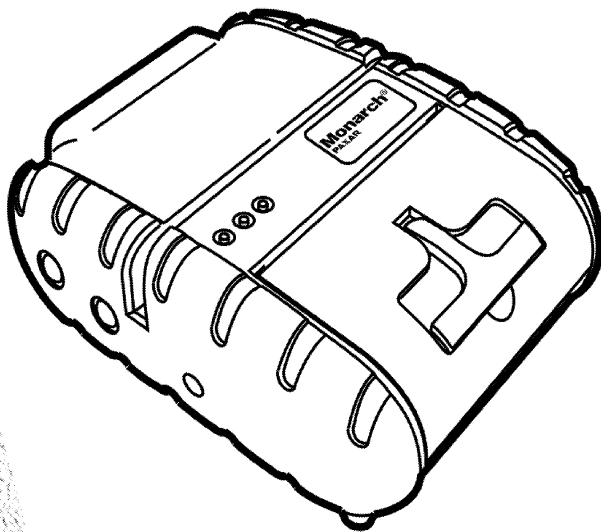# Programmer's Manual

Monarch® **9430RXÔ Printer**

PAXAR

Each product and program carries a respective written warranty, the only warranty on which the customer can rely. Paxar reserves the right to make changes in the product, the programs, and their availability at any time and without notice. Although Paxar has made every effort to provide complete and accurate information in this manual, Paxar shall not be liable for any omissions or inaccuracies. Any update will be incorporated in a later edition of this manual.

Regulatory Compliance

Paxar products are designed to be compliant with the rules and regulations in the locations into which they are sold and will be labeled as required. The majority of RF devices are type approved and do not require the user to obtain license or authorization before using the equipment. Any changes or modifications to Paxar equipment not expressly approved by Paxar could void the user authority to operate the equipment.

Radio Frequency Interference Requirements

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference that may cause undesired operations.

Radio Frequency Interference Requirements - Canada

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe B prescrites dans le Réglement sur le brouillage radioélectrique édicte par le ministère des Communications du Canada.

To comply with FCC and Industry Canada exposure requirements, if this device is a *hand-held portable* device, it is approved for operation in a user's hand when there is 2.5 cm or more between the antenna and the user's body; if this device is a *table-top* device, it is approved for operation when there is 25 cm or more between the antenna and the user's body.

European Economic Area

The European variant is intended for use throughout the European Economic Area, and is compliant with the R&TTE directives; however, authorization for use restricted as follows:

European standards dictate maximums radiated transmit power of 100 mW EIRP and frequency range 2.400 –2.4835 GHz.

France, the equipment is to be restricted to the 2.4465 – 2.4835 GHz frequency range.

Belgium outside, the equipment is to be restricted to the 2.460 – 2.4835 GHz frequency range.

Operation in Italy requires a user license.

Trademarks

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INTRODUCTION

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The Monarch® 9430RX™ printer control language contains a variety of commands to

♦ create and print formats.

♦ configure the printer.

♦ enable specific printer features.

You download these commands in a data stream from another device. This manual describes the printer's control language.

Duty Cycle

The printer is designed to print up to 1000 inches per day. The average print rate is 1 inch every 10 seconds at a text character print density of 25% (i.e., one character printed out of every four positions). Bar codes and graphics are more dense (print with more dots) than text and may need a lower duty cycle. In high temperature environments, pause the printer for one minute after every four (4) inches printed. If the duty cycle is exceeded, the printer may not print all of the information that was sent to it.

Conventions Used in this Manual

Following are the conventions used in the syntax descriptions of each command.

Symbol	Description
-	Separates items in the command sequence.
< >	Indicates a variable with a single-byte value.
' '	Indicates the value is a literal. Enter the value as it appears or use the ASCII hex values for the same characters.
( )	Indicates a variable of any length.
# #	Indicates a variable of an exact length.
ESC	Indicates the beginning of a command sequence. Enter **1B hex** for this item.
CR-LF-NAK	Indicates the end of a response from the printer. In the response, it is represented as **0D 0A 15 hex**.

These conventions make it easier for you to read the commands' syntax descriptions. They are not part of the data streams. For example, **ESC-'F1'** may be the syntax description, but the data stream should contain **1B** for **ESC**. Also, - and ' (and other such characters described here) are not part of the data stream.

For values not enclosed within single quotation marks, enter the value shown while pressing ALT on the keyboard.

NOTE: The printer ignores commands with syntax errors.

Control Characters

The following characters are reserved and used to control the printer. The printer provides single-byte responses to the host of its status.

Char.	Control	Hex	Dec	Control Action
EOT	^D	0x04	04	End Of Text Signals to the host device that the printer is in idle mode and the print buffer is empty.
BS	^H	0x08	08	Backspace Removes the previous character in the print buffer.
HT	^I	0x09	09	Horizontal Tab Advances to the next tab position (from the following list) or to the beginning of the next line: 5, 9, 13, 17, 21, 25, 29, 33, 37.
LF	^J	0x0A	10	Line Feed Advances to beginning of next line.
VT	^K	0x0B	11	Vertical Tab Advances 5 lines.
FF	^L	0x0C	12	Form Feed Advances 10 lines.
CR	^M	0x0D	13	Carriage Return Advances to beginning of next line.
SO	^N	0x0E	14	Shift Out Switches to 36-column print mode
SI	^O	0x0F	15	Shift In Switches to 57-column print mode.

Char.	Control	Hex	Dec	Control Action
XON	^Q	0x11	17	Transmitter On
				Signals that the device is ready to receive data (can be sent by the printer or host).
AUXON	^R	0x12	18	Printer on
				Signals to the host that the printer is online. It is sent after initial power up, clearing a supply jam, or a supply reload.
XOFF	^S	0x13	19	Printer receiver is off
				Signals to the host that the print buffer is full or an error has occurred.
				Signals to the printer that the host's transmitter is off.
NORM	^T	0x14	20	Switches to 57-column print mode.
AUXOFF	^U	0x15	21	Printer is off
				Signals to the host that the printer is out of supply or has powered down.
CANCEL	^X	0x18	24	Cancel and reset printer
				Resets the print buffer places the printer in initial power-up mode with the default settings.
ESC	^[	0x1B	27	Escape
				Indicates that the following characters are part of a printer control language command.
EXTEND	^\	0x1C	28	Extended print
				Prints characters double high.
EXTEND OFF	^]	0x1D	29	Extended print off/Normal print
				Prints characters at the normal height.

CONFIGURING THE PRINTER

There are several commands to configure the printer. You can include these commands anywhere in a data stream. This chapter describes the commands to configure the printer.

Selecting the Operating Mode

The printer works in either online or buffer mode. In online mode, the printer prints characters as soon as they are received. In buffer mode, the printer receives and stores characters, and then prints them upon receipt of an EOT control character (**4** hex).

Syntax   `ESC-'cmdol'`

ESC	Starts the command language.
'cmdol'	Online command. Options: **P#** Selects online mode. **P$** Selects buffer mode.

Example   `ESC P#`

Uses online mode. The printer starts printing as soon as it receives a character.

Setting the Print Contrast

You can increase or decrease the print contrast for lighter or darker print. This setting affects the print speed (the higher the contrast, the lower the speed and vice versa). The print contrast also depends on the battery voltage.

Syntax   `ESC-<cmdpc>-<contrast>`

ESC	Starts the command language.
<cmdps>	Print contrast command. Enter **P**.
<contrast>	Print Contrast. Value can be between 0-9, where 0 is the highest contrast and 9 is the lowest contrast. The default is 5.

Example   `ESC P9`

Sets printer to lowest contrast (9) and fastest print speed.

Setting the Power Mode

The printer can operate in five different power modes, each using a different number of *printhead sections*, which are groups of dots on the printhead. The mode selected also affects the print speed (the more printhead sections used, the faster the printer speed and vice versa).

Syntax   `ESC-<cmdpm>-<powmode>`

ESC	Starts the command language.
<cmdpm>	Power mode command. Enter **P**.
<powmode>	Power mode. The number of printhead sections to use, specified in hex. Options:

    1   Low - Use one printhead section, less than 1.0 Amp.

    2   Medium - Use two printhead sections, less than 2.0 Amps.

    3   High - Use three printhead sections, less than 3.0 Amps.

    6   Very high - Use six printhead sections, less than 9.0 Amps.

    7   Auto Control - Dynamically choose the number of printhead sections to use (1, 2, 3, or 6), depending on what is printed (default).

Example   `ESC P2`

Uses two printhead sections, which is less than 2.0 Amps.

Checking the Battery Voltage

The following commands/control characters check the battery's voltage and request statuses.

Syntax   `ESC-'cmdvolt'`

ESC	Starts the command language.
'cmdvolt'	Battery voltage command. Options:

    P^ Prints the battery voltage.

    P! Requests the battery voltage from the printer.

Example   `ESC P^`

Prints the battery voltage.

2-2 Configuring the Printer

Request the printer statuses

You can request the print buffer, battery status, and magnetic card reader status from the printer by sending **16 hex (Ctrl-V)** to the printer.

The printer responds with

ESC-'B'-#pbchars#-CR-LF-ESC-'V'-#volts#-CR-LF-ESC-'M'-#card#-CR-LF-NAK

ESC B	Print buffer status.
#pbchars#	The number of characters currently in the print buffer, shown as four ASCII hex digits, which are "OR'd" with **30 hex**.
CR LF	Carriage return and line feed.
ESC V	Battery voltage status.
#volts#	Four ASCII decimal digits (which are "OR'd" with **30 hex**). The first three are the battery voltage (form x.x).
	The fourth character categorizes the voltage listed to give it a reference. Values are 1-4, where 1 is high and 4 is low.
CR LF	Carriage return and line feed.
ESC M	Magnetic card reader status.
#card#	Four ASCII hex digits (which are "OR'd" with 30 hex) representing the time left before the printer enters sleep mode.
CR-LF-NAK	Indicates the end of a response from the printer.

You can send a print status request to the printer for print buffer status and the magnetic card reader status by sending **2 hex (Ctrl-B)**

Using the Power-Off Timer

The printer has a power-off timer to conserve battery life. After a specified period of inactivity occurs, the printer goes into sleep mode.

The printer returns to normal mode when it starts receiving commands again, but the countdown re-starts after every character received.

Before powering down, the printer sends AuXon then Xoff. See "Setting the Communications Parameters" for descriptions of the dip switches and for information about this feature.

Syntax	`ESC-<cmdpt>-<digit1><digit2>-CR`

ESC	Starts the command language.
<cmdpt>	Power-off timer command. Enter **M**.
<digit1><digit2>	Number of seconds for the inactivity period. Options: **0** to **9**. The first and second digits, respectively, of the number of seconds to set the inactivity period to. To disable the timer, set both parameters to 0.
CR	Carriage return.
NOTE:	Be careful when using sleep mode with buffer mode. If there is data in the print buffer when the printer goes into sleep mode, you lose the data.

Example `ESC MC CR`

Sets the inactivity period to the default (20 seconds).

Example `ESC M560 CR`

Sets the inactivity period to 56 seconds.

Example `ESC M000 CR`

Disables the power-off timer.

Supply Control Commands

The commands in this section control how the printer uses black-mark supplies.

Look at your supply (distance between black marks, existence of any preprinted text, etc.) before you begin. You may have to use the black mark search command multiple times if the marks are farther apart than the maximum search allows. To use these commands:

1. Set the sensitivity of the sensor search mechanism detecting the black mark (**ESC QQ** command).

2. Move the supplies forward (**ESC QF** command) or backward (**ESC QB** or **ESC QJ** commands) to find the black mark.

3. Wait for a response from the printer (found or not found).

4. Send a data stream with printing commands.

Syntax   **ESC-'cmdbw'-<lines>**
            ESC-'cmdos'-<lines>
            ESC-'cmdbfw'-<max>
            ESC-'cmdbbw'-<max>

ESC	Starts the command language.
'cmdbw'	Backward command. Enter **QJ**.
<lines>	The number of lines to move the printer backwards in 0.125 mm increments (in 00 hex – FF hex).
ESC	Starts the command language.
'cmdos'	Out of supply sensitivity command. Enter **QQ**.
<lines>-	The number of lines to continue to print in 0.125mm increments (00 hex – FF hex) after failing to detect a black mark. The default is 28 hex.
ESC	Starts the command language.
'cmdbfw'	Search for black mark forward command. Enter **QF**.
<max>	The maximum number of lines to move forward (advance) in 0.25mm line increments (in 00 hex – FF hex).

ESC	Starts the command language.
'cmdbbw'	Search for black mark backward command. Enter **QB**.
<max>	The maximum number of lines to move backward in 0.25mm line increments (in 00 hex – FF hex).

Printer Responses

See the printer's response to the black mark commands in the following table.

Command	Response	Description
`ESC QR39` `ESC QB35`	`ESC-'Q'-3F hex-3F hex-#high#-#low#`	Black mark found.
	`ESC-'Q'-30 hex-30 hex-#high#-#low#`	Black mark not found

#high#	The left digit of the hex number representing the number of lines moved to find the black mark in 30 hex – 3F hex.
#low#	The right digit of the hex number representing the number of lines moved to find the black mark in 30 hex – 3F hex.

Checking Version Information

You can check the versions of both the printer's hardware and firmware.

Syntax	`ESC-'cmdfv'` `ESC-'cmdhv'`

ESC	Starts the command language.
'cmdfv'	Request firmware version command. Enter **P(**.
ESC	Starts the command language.
'cmdhv'	Request hardware version command. Enter **P)**.

Example `ESC P(`

The printer responds with:

`ESC-'('-#version#-CR-LF-NAK`

ESC (	Response from the firmware version request.
#version#	Four ASCII characters representing the firmware version.
CR-LF-NAK	Indicates the end of a response from the printer.

Example `ESC P)`

The printer responds with:

`ESC-')'-'103'-#version#-CR-LF-NAK`

ESC)	Response from the hardware version request.
#version#	An ASCII character representing the hardware version.
CR-LF-NAK	Indicates the end of a response from the printer.

Printer/Device Communications

Following are the printer's communication values. The defaults are listed in bold.

- **Baud Rate** – 2400, 9600, **19200**, or 38.4K

- **Stop Bits** – **1** or 2

- **Parity** – **None**, Odd, or Even

- **Data Bits** – 7 or **8**

- **Flow Control** – RTS/CTS (hardware) or XON/XOFF (software)

The printer and host cannot communicate unless they use the same communication values. Additional communication specifications:

Word Length –10 or 11 bits   **Start Bit** – 1   **Signal Levels** – RS232C

Mark or Logical 1 – -3 to -15VDC   **Space or Logical 0** – +3 to +15VDC

Auto Power Up – Positive signal on RTS input turns printer on.

Setting the DIP Switches

Use the DIP switches to set the RS232 communication, IrDA, and optional RF values. To access the DIP switches, open the battery door and remove the battery. Turn the printer upside down to easily read the DIP switches.

To activate the DIP switches, turn the printer off and then back on. Gently use a plastic-tipped object to set the DIP switches. **Do not use any metal object!**

The communications interface settings must be set as defined in the table.

Select DIP switches 4 through 8 for RS232 and 6 through 8 for IrDA.

	1	2	3	4	5	6	7	8
Communication Interface								
RS232	OFF	OFF	OFF					
IrDA – Fixed 9600	ON	ON	OFF	OFF	OFF			
IrDA – Variable Baud	ON	ON	OFF	ON	OFF			
Bluetooth®	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
Baud Rate								
38400				OFF	OFF			
19200				OFF	ON			
9600				ON	OFF			
2400				ON	ON			
Parity								
None						OFF	OFF	
Odd						ON	OFF	
Even						ON	ON	
Printer Power								
Auto Power Off *								ON
Manual Power Off								OFF

* The printer automatically turns off after 99 sec. (default) or the time set up by the System Administrator.

Printer Pinouts

There is a port for a 6-Pin RJ25 data connector. It provides RS-232 communications and is located at the back of the printer. The six connections provide the serial interface to the host. The table below lists the serial interface signals and pinouts.

NOTE: Pins 1 and 3 must be set on at all times.

Pin #	Description	Input/Output	Signal
3	Signal to printer from host	Input	RXD
2	Signal to host from printer	Output	TXD
6	Request to send from Host	Input	RTS
4	Clear to send from Printer	Output	CTS
1 and 5	Logic common		COM

Following are the pin locations on the connector:

RJ-25 DATA CONNECTOR
SHOWING PIN # LOCATIONS
FRONT-VIEW
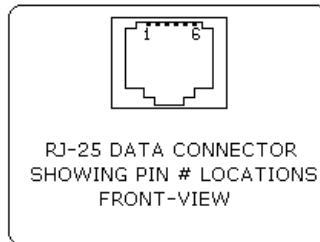
The following control characters are related to communications between the printer and the host.

Char.	Hex	Control Action
AUXON	0x12	Signals to the host that the printer is online. It is sent after initial power up, clearing a supply jam, or re-loading supply.
AUXOFF	0x15	Signals to the host that the printer is out of supply or has powered down.
XON	0x11	Transmitter On Signals that the device is ready to receive data (can be sent by the printer or host).
XOFF	0x13	Printer receiver is off Signals to the host that the print buffer is full or an error has occurred. Signals to the printer that the host's transmitter is off.

Miscellaneous Control Characters

You may need to use some of these miscellaneous control characters in your data streams.

Char.	Hex	Control Action
BS	0x08	Removes the last character entered in the print buffer.
CANCEL	0x18	Re-initializes the printer. We recommend that you begin all data streams with this command.
EOT	0x04	Sent by the printer to indicate the buffer is empty and the printer is idle (End Of Text).

CREATING AND PRINTING FORMATS

A *format* defines which *fields* appear and where the fields are printed on the supply. Fields can contain text, graphics, and bar codes.

This chapter describes how to create a format.

Overview

To create a format:

1. Decide the information (fields) you want on your supply.

2. Draw a rough sketch of how you want the format to look. For example, a graphic (graphic field) may appear at the top, followed by the name of your organization (text field), followed by a list of items (text field) purchased. Your format could be organized any number of ways.

NOTE: There are .157-inch no-print zones on the left and right sides of the format, and a .7-inch no-print zone at the top of the format.

3. Create the data stream, based on your format's design.

4. Add any commands to the data stream related to how the printer performs. For example, at the data stream's beginning, enter the command to initialize the printer (**18 hex**) or any supply control commands.

5. Send the data stream from the host to the printer.

Creating Text Fields

Text fields can contain letters, numbers, and symbols. To specify text for the format, write the text directly to the printer. There is no special Text field command. However, there are commands/control characters to select a character set and font.

Selecting Character Sets

The printer comes with a default ASCII character set.

ASCII Character Set

You can select either of two extended character sets: International or PC Line-Draw.

International Character Set

PC Line Draw Character Set

These character sets are standard in the printer.

NOTE: You can modify the standard character sets/fonts. See Appendix B, "Modifying Standard Fonts," for more information.

Character Exceptions

Both character sets have missing characters. The ↑ and ↓ characters replace ⌐ and ¬, respectively; the ○ character replaces α.

Syntax   `ESC-<cmdcs>-<chset>`

ESC	Starts the command language.
<cmdcs>	Character set command. Enter **F**.
<chset>	Character Set. Options:

    1   Selects International (ANSI) characters (default)

    2   Selects PC Line-Draw (ASCII) characters.

Example `ESC F1`

Selects the International (ANSI) character set.

Selecting a Font

For your format's text, select the font, its size, and style (normal or bold).

Syntax   `ESC-'chheight'`
           `ESC-<cmdf>-<font>`
           `ESC-<cmdb>-<bold>`

ESC	Starts the command language.
'chheight'	Character Height. Use EXTEND or EXTENDOFF.

    1C hex Prints characters twice as high as normal (EXTEND).
    1D hex Prints characters at the normal height (EXTENDOFF).

ESC	Starts the command language.
<cmdf>	Font command. Enter **k**.
<font>	Font. Options:

    0   Large Rotated (90 degrees clockwise)

    1   Large Normal

    2   Standard Bold (default)

    3   Standard Normal

    4   Reduced Bold

    5   Reduced Normal

ESC	Starts the command language.
<cmdb>	Bold command. Enter **U**.
<bold>	Enables or disables bold printing. Options:

> **0** Turn off bold printing.
> **1** Turn on bold printing.

Example `ESC 1D hex`
      `ESC k1`
      `ESC U0`

This example uses the International (ANSI) character set, prints characters at the normal height, uses the Large Normal font, and disables bold printing.

Using Underline Characters

You can specify underlining for text on your format.

Syntax `ESC-<cmdu>-<uline>-'data'`

ESC	Starts the command language.
<cmdu>	Underline command. Enter **F**.
<uline>	Sets underline mode. Options: **w** Turns on underline for all characters following this command. Underline is used until an **ESC Fh** command is received or until the end of the current line. **h** Turns off underline for all for all characters following this command. No underline is used until an **ESC Fw** command is received or until the end of the current line.
'data'	Enter the data to print in your format. Must be enclosed within single quotation marks.

Example `ESC Fw '12345' ESC Fh '78910' ESC Fw '3345' CR`
      `'12345'`

Turns on underline for characters 12345 and turns off underline for characters 78910. The printer prints:

> <u>12345</u>78910<u>3345</u>
> <u>12345</u>

Selecting the Line Spacing

You can change the line spacing between lines or before a line.

Syntax   `ESC-<cmdls>-num`

ESC	Starts the command language.
<cmdls>-num	Line spacing command. Options:

a-num   sets the line spacing between text lines. Value for *num* is 0-10, in increments of 0.125mm.

J-num   sets the number of line feeds at the beginning of a line. Value for *num* is 0-255, in increments of 0.125mm.

Example   `ESC a2`

Sets the spacing between lines to 0.25mm.

Creating Graphic Fields

The printer can print bitmap graphics from

♦ data streams

♦ flash memory.

You use the same commands for both methods. However, if you use a data stream, you must recreate the graphic every time you print it. If you save the graphic in flash memory, you only create it once and retrieve it when you want to print it.

You can also compress graphics.

You can also change the line spacing between lines or before a line. See "Selecting the Line Spacing" in this chapter for more information.

Using Data Stream Graphics

Data stream graphics print one line at a time. These lines may contain data or spaces. To create a line, you specify bits to turn off or on. Bits turned off represent white space, and bits turned on represent part of the graphic. There is a .125 mm gap between consecutive lines.

Syntax   `ESC-<cmdgl>-<lines1><lines2>-#data#`

ESC	Starts the command language.
<cmdgl>	Graphic line command. Enter **V**.
<lines1><lines2>	The first and second hexadecimal digits of the number of lines to print.
#data#	72 hex bytes, indicating the dots to turn on or off. For example, if a specified byte is FF, all the dots are on. If it is 01, only one dot is on, and the other 7 are off.
	If you accidentally specify less than 72 bytes, the printer does not print the graphic. If you specify more than 72 bytes, a fatal error occurs.
NOTE:	You do not directly specify the bits turned on or off. You specify the bits in groups of eight by using two-digit hex values.

Example   `ESC V 10`
```
FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
FFFFFFFFFFFFFFFFFFFF
```

This line of code prints a solid horizontal line of dots. The data needs to be entered on one line. Do not use line breaks to wrap the data. This data is shown on several lines because of the font size and margins.

Using Compressed Graphics

You can compress the data in a graphic when it has repetitive values.

Syntax   **ESC-<cmdg>-<height>-<width>-<counter>-#data#**

ESC	Starts the command language.
<cmdg>	Graphic command. Enter **v**.
<height>	The number of dot lines in the following data (entered as 8-bit data).
<width>	The number of bytes per dot line (entered as 8-bit data).
<counter>	An indicator of how much data to process.
	When <counter> is signed (and a positive number), process the specified amount of data as with data stream graphics. Otherwise, repeat the next byte the specified number of times.
	When <counter> is unsigned (and less than or equal to 127), process the specified amount of data as with data stream graphics. Otherwise, repeat the next byte the specified number of times (the specification being the difference between counter and 256).
#data#	The data in the graphic. 72 hex bytes, indicating the dots to turn on or off. For example, if a specified byte is FF, all the dots are on. If it is 01, only one dot is on, and the other 7 are off.

NOTES: <counter> and <data> can repeat multiple times within one command. For using Flash Memoroy Graphics, use the graphic command above. However, <height> and <width> are replaced by <low> and <high>. Do not use <counter>, but make sure you still include the graphic's #data#.

<low><high>	The hex digits (listed backward) of a number indicating how many lines to print. For example, to print 10 lines, <low> is A, and <high> is 0.
#data#	72 hex bytes, indicating the dots to turn on or off. For example, if a specified byte is FF, all the dots are on. If it is 01, only one dot is on, and the other 7 are off. If you accidentally specify less than 72 bytes, the printer does not print the graphic. If you specify more than 72 bytes, a fatal error occurs.

Using Flash Memory Graphics

You can also use a graphic stored in flash memory. You are limited to one graphic stored in memory at a time. Saving a graphic to flash memory when there is already one there overwrites the previous one.

1. Remove the printer's battery and wait several seconds.

2. Re-insert the battery and enter Download Mode immediately. It takes two commands to enter Download Mode:

   ESC DL

   Have the host wait to send the second command until the printer responds to the first command by returning a '?' character.

   ESC LG0

3. Send the graphic one line at a time using the ESC-V command as described in "Using Data Stream Graphics."

   ESC V 1 0
   FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
   FFFFFFFFFFFFFFFFFFF

4. Save the graphic to flash memory using the following command:

   ESC LG FF hex

   When the printer receives the command, it returns a 'D' character, and begins the save. When the save is complete, the printer sends a '!' character, and then an 'X' character every 500 milliseconds.

5. Remove the printer's battery and wait several seconds before replacing it.

6. Print the flash memory graphic with the following command:

   ESC Lg0

Creating Bar Code Fields

The printer can print the following bar codes, with or without human-readable data.

♦ Code 39

♦ Codabar

♦ Interleaved 2 of 5

♦ Code 128 (UCC/EAN-128)

♦ UPC/EAN/JAN

Syntax   `ESC-<cmdbc>-<bctype>-<length>-<height>-'data'`

ESC	Starts the command language.
<cmdbc>	Bar code command. Options: **z** Prints a bar code without human-readable data. **Z** Prints a bar code with human-readable data.
<bctype>	The type of bar code to print (values are the ASCII representation, not hex). Options: **1** Code 39 **2** Code 128 (UCC/EAN-128) **3** Interleaved 2 of 5 **4** UPC/EAN/JAN **5** Codabar
<length>	The data length, specified in hex (01 – FF). This value is dependent on the bar code you choose with <bctype>. See "Specifying Particular Bar Codes."
<height>	The bar code height, specified in hex, in increments of .125 mm. <height> can be no smaller than 14. For example, 14 = 2.5 mm, 15 = 2.625 mm, etc. For UPC/EAN/JAN bar codes, the height you specify includes a 1.25 mm drop bar pattern after the bar code.
'data'	The data for the bar code. It must equal <length>. See "Specifying Particular Bar Codes" for data restrictions, which vary by bar code.

Example   `ESC Z 3 08 hex 50 hex '12345678'`

Prints an Interleaved 2 of 5 bar code, 10 mm high, containing 12345678 as the data.

Specifying Particular Bar Codes

Values for the `<length>` and `<data>` parameters depend on the type of bar code you choose with `<bctype>`.

Bar Code	`<length>`	`<data>`
Code 39	12 (maximum) with automatic centering	0-9, A-Z, -, (space), $, /, +, and %
Interleaved 2 of 5	24 (maximum)	Pairs of numeric characters (0-9)
UPC/EAN/JAN	UPCA: 12 UPCE: 7 EAN/JAN-8: 8 EAN/JAN-13: 13 These lengths are fixed and all include a check digit.	0-9
Codabar	20 (maximum) plus start and stop characters. The printer adds the stop character automatically.	Data: 0-9, $, -, :, /, ., and +. Start characters: a (the default), b, c, or d.

Code 128 (UCC/EAN-128) Details

For Code 128 (UCC/EAN-128) bar codes, `<length>` can be a maximum of **18** (with alphanumeric/control code data) or **36** (if you use subset C and numeric pairs).

The first character of `<data>` must specify the subset to use: A, B, or C (listed as **87**, **88**, and **89 hex**, respectively). The rest of the data can be all 256 ASCII characters by using a combination of the subsets. The data must appear as numeric pairs corresponding to the hex values for the ASCII character in question.

Each subset enables the bar code to contain different characters. Subset A uses **20-3F hex** and **40-7F hex** (read by a bar code scanner as **00-7F hex**), subset B uses **20-7F hex**, and subset C uses **30-39 hex**.

The following tables explain how to switch from one subset to another and use the functions.

Character	Subset A	Subset B	Subset C
`80 hex`	Function 3	Function 3	
`81 hex`	Function 2	Function 2	
`82 hex*`	Shift	Shift	
`83 hex`	Switch to Subset C	Switch to Subset C	
`84 hex`	Switch to Subset B	Function 4	Switch to Subset B
`85 hex`	Function 4	Switch to Subset A	Switch to Subset A
`86 hex`	Function 1	Function 1	Function 1

* A temporary, one character shift to another subset.

The following table describes the purpose of each function (listed in the previous table).

Function Number	Purpose
Function 1	Uses reserved Code 128 characters (UCC/EAN128).
Function 2	Appends data (subsets A and B only). The result is not readable by all bar code scanners.
Function 3	Initializes a bar code scanner.
Function 4	Extends characters by adding 128 to the ASCII code. For example, 'a' (97 decimal) is changed to 'β' (225 decimal) by adding 128 to it. This function is unavailable in subset C.

Positioning Fields

You may need to use some of these supply positioning control characters to position the fields on the format. The data stream can also write spaces to the printer before it prints text to position a field.

You can also change the line spacing between lines or before a line. See "Selecting the Line Spacing" in this chapter for more information.

NOTE: There are .157-inch no-print zones on the left and right sides of the format, and a .7-inch no-print zone at the top of the format.

Char.	Hex	Control Action
CR	0x0D	Carriage Return - Advances to beginning of next line.
LF	0x0A	Line Feed - Advances to beginning of next line.
FF	0x0C	Form Feed - Advances 10 lines.
NORM	0x14	Switches to 57-column print mode.
SI	0x0F	Shift In - Switches to 57-column print mode.
SO	0x0E	Shift Out - Switches to 36-column print mode
HT	0x09	Horizontal Tab - Advances to the next tab position (from the following list) or to the beginning of the next line: 5, 9, 13, 17, 21, 25, 29, 33, 37.
VT	0x0B	Vertical Tab - Advances 5 lines.

USING THE MAGNETIC CARD READER

Optional. Your printer may have a magnetic card reader, which reads up to three tracks of magnetically encoded data from cards conforming to the ANSI/ISO 7810 and 7811 standards.

Magnetic Card Specifications

The card thickness is 0.76 mm (+/- 0.08 mm)

Track Position	Recording Density	Recording Capacity	Number of Data Bits
Track 1 ISO1 (IATA)	210 BPI	79 Characters	7
Track 2 ISO2 (ABA)	75 BPI	40 Characters	5
Track 3 ISO3 (MINTS)	210 BPI	107 Characters	7

After reading the data, the printer returns the information to the host.

Following is a summary of what occurs when using the reader:

1. The host wakes up the printer by sending it some characters.

2. The printer responds with an XON character.

3. The device starts the reader (**ESC M** command). The green LED turns on.

4. The user swipes a card.

5. If the swipe was successful, the reader turns off and the printer sends the data read. If an error occurs, the red LED turns on. If the reader times out, the printer sends a message.

Syntax   `ESC-<cmdmc>-#timer#-<tracks>-CR`

ESC	Starts the command language.
<cmdmc>	Magnetic card command. Enter **M**. Prepares the reader for a magnetic card swipe. The reader's LED turns on when the printer receives this command, indicating it is waiting for the user to swipe the card. On a successful swipe, the LED turns off.
#timer#	Sets the reader's timer. If the user does not swipe the card through the reader before the timer runs out, an error occurs. Values are 00-99 (seconds). 00 disables the timer.
<tracks>	The combination of tracks to read. **1** Track 1 only. **2** Track 2 only. **3** Track 3 only. **4** Tracks 1 and 2 together. **5** Tracks 2 and 3 together. **6** Tracks 1, 2, and 3 together.
CR	Carriage return.

The reader responds to the read command with:

`#trck#-(data)-'?'-CR-LF-NAK`

#trck#	Track indicator. Values are %/1/ (track 1), ;/2/ (track 2), and +/3/ (track3).
(data)	The data read from the card. This field can be empty. If an error occurs, this field contains an E character and the error message text (see "Error Messages").
?	End of track character.
CR-LF-NAK	Indicates the end of a response from the printer.

4-2 Using the Magnetic Card Reader

Syntax `2 hex`

> *2 hex (Ctrl-B)*   Requests the status of the print buffer and card reader.

> The printer responds with:

`ESC-'B'-#pb#-CR-LF-ESC-'M'-#sleep#-CR-LF-NAK`

> *#pb#*   The number of characters currently in the print buffer, shown as four hex digits, which are "OR'd" with 30 hex.

> *#sleep#*   Four ASCII hex digits (which are "OR'd" with 30 hex) representing the time left before the printer enters sleep mode.

> *CR-LF-NAK*   Indicates the end of a response from the printer.

Example `ESC C`

Cancels the reading process.

Error Messages

The following data is returned when an error occurs with the magnetic card reader. When an error occurs, the reader's LED blinks once.

> `'%'-'E,'-#error#-','-(text)-CR-LF`

> Indicates an error occurred.

> *% and +*   Start of track characters.

> *E*   Indicates an error occurred.

> *#error#,(text)*   Error number and corresponding text.
> **05** Timeout Expired.
> **07** Invalid Track Number.
> **08** Unsupported Track selected.
> **09** Cancel Request.

> *CR-LF*   Carriage return and line feed.

Set the value for the timer long enough to allow the swipe, but short enough not to allow multiple swipes. If multiple swipes are done (with different cards) and each uses different tracks to store data, the data sent back to the host is a mixture from the two cards.

4-4 Using the Magnetic Card Reader

QUICK REFERENCE

For more detailed information about each command, see the previous chapters.

Choosing a Font

Syntax	Character size (WxH)	Font Name/Action
`ESC k5`	8x21	Reduced Normal
`ESC k4`	9x21	Reduced Bold
`ESC k3`	10x21	Standard Normal
`ESC k2`	12x21	Standard Bold
`ESC k1`	16x21	Large Normal
`ESC k0`	14x16	Large Rotated (90 degrees clockwise)
`ESC F1`		Selects the International character set.
`ESC F2`		Selects the PC Line-Draw character set.
`ESC U1`		Enables bold printing.
`ESC U0`		Disables bold printing.
`ESC Fw`		Enables underline mode.
`ESC Fh`		Disable underline mode.
`ESC a <num>`		Selects the dot line spacing between printed lines.
`ESC J <num>`		Performs a line feed.

Choosing a Bar Code

Syntax	Printer Action
`ESC z <bctype> <length> <height> <data>`	Prints a bar code without human-readable data.
`ESC Z <bctype> <length> <height> <data>`	Prints a bar code with human-readable data.

Printing Graphics

Syntax	Printer Action
`ESC P#`	Selects online mode, characters are printed when received.
`ESC P$`	Selects buffer mode, characters are printed on receipt of an EOT character.
`ESC V <lines1> <lines2> #data#`	Prints a line from a data stream graphic.
`ESC v <height> <width> <counter> #data#`	Specifies a line of a compressed graphic Command
`ESC DL`	Performs step 1 of entering flash memory graphic download mode.
`ESC LG0`	Performs step 2 of entering flash memory graphic download mode.
`ESC LG FF hex`	Saves a flash memory graphic.
`ESC Lg0`	Prints the stored flash memory graphic.

Supply Control Commands

Syntax	Printer Action
`ESC QJ <lines>`	Moves the supply backward in .125mm increments, looking for a black mark.
`ESC QQ <lines>`	Specifies the number of lines to continue printing after failing to find a black mark.
`ESC QF <max>`	Moves the supply forward in .25mm increments, looking for a black mark.
`ESC QB <max>`	Moves the supply backward in .25mm increments, looking for a black mark.

Font Modification

Syntax	Printer Action
`ESC DAO`	Selects characters from the ASCII character set.
`ESC DX <charfont>`	Selects extended characters from the PC Line-Draw or International character sets.
`ESC D <font> <code> <matrix>`	Loads a character at a particular position.

Configuring the Printer

Syntax	Printer Action
`ESC P^`	Prints the battery voltage.
`ESC P <value>`	Sets the power mode (when <value> is hex). Sets the print contrast (when <value> is decimal).
`ESC Mnn0 CR`	Sets the power down timer to *nn* seconds (000 = disable timer).
`ESC C`	Resets auto power down to 20 seconds.
`ESC P!`	Requests the printer's battery voltage.
`ESC P(`	Queries the printer firmware version.
`ESC P)`	Queries the printer hardware model.
`CTRL B`	Print status request for buffer and magnetic card reader.
`CTRL V`	Battery status request for buffer, battery voltage, and magnetic card reader.

Using the Magnetic Card Reader

Syntax	Printer Action
`ESC M' #timer# <tracks> CR`	Prepares the reader for a card swipe.

A-4 Quick Reference

MODIFYING STANDARD FONTS   **B**

You can modify the printer's standard fonts by redefining the characters.

NOTE: Each time you modify a font, it replaces the current font definition. The only way to return to the default font is to reload the original definition.

Standard Fonts

The following fonts are standard in the printer. Standard Bold is the default. Before you start any modifications, note the maximum size of characters in the font you want to use.

Font Name	Pitch	Columns per Line	Character Size (WxH)	Syntax
Reduced Normal	24 CPI normal	72	8x23	ESC k5
Reduced Bold	21 CPI normal	63	9x23	ESC k4
Standard Normal	19 CPI normal	57	10x23	ESC k3
Standard Bold	16 CPI normal	48	12x23	ESC k2
Large Normal	12 CPI normal	32	16x23	ESC k1
Large Rotated (90 degrees clockwise)	13 CPI rotated	32 (rows per line)	14x16	ESC k0

Modifying Fonts

To modify a font:

1. Define a new character.

2. Select a character set to modify.

3. Load the new character.

4. Save the modified font.

Modifying Standard Fonts   B-1

Defining New Characters

You must define each new character separately, performing the following procedure for each one.

1. Define the character in a matrix. The matrix size depends on the font you select (see "Standard Fonts"). Think of the matrix as a bitmap showing the character's design. Following is an example.

Left Byte								Right Byte							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

NOTE: Leave at least one column blank to the character's right so character strings do not run together.

2. Translate each line into two bit sequences (left byte/right byte), where an empty square is 0, and a filled-in square is a 1. For example, the second line from the top is 00000000 01000000.

3. Convert each bit sequence into two hex characters. For example, the second line from the top is 00 40.

Selecting Character Sets

Before selecting a character set, remove the printer's battery and wait several seconds. Then, replace the battery and immediately use one of these commands to select the character set to modify.

When it receives either of these commands, the printer copies the character set to memory, then sends a '?' character to the host.

The printer returns any characters not accepted as part of this command.

NOTE: Do not send any commands to the printer between turning it on and selecting the character set.

Syntax   `ESC-'cmdmd'-<chfont>`

ESC	Starts the command language.
'cmdmd'	Modify font command. Options:
	DA0 Selects characters from the ASCII character set (33-127).
	DX Selects characters and fonts from the Extended PC Line-Draw or International character set (128-255).
<chfont>	Character Set and Font options:
	0 Extended PC Line-Draw characters – Large Rotated, Large Normal, and Standard Bold fonts.
	1 Extended PC Line-Draw characters – Standard, Normal, Reduced Bold, and Reduced Normal fonts.
	2 International characters –Large Rotated, Large Normal, and Standard Bold fonts.
	3 International characters –Standard Normal, Reduced Bold, and Reduced Normal fonts.

Example   `ESC DX2`

Selects characters from the International Set (Large Rotated, Large Normal, and Standard Bold) fonts.

Loading New Characters

This step allows you to load the new characters at a particular position in the set.

Syntax   `<ESC>-<cmdlc>-<chfont>-<code>-#matrix#`

ESC	Starts the command language.
<cmdlc>	Load character command. Loads a character at a particular position. Enter **D**.
<chfont>	Character Set and Font options:
	0 PC Line-Draw characters (Large Normal and Standard Bold) Extended PC Line-Draw and International Fonts (Large Normal, Standard Bold, and Standard Normal)
	1 PC Line-Draw Fonts (Standard Normal) Extended PC Line-Draw and International Fonts (Large Rotated, Reduced Bold, and Reduced Normal)
	2 PC Line-Draw Fonts (Reduced Bold and Reduced Normal)
<code>	The hex character code for the new character: 21 hex – 7F hex (PC Line-Draw) or 80 hex – FF hex (Extended PC Line-Draw and International).
#matrix#	The hex data from the matrix describing the new character (see "Defining New Characters").

Saving Modified Fonts

To save the modified font into flash memory, use `ESC D FF hex`. The printer sends a 'D' character and then performs the save. When the fonts have been saved, the printer sends a '!' character to the host. Then, it sends an 'X' character every 500 milliseconds.

Next, remove the battery and wait several seconds before replacing it.

BLUETOOTH® RF COMMUNICATION

C

This printer has been electronically modified to extend the life of the battery due to the current demands of Bluetooth RF communication. The printer can be set to operate in either the MANUAL POWER OFF or AUTO POWER OFF mode of operation.

To use Bluetooth, make sure the DIP switches are set as follows:

	1	2	3	4	5	6	7	8
Bluetooth	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF

Setting the Communications Parameters

Bluetooth RF communication occurs at 38.4Kb/sec and parity none. To access the DIP switches, open the battery door and remove the battery. See "Setting the DIP Switches" in Chapter 2 for the proper location of the following DIP switch settings.

> DIP switch **#4** = OFF and DIP switch **#5** = OFF for 38.4Kb/sec
> DIP switch **#6** = OFF and DIP switch **#7** = OFF for parity none

Manual Power Off

When using RF wireless communication, turn the printer on by pressing the ON switch located on the left side of the printer. The printer remains active waiting for the wireless print command. Pressing the ON switch again turns the printer OFF. For each wireless use, turn on the printer again by pressing the ON switch. Operating in this way greatly extends the life of the battery.

Operating with dip switch **#8** ON means that the printer automatically turns off after 99 sec. (default) or the time set up by the System Administrator. This places the highest current demand from the battery resulting in reduced battery charge life. It is recommended using the universal wall charger for additional trickle charging to the battery to keep it fully charged.

If you want to leave the printer on for continuous operation (MANUAL POWER OFF), set the DIP switch **#8** to OFF.

> DIP switch **#8** = OFF

C-2 Bluetooth® RF Communication

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