
10	ACKNLG	Output from printer. A low pulse (5 microseconds) indicates the printer has accepted the input data.
11	BUSY	Output from printer. Printer sets this line high to indicate printer is busy; low indicates printer is not busy and can accept data. A Busy is sent after each character received.
12	PAPER OUT or PAPER EMPTY	Output from printer. High indicates out of paper. (Stop Print On Paper Out switch on printer does not affect this signal.)
13	SELECT	Output from printer. High indicates printer is selected and ready to receive data.
14	SIGNAL GROUND	Signal Ground.
17	CHASSIS GROUND	Chassis or frame ground.
31	INIT	Input to printer. A low pulse (1.0 microsecond minimum) initializes the printer. Clears printer input buffer and sets the printer to default parameters. Performs a Restore function.
32	FAULT	Output from printer. A low indicates printer needs attention: Ribbon out, cover off, paper out, or printer in CHECK.

Signal Grounds - Pins 19 to 30 Other pins may be used by some printers.



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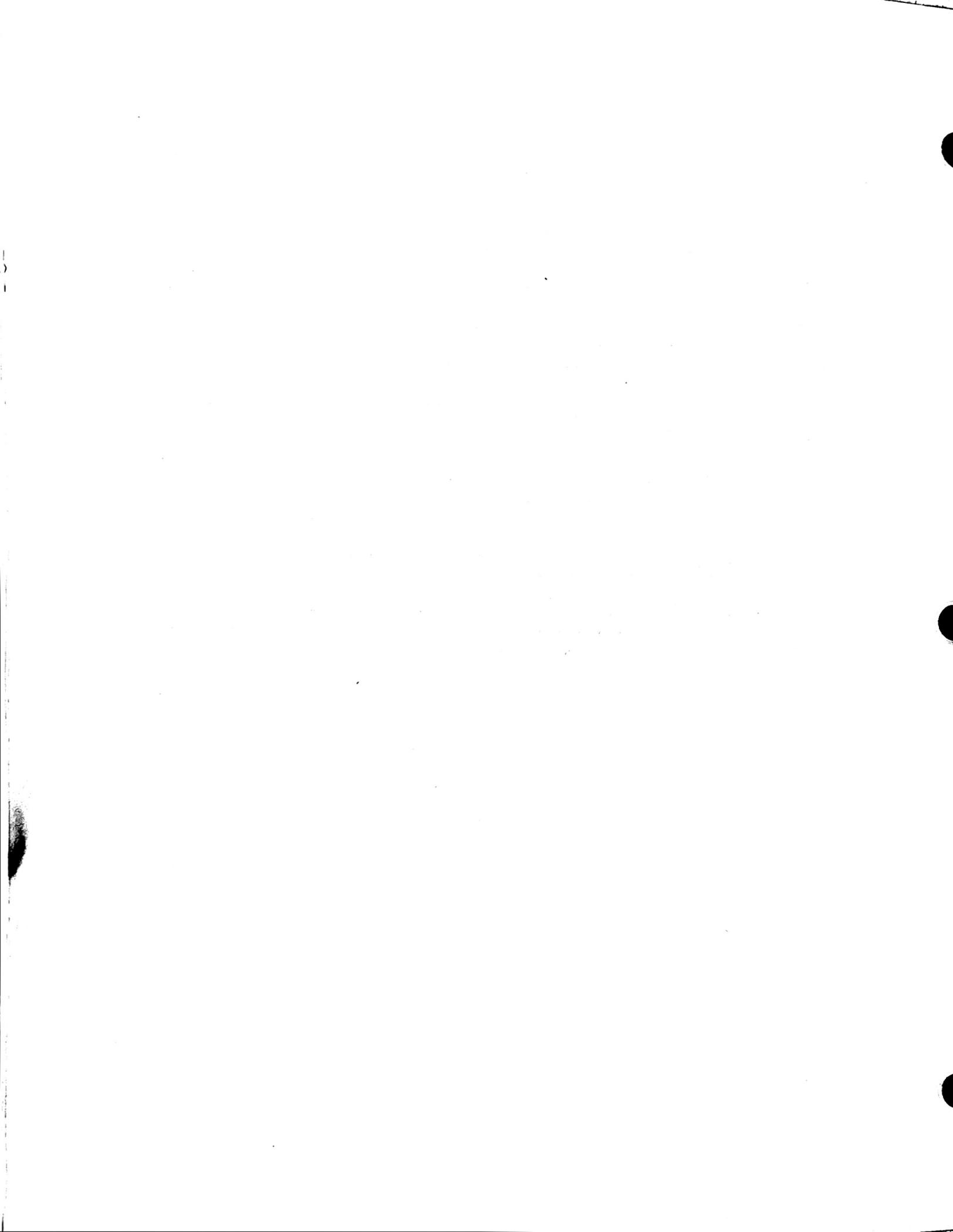
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