



6820 Printer

TECHNICAL REFERENCE

P/N 977-019-001
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Section 1

Overview

This *Technical Reference* has been developed to provide assistance in accessing the programming capability of the 6820 Printer.

The following descriptions provide an overview of this publication.

Section 1, Overview

Consists of this overview.

Section 2, Using the Configuration Tool

The Configuration Tool for the 6820 Printer is run on a host PC. It is a step-by-step procedure, which describes how to install and use the Configuration Tool, including illustrations for almost every screen and dialog window in the program. There is also a list of the default values that would be restored if the Save Defaults button is pressed.

Section 3, Control Code Definitions

This information is useful when writing applications for the 6820 Printer; including definitions for control codes and escape sequences, with page layout diagram and end of page detection.

The control codes are organized into logical groups in this section. However, if you need to look up a function by its name, check the cross-reference tables in Section 5.

Section 4, Troubleshooting and Diagnostics

This includes some troubleshooting strategy, a description of the selftest function, a sample selftest report, diagnostic information, and error codes. The following is a list of tables included in Section 4:

- Run-Time Error Codes
 - beep codes and LED states for each error condition, with descriptions
- POST Error Codes
 - beep codes and LED states for each error condition, with descriptions
- Problems and Solutions
 - miscellaneous troubleshooting tips and possible solutions
- Compatibility Issues and Conclusions
 - some issues relating to compatibility with the 4820 printer
- Diagnostic Information

Section 5, Cross-Reference Tables

Several cross-reference tables to assist in locating control codes, as follows:

- Control Codes & Escape Sequences Index
this index is organized alphabetically, and categorized by topics with several ways to look up functions
- Single Character Control Code Definitions
this is a list of control codes consisting of one character only with definitions for those which are used other places in the publication—such as the Quick Reference table (in Section 5) and the definitions in Section 3
- Escape Sequences Quick Reference
this table is for experienced programmers who know the control codes, but just need a little reminder about the parameters; or look up a control code by its value to see what that function does
- Factory Default Printer Settings
this is a list of the default settings established in the factory, and restored upon implementing the process described in the Maintenance section of the User's Guide
- Configuration Default Settings
this is a list of the default settings that can be restored when you use the *Save Defaults* button described in the *Using the Configuration Tool* section of this *Technical Reference*

Index

A fairly comprehensive index to specific topics of interest. Use this index if you are looking for a topic not listed in the *Contents* section. It could also help you save time, instead of thumbing through the book.

Using the Configuration Tool

Introduction

The NORAND[®] 6820 Printer Configuration Tool is run on a host PC, and provides you with the means to manipulate the configuration of a 6820 Printer's flash memory.

This section describes how to install and use the configuration tool.

A list of the screens and procedures, described in this section, are listed below. The screens are shown as Figures.

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Configuration Tool Setup

Initialization

All files necessary to configure the 6820 Printer are located in the Tool Kit, including the Configuration Tool application program, `RPGPCONF.EXE`, and the initialization file, `RPGPCONF.INI`. The initialization file is used by the Configuration Tool to specify the location and names of font and printer control program files.

To set up your host PC to use the Configuration Tool, extract the Tool Kit files from the self-extracting archive file, `NPTK6820.EXE`. First, create a directory, on your host PC, with an appropriate name for the Configuration Tool files. The name of this directory is your choice. You could, of course, choose to have the files extracted at the root directory of your host PC. However, the directory used in the example below is `\6820PRTR`. Execute the self-extracting file from the target directory while specifying the path to `NPTK6820.EXE` in the command line.

Upon executing `NPTK6820.EXE`, a “TOOLKIT” subdirectory is created, as well as other associated subdirectories, as shown in the diagram below. The Configuration Tool application program and the initialization file are extracted to the `TOOLKIT` subdirectory. Other files are extracted to the other subdirectories created by the archive file.

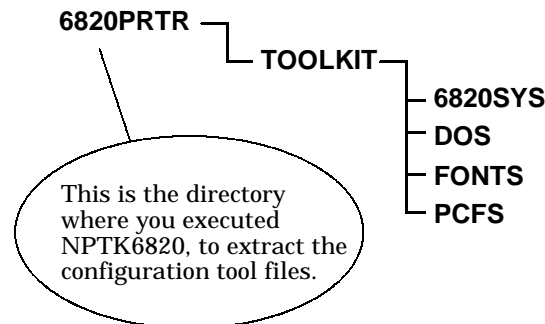


Figure 2-1
Tool Kit Directory Structure

Configuration File Support

The configuration tool allows the user to generate custom configuration files. These files have the filename extension of “.PCF”, and they reside in the directory specified in the initialization file. See `DEFAULT.PCF`, in the `PCFS` directory for an example.

Configuration Tool Operation

Overview

A configuration consists of a list of fonts, some parameter settings, and optionally, a printer control program.

When the utility is active, it holds a configuration in memory. This is called the “working configuration”. Initially, this working configuration has no fonts, the parameters are set to the default values, and there is no printer control program in memory. The working configuration should be considered as temporary, and is lost when you exit from the utility.

The Configuration Tool’s main menu offers you various ways to manipulate the working configuration. This working configuration can be overwritten with a previously saved configuration, stored either in a disk file on the computer or in the 6820 Printer itself by using one of the *Load Printer Configuration* options. The working configuration can be modified by using one of the *Modify Printer Configuration* options. Once the working configuration is loaded and/or modified, it can be saved to either a disk file or the printer by using one of the *Save Printer Configuration* options.

In addition to the various Load, Modify, and Save options, a *Defaults* option is provided, which allows you to restore the printer to a default configuration with a single option.

Starting the Program

When you run RPGPCONF.EXE, the first screen you see is like the following.

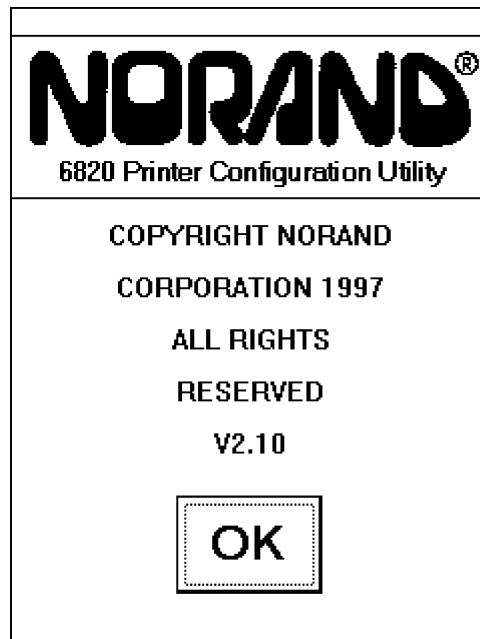


Figure 2-2
Opening Screen

Press the **OK** button to continue. *Main Menu* is the next screen.

Main Menu Options

The following options are available on the main menu dialog window.

1. Use the *Load Printer Configuration* options to load an existing configuration. Load either from disk or from the printer.
2. Use the *Modify Printer Configuration* options to review or modify the working configuration, or include the printer control program in the currently loaded configuration.
3. Use the *Save Printer Configurations* options to save a configuration file to disk or download the working configuration to your 6820 printer.
4. Use the *Defaults* option to restore the printer to its default configuration.

Note that when the *Main Menu* is first displayed, the *Save Printer Configuration* options are grayed out, prohibiting selection of those options until a configuration is loaded or modified.

The image shows a dialog window titled "Main Menu" with a "0000" value field. It is organized into several sections:

- Load Printer Configuration:** Contains two buttons: "From File" and "From Printer".
- Modify Printer Configuration:** Contains two buttons: "Fonts" and "Parameters", and a checkbox labeled "Include Control Program".
- Save Printer Configuration:** Contains two buttons: "To File" and "To Printer".
- Defaults:** Contains two buttons: "Save To Printer" and "Exit".
- Main Menu:** A button labeled "Main Menu" with the value "0000" displayed next to it.

Figure 2-3
"Main Menu" Dialog Window

• *Exit from the Configuration Tool Program*

Pressing the **Exit** button, results in displaying a message to confirm whether you are sure you really want to exit. Press the **No** button to return to the *Main Menu* dialog window. Press the **Yes** button to exit from the program.

Load Printer Configuration Options

This set of options allows you to load configuration information from disk (on the host PC) or from the printer (connected to the host computer).

There is a button for each of the two options in this set:

Button	Option
From File	Load Configuration From File
From Printer	Load Configuration From Printer

Load Configuration from File option

This option, selected from the *Main Menu*, allows you to load a configuration file from one of the drives on your host PC.

Pressing the **From File** button (from the *Main Menu* dialog) takes you to the *File Open* dialog window. In this dialog window, you can open a configuration parameters file from one of your host PC drives. It operates like the *File Open* on a standard Windows program.

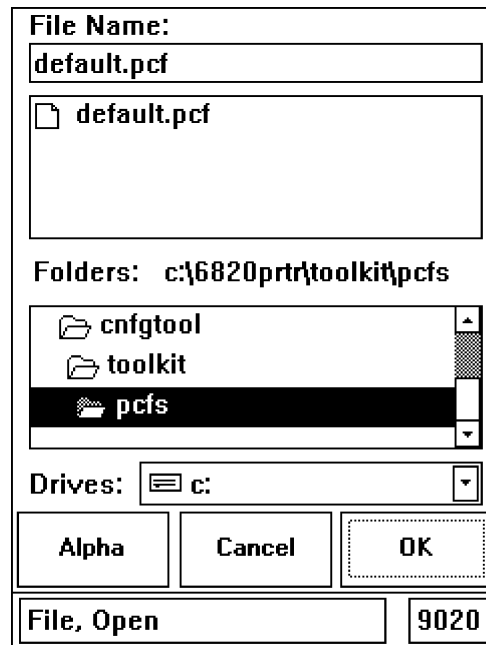


Figure 2-4
"File Open" Dialog Window

Canceling the "Load Configuration from File" Operation

Press the **Cancel** button to return to the *Main Menu* dialog window, without selecting a file to open.

Selecting a Filename

You can select the drive, directory, and filename with your pointing device, using standard MS Windows file selection methods. If you want to enter text for a filename, you can do this with the *Alpha Keyboard* option, or use your host PC keyboard. Press the **Alpha** button to bring up the *Alpha Keyboard* dialog window (see *The Alpha Keyboard* paragraph, later in this section).

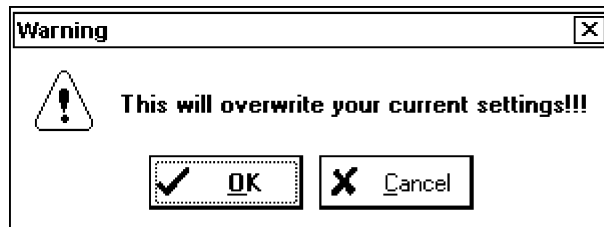
Loading the Selected File

After selecting a configuration file to load, press the **OK** button. If the selected file does NOT exist, you see an error message similar to the following.



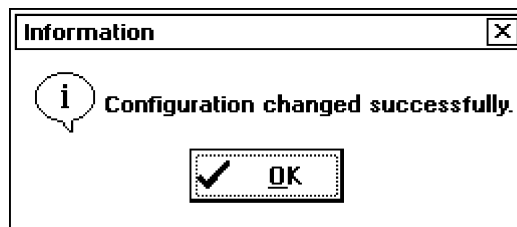
At this point, your only option is to press the **OK** button. This takes you back to the *Main Menu* dialog window, without loading a file.

If the file does exist, you see a warning that loading the selected file will overwrite your working configuration, as shown in the message box below.



If this is acceptable, press the **OK** button. Otherwise, press the **Cancel** button. If you cancel, you are taken back to the *Main Menu* dialog window, without loading a file.

After the **OK** button is selected, the configuration from the selected file is loaded into memory and becomes the current working configuration. If this load is successful, a message similar to the one shown below is displayed.



When you press the **OK** button, you are taken back to the *Main Menu* dialog window.

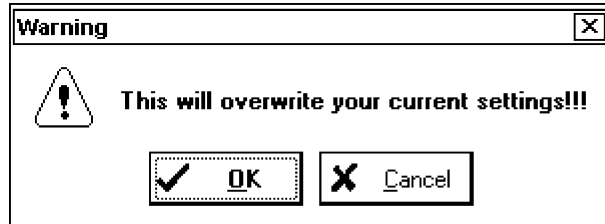
However, if the working configuration is not replaced successfully with the configuration from the selected file, an error message is displayed informing you that it was not successful, as shown below.



At this point, your only option is to press the **OK** button. This takes you back to the *Main Menu* dialog window, without loading a file.

Load Configuration from Printer option

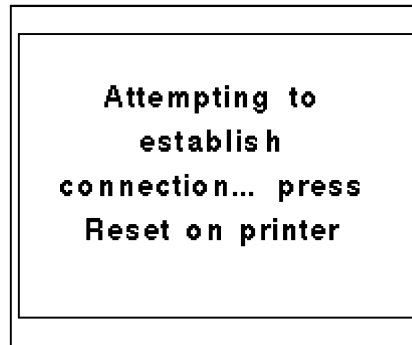
This option, selected from the *Main Menu*, loads a configuration from the 6820 Printer. Pressing the **From Printer** button (from the *Main Menu* dialog), displays a warning message (as shown below) indicating that the printer's configuration will overwrite the working configuration. If this is what you want, press the **OK** button, otherwise press the **Cancel** button.



If you press the **Cancel** button, you are returned back to the *Main Menu* dialog window, without loading the printer's configuration.

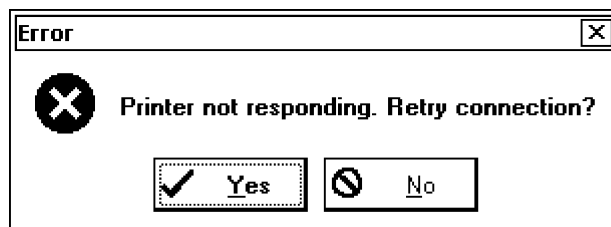
Attempting a Connection to the Printer

If you elect to continue, by pressing the **OK** button, a message is then displayed prompting you to reset the printer.



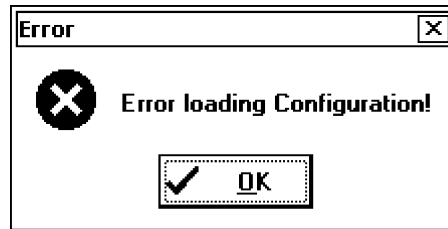
Connection Failed

If the connection is not successful, after approximately 20 seconds, the following message is displayed.



If you select the **Yes** button, repeat the previous steps, starting with *Attempting a Connection to the Printer*.

If you select the **No** button, an error message appears (as shown below) is displayed informing you that the configuration was not loaded.



At this point, your only option is to press the **OK** button. This takes you back to the *Main Menu* dialog window, without loading the printer's configuration.

Connection Successful

If the connection to the printer is successful, then no user intervention is required throughout the remainder of this operation. The *Get From Printer* function is initiated, and the Configuration Tool copies the printer configuration into the working configuration.

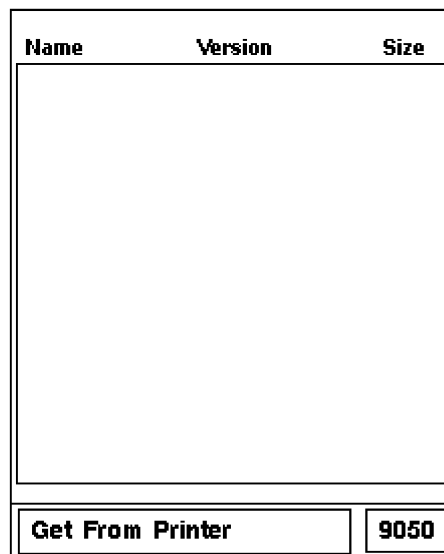


Figure 2-5
"Get From Printer" Window

This utility communicates with the 6820 printer to find out the current parameter settings and which font modules are loaded. The name, version, and size of these font modules are then displayed on the "Get From Printer" screen.

If the operation is successful, you are returned to the *Main Menu* and the printer configuration is loaded as the working configuration. You can view or modify the working configuration by selecting a *Modify Printer Configuration* option.

Modify Printer Configuration Options

This set of options allows you to view or change a working configuration, including adding fonts from disk (on the host PC), deleting printer fonts, and changing parameters settings.

There are two buttons and one selection box for the options in this set:

Button	Option
[Fonts]	<i>Font Selection</i>
[Parameters]	<i>Parameters Selection</i>
selection box	<i>Include Control Program</i>

The *Include Control Program* selection box is a switch that determines whether or not the printer control program is included when saving the working configuration to the printer. Click in this box to change the setting. When the “X” appears in the box, this means the control program will be included the next time you choose to save the printer configuration.

Generally, the control program only needs to be updated as new versions become available. The control program is named NPFL6820.MOD.

Font Selection option

This option, selected from the *Main Menu*, allows you to select fonts that are available on disk, or delete existing fonts. A variety of different international fonts are also available in the Tool Kit for the 6820 Printer.

Pressing the **Fonts** button (from the *Main Menu* dialog) takes you to the *Font Selection* dialog window. In this dialog, you can perform operations related to font files, as described below.

Note that the *Save* button is grayed out, prohibiting that selection, until either new fonts are selected, or fonts are removed from the *Fonts Selected* list.

Fonts Available	Fonts Selected
nft00000mod	
nft00437mod	
nft00932mod	
nft00936mod	
nft00949mod	
nft00950mod	
* = Not Available	
Space	438
Cancel	Copy ->
Erase	Save
Font Selection	1000

Figure 2-6
“Font Selection” Dialog Window

The “Fonts Available” List

This list shows the font files available on disk.

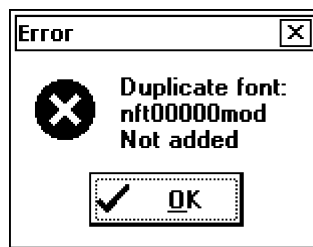
The “Fonts Selected” List

This list shows the fonts in the current configuration.

Copying Font Files

To select font files, highlight the font files in the *Fonts Available* list, with your pointing device. Several files can be highlighted at one time, using conventional Windows selection methods. Then press the **Copy** button. This will copy those font files to the *Fonts Selected* list, and you remain in the *Font Selection* dialog.

However, if you attempt to copy fonts from the *Fonts Available* list when these fonts already exist in the *Fonts Selected* list, the following error message is displayed, once for each of the duplicate fonts (where the current font filename is listed in place of nft00000.mod).



Your only option is to press the **OK** button. The error message goes away and the font is not copied to the *Fonts Selected* list. If there are two or more duplicate fonts, the cycle repeats until an error message is displayed for each of the duplicate font filenames.

The font filenames become unhighlighted, you remain in the *Font Selection* dialog window, and the duplicate fonts are not copied to the *Fonts Selected* list.

Deleting Font Files

To avoid the problem of exceeding flash memory, you can delete fonts in the printer flash, from the *Fonts Selected* list. To do this, select the font names, you want to delete in the *Fonts Selected* list. After the **Erase** button is pressed, the names disappear from the *Fonts Selected* list.

Space Remaining in Flash

The *Space Selection* box, below the *Fonts Selected* list, displays the space remaining in flash (in kilobytes), based on fonts currently selected. When this number is negative, it means the available space in flash is less than the size of the selected fonts, and some fonts need to be deleted before the selected fonts can be saved.

Saving the Selected Fonts

Note that the **Save** button is initially grayed out, disabling its use. Once the *Fonts Selected* list is changed, the **Save** button is enabled (no longer grayed out).

” **NOTE:** *Fonts marked with an asterisk (*), in the Fonts Selected list, are currently in printer flash, but not found on disk, and will be lost when flash is updated from disk (Save to Printer option).*

When the **Save** button is pressed, and there is enough space in printer flash memory for the fonts in the *Fonts Selected* list, the working configuration is

updated with the selected fonts. The amount of printer flash memory to spare, after being loaded with the selected fonts, is shown (in kilobytes) in the *Space* box. As long as this number is not negative, there is enough space for the selected fonts.

However, if you attempt to save fonts and there is not enough space in printer flash memory, the following error message is displayed.

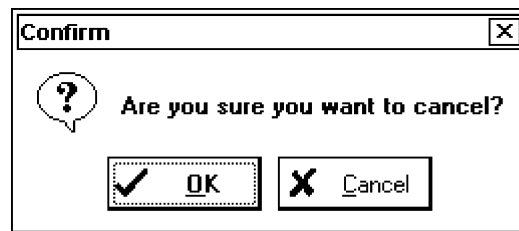


At this point, your only option is to press the **OK** button. You are still in the *Font Selection* dialog window, so you can take action to solve the space problem. To do this, delete fonts in the *Fonts Selected* list.

Canceling the “Font Selection” Operation

Press the [**Cancel**] button to return to the *Main Menu* dialog window, without making any changes. If you have not made any changes to the *Fonts Selected* list, you are returned to the *Main Menu* dialog window.

However, if you have already made some changes to the *Fonts Selected* list, a confirmation message appears, similar to that shown below.



If you select the **OK** button, you are returned to the *Main Menu* dialog window, and any changes to the *Fonts Selected* list are discarded.

If you select the **Cancel** button, you remain in the *Font Selection* dialog window.

Parameters Selection option

This option, selected from the *Main Menu*, allows you to review or modify the working configuration.

Pressing the **Parameters** button (from the *Main Menu* dialog) takes you to the *Parameters* dialog window. In this dialog, you can modify any of the parameters that are not grayed out.

Default parameter values are designated with an asterisk (*).

- " **NOTE:** The Parity options are grayed out, while the NPCP (NORAND^R Portable Communications Protocol) option is selected, prohibiting any modification of the Parity options.

Ignore these options, see notes below

Zero Print Option
 With slash * No Slash

Autofeed Configuration
 CR * CR+LF

Protocol
 NPCP *
 XON/XOFF
 DTR

Parity
 None
 Odd
 Even

Bit Rate
 9.6 K 19.2 K * 38.4 K

* = Default Values

Cancel Save

Parameters 2000

Figure 2-7
 "Parameters" Dialog Window

Modifying Parameters

To modify the configuration, select parameters on this screen using your pointing device.

- " **NOTE:** If your version of the Configuration Tool has a 38.4K bit rate selection, you should ignore that selection. If selected, it defaults to 19.2K bps. On future releases, the 38.8K bit rate will not be shown on the display.
- " **NOTE:** If your version of the Configuration Tool has an XON/XOFF selection, you should ignore that selection. If selected, it defaults to DTR. On future releases, the XON/XOFF protocol will not be shown on the display.

Saving Parameters

Pressing the **Save** button updates the working configuration, and you are returned to the *Main Menu* dialog window.

Canceling the "Parameters Selection" Operation

Press the **Cancel** button to return to the *Main Menu* dialog window, without modifying any configuration parameters.

Save Printer Configuration Options

These options allow you to save the working configuration to disk or to printer.

The "Save" options are initially grayed out in the *Main Menu*, and cannot be used until a configuration has either been loaded or modified.

There are two buttons for the options in this set:

Button	Option
[To File]	<i>Save to File</i>
[To Printer]	<i>Save to Printer</i>

Save to File option

This option, selected from the *Main Menu*, allows you to select the drive, directory, and filename with your pointing device, using standard Windows file selection methods.

Pressing the **To File** button (from the *Main Menu* dialog) takes you to the *File Save As* dialog window. This is similar to the *File Open* dialog. This option allows you to save the working configuration to a disk file.

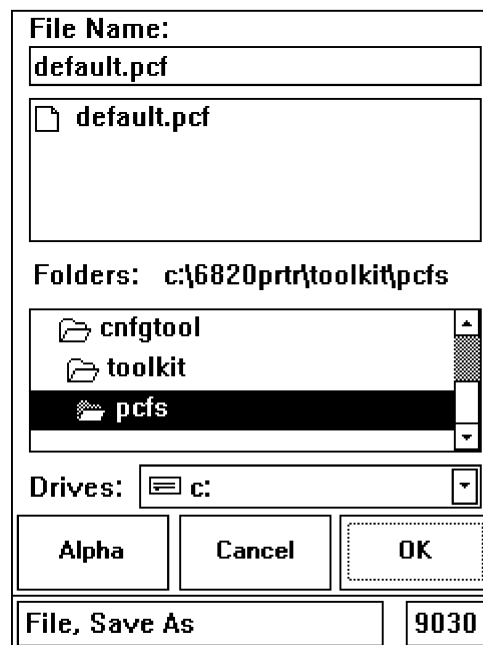


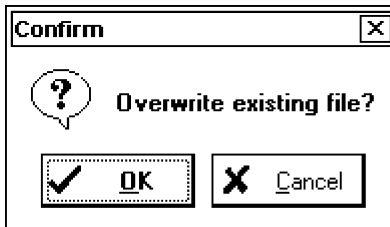
Figure 2-8
"File Save As" Dialog Window

Choosing Filename and Location on Disk

You can select the drive, directory, and filename with your pointing device, using standard MS Windows file selection methods. If you want to enter text for a filename, you can do this with the *Alpha Keyboard* option, or use your host PC keyboard. Press the **Alpha** button to bring up the *Alpha Keyboard* dialog window. (See the *Alpha Keyboard* paragraph, later in this section).

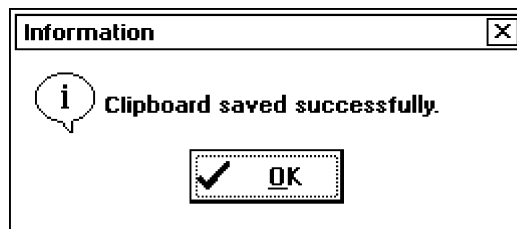
Saving the Configuration to Disk

After you have selected the drive, directory, and filename, pressing the **OK** button begins the process of saving the configuration file. If a file by the same name exists, the following confirmation message is displayed, informing you that if you continue it will overwrite the existing file.



Pressing the **Cancel** button returns you to the *Main Menu* without the working configuration being saved to a file.

If you press the **OK** button on the *Confirm* dialog window, the *File Save As* operation continues, and the following information is displayed assuring you that the working configuration has been successfully saved to disk. Then you are returned to the *Main Menu* dialog window.



Canceling the "Save to File" Operation

From the "File, Save As" dialog window, if you press the **Cancel** button, this aborts the *Save to File* operation, and you are returned to the *Main Menu* dialog window, without saving the working configuration.

Save to Printer option

This option selected from the *Main Menu*, allows you to send the working configuration to your 6820 Printer.

When the **To Printer** button (from the *Main Menu* dialog) is pressed, a warning message (as shown below) is displayed.

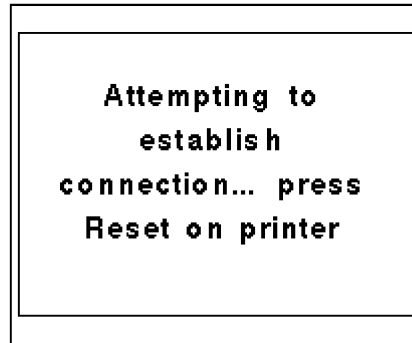


This means that the working configuration will be copied into flash memory, in your 6820 Printer, and will overwrite the current configuration settings that are in your printer. If this is what you want, press the **OK** button, which informs the system to connect to the printer and transfer the configuration.

If this is not what you want, then press the **Cancel** button, and you are returned to the *Main Menu* dialog window, without updating the printer.

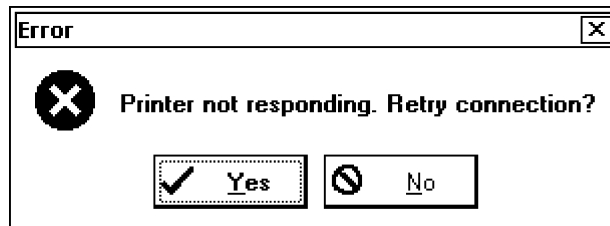
Attempting a Connection to the Printer

After pressing the **OK** button, a message is displayed, informing you that the system is attempting to establish connection with the printer. At this point you should connect a serial cable between your host PC and the printer (if not already connected), then reset the printer.



Connection Failed

If the connection is NOT successful after the predetermined period of time (approximately 20 seconds), the following message is displayed.



If you select the **Yes** button, the previous steps above (starting with *Attempting a Connection to the Printer*) are repeated.

If you select the **No** button, an error message (as shown below) is displayed informing you that the configuration was not saved.



At this point, your only option is to press the **OK** button. This takes you back to the *Main Menu* dialog window, without the printer being updated.

Connection Successful

If the connection is successful, the following screen is displayed, the *Send to Printer* function is initiated, and the printer's configuration is updated to match the working configuration.

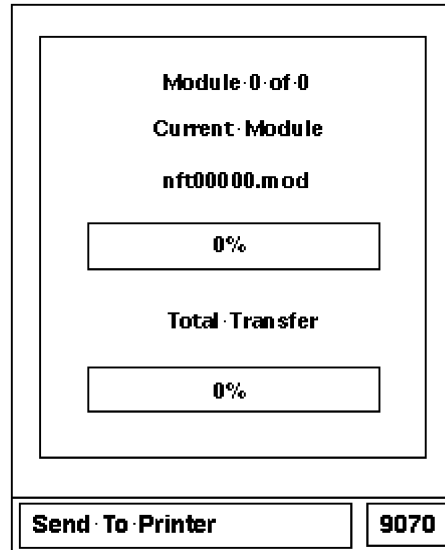
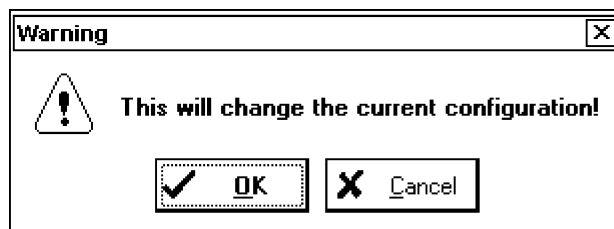


Figure 2-9
"Send To Printer" Window

The screen in Figure 2-9 displays the progress made while updating the printer's configuration. Upon completion of this operation, the *Total Transfer* bar reaches 100%, and you are returned to the *Main Menu* dialog window.

Save Defaults to Printer

Press the **Save to Printer** button, on the *Main Menu* dialog window, to load the default configuration file, DEFAULT.PCF, and save it to the printer. This combines the operations of the [from file], the selection of the DEFAULT.PCF file, and the [to printer] into a single button. The following message appears stating that the working configuration will be overwritten.

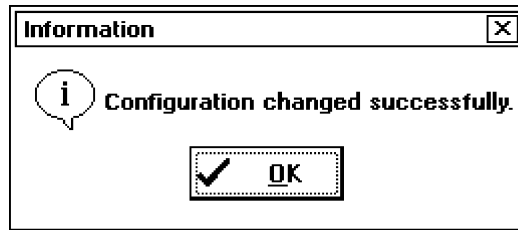


Press the **Cancel** to return to the *Main Menu* dialog window without loading the default configuration file.

If you press the **OK** button, and if the default configuration file is NOT successfully loaded into the working configuration (i.e. the DEFAULT.PCF file is missing), then the following error message appears:



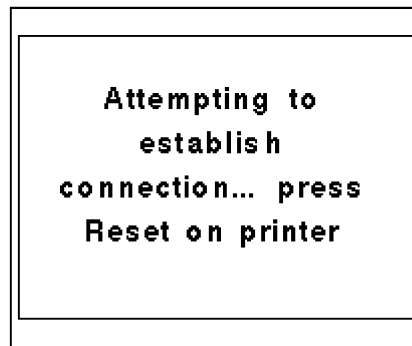
Press the **OK** button to return to the *Main Menu* dialog window, without loading a file. If the default configuration file is successfully loaded into the working configuration, a message, as shown below, is displayed.



Press the **OK** button to continue with the *Restore Defaults to Printer* operation.

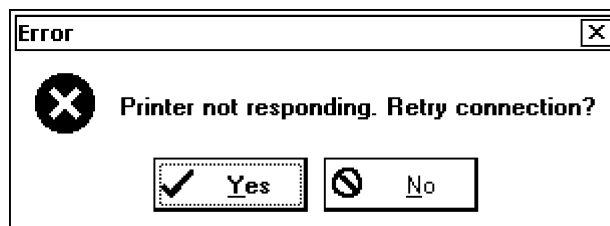
Attempting a Connection to the Printer

If the default configuration was successfully loaded into working configuration, then the following message is displayed, prompting you to reset the printer.



Connection Failed

If the connection is not successful, after approximately 20 seconds, the following message is displayed.



Press the **Yes** button to repeat the previous steps, above, starting with *Attempting a Connection to the Printer*. If you select the **No** button, an error message (as shown below) is displayed.



At this point, pressing the **OK** button takes you back to the *Main Menu* dialog window, without saving the default configuration to the printer.

Connection Successful

If the operation was successful, your 6820 Printer is now set to the default configuration in flash memory, and you are returned to the *Main Menu*.

Default Printer Settings

The following settings are used when *Restore Defaults to Printer* is selected:

- **Zero Print Option:** Slash all zeros (zeros are printed with a slash)
- **Autofeed Configuration:** CR (carriage return at end of line without line feed)
- **Protocol:** NPCP
- **Parity:** N/A (for NPCP)
- **Bit Rate:** 19.2K

For other printer defaults, refer to the *Printer Defaults* paragraph, in the *Cross-Reference Tables* section of this publication.

Alpha Keyboard

The **Alpha** button, on either the *File Open* dialog window or the *File Save As* dialog window, brings up the alpha keyboard onscreen for you to enter text.

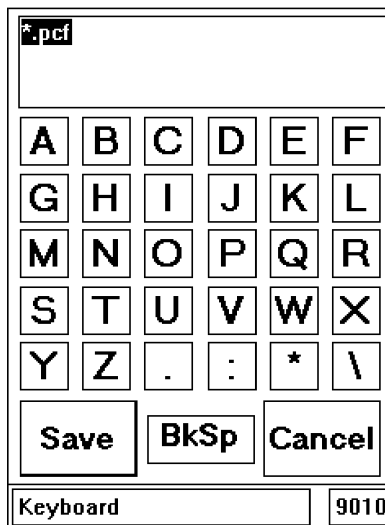
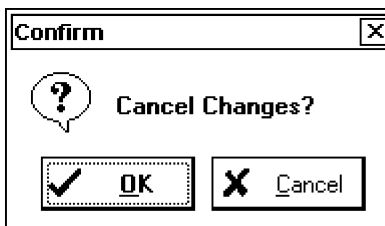


Figure 2-10
"Alpha Keyboard" Dialog Window

Returning the Filename to the Previous Dialog Window

After selecting all of the needed text, press the **Save** button to return the text to the window where needed. Press the **Cancel** button to exit without saving the text. The following confirmation message appears:



Press the **OK** button to return to the previous dialog window without the text you have entered, or press **Cancel** to stay in the *Alpha Keyboard* dialog window.

Control Code Definitions

Introduction

This section contains a set of control code definitions and specifications for page layout for the 6820 Printer. These control code definitions are organized by categories of functions, as listed below.

Topics	Page
Control Code Definitions	3-2
Buffers (I/O buffer and Print buffer)	3-2
General Printer Control Functions	3-2
Backspace, Beeper, Cancel line, Carriage Return, Delete, Form Feed, Half-speed, Inactivity time, Line Feed, Master reset, Set print position, Top-down/Bottom-up, Unidirectional printing	
Page Formatting Functions	3-6
Page length, Line spacing, Margins, Skip over perforation	
Character Style and Text Mode Functions	3-9
Condensed, Double-strike, Double-wide, Elite, Emphasized, Italic, Intercharacter space, Master select, Pica, Superscript, Subscript, Underline	
Tabs and Tab Setting Functions	3-14
Horizontal tabs, Vertical tabs	
Character Sets and User Defined Functions	3-17
Single/Double/Multi-byte, National character set, User defined, Printing of character graphics	
Graphics Functions	3-24
Eight-pin graphics modes, Nine-pin graphics modes	
Page Layout for Fanfold Paper	3-27

To locate control codes easily, several methods have been provided:

By **Categories**—in the *Topic Summary* above, select the category, turn to that page, then locate the control code definition.

Alphabetically organized (complete list)—refer to *Control Codes & Escape Sequences Index* table, in *Cross-Reference Tables* section, locate the index for the control code, and turn directly to that page.

Numeric order (single character codes only)—refer to *Single Character Control Code Definitions* table, in *Cross-Reference Tables* section, locate index for the control code, and turn directly to that page.

Numeric order (complete list)—refer to *Escape Sequences Quick Reference* table, in *Cross-Reference Tables* section, to look up control codes by actual code values. Locate index for the escape sequence, and turn directly to that page.

Control Code Definitions

Buffers

I/O Buffer

All characters and control codes received by the printer are stored in this buffer. Characters and controls codes are read from this buffer and acted upon to form the print buffer. Characters are removed from the I/O buffer as they are processed.

Print (image) Buffer

All characters go through this buffer on their way to the printed page. This buffer contains the graphic image of the dots to be printed, from which characters are rendered. It is cleared whenever its contents are printed.

Special Notations

The following information defines notations included in the format definitions of the escape sequences, throughout this section.

Notation	Description
(0)	Used in the ASCII column of any of the <i>Format</i> definitions, indicates that its value can only be zero (and not the character "0"). For example: Select Top-Down Printing ESC US (0).
(1)	Used in the ASCII column of any of the <i>Format</i> definitions, indicates that its value can only be one (and not the character "1"). For example: Select Bottom-Up Printing ESC US (1).
*	When a number (at the end of an escape sequence) is marked with an asterisk, then either the value corresponding to that number or the value of the string character can be used for that number. For example, if 1* is shown, then either the value (1), or the value of the string character (decimal: 49, hex: 31) can be used.
NUL	The NUL character is represented in the Dec column as 0, in the Hex column as 00, and in the ASCII column as NUL.

General Printer Control Functions

Backspace

The print buffer is emptied. The print head is moved to the left one character space (using the current pitch). This can be performed to, but not beyond, the left margin setting. The backspace is ignored if justification of right, full, or centered has been selected.

Format:

Decimal	Hex	ASCII
8	08	BS

The backspace control code (BS) is not reliable when text contains different character pitches. For reliable backspacing, use the escape sequence (ESC “\”), *Set Relative Print Position*.

Beeper

The printer’s sounding device produces a beep sound for approximately 1/10 of a second.

Format:

Decimal	Hex	ASCII
7	07	BEL

Cancel Line

All of the characters currently in the print buffer are discarded. Current print position is set to left margin. Text that has already been printed cannot be canceled.

Format:

Decimal	Hex	ASCII
24	18	CAN

Carriage Return

The print head is repositioned at the start of the print line (usually at the left margin), and repositions the pointer to the start of the print buffer, after printing all data in the buffer. Also, all of the “one line” functions are reset (for example: bold, double-strike, double-wide, unidirectional printing).

Format:

Decimal	Hex	ASCII
13	0D	CR

” **NOTE:**

*An automatic line feed can be added with a configuration item (see **Configuration Parameters**, in the **Troubleshooting and Diagnostics** section).*

Delete

The last character in the print buffer is deleted. This functions only in left justification.

Format:

Decimal	Hex	ASCII
127	7F	DEL

Form Feed

The contents of the print buffer is printed, the print buffer is cleared, and the paper is advanced to the top of the next page (Top of Form), according to the current page length setting. The carriage position is moved to the start of the line.

Format:

Decimal	Hex	ASCII
12	0C	FF

Select Half-Speed Printing

Half-speed mode is turned on to provide quiet printing, and more accurate print positioning during text mode printing.

Format:

Decimal	Hex	ASCII
27 115 1*	1B 73 01*	ESC "s" 1*

Cancel Half-Speed Printing

Half-speed mode is turned off (factory default), and continues with normal speed printing.

Format:

Decimal	Hex	ASCII
27 115 0*	1B 73 00*	ESC "s" 0*

Set Inactivity Time for Sleep Mode

The time period, for which the printer waits during inactivity before it goes into low-power mode, is set (in **n** seconds). The factory default = 10 seconds.

Format:

Decimal	Hex	ASCII
27 122 n	1B 7A n	ESC "z" n

Line Feed**Perform Line Feed**

The contents of the print buffer is printed, then cleared, and the character count is reset to zero; then the print head advances to the next print line, using the current spacing. The position of the carriage is not affected and a carriage return is not executed.

Format:

Decimal	Hex	ASCII
10	0A	LF

Perform n/216-inch Line Feed

The paper to immediately advanced n/216 of an inch. This does not affect subsequent line feeds.

Range of n: 0–255

Format:

Decimal	Hex	ASCII
27 74 n	1B 4A n	ESC "J" n

Perform n/216-inch Reverse Line Feed

An immediate reverse line feed of n/216 of an inch is produced. This does not affect subsequent line feeds.

Range of n: 0–255

Format:

Decimal	Hex	ASCII
27 106 n	1B 6A n	ESC "j" n

Perform Master Reset

The Master Reset code initializes the printer, by resetting all special modes to their default power-up states (see the *Factory Defaults* paragraph, in the *Cross-Reference Tables* section, for a complete list of the settings that are initialized with this command).

Format:

Decimal	Hex	ASCII
27 58	1B 40	ESC "@"

Set Print Position (absolute)

The print head is moved to an absolute horizontal position on the paper. The distance is specified, in dots from the left margin to the new print position (at which subsequent characters are printed). Each dot represents 1/60 of an inch. The values for n1 and n2 determine the distance, as follows:

$$\text{number of dots} = n1 + (n2 * 256)$$

Maximum position is 480. The previous contents of the current print buffer is printed.

If the position specified would have placed the print head outside the current margins, this function is ignored and the previous setting remains effective. This function is also ignored in right, center, and full justification modes.

Format:

Decimal	Hex	ASCII
27 36 n1 n2	1B 24 n1 n2	ESC "\$" n1 n2

Set Print Position (relative)

The print head is moved to a horizontal position on the paper, relative to the current print head position. The distance specified is in dots. To determine n1 and n2, first calculate the displacement required in 1/120ths of an inch. If the displacement is to the left, subtract it from 65536. The values for n1 and n2 determine the distance, as follows:

$$\text{number of dots} = n1 + (n2 * 256)$$

Maximum displacement is ± 960 . If the position specified would place the print head outside the current margins, this function is ignored and the previous setting remains in effect. This function is also ignored in right, center, and full justification modes.

Format:

Decimal	Hex	ASCII
27 92 n1 n2	1B 5C n1 n2	ESC "\" n1 n2

Select Top-Down Printing

Top-down printing (factory default) is enabled. The first page is printed first.

Format:

Decimal	Hex	ASCII
27 31 0	1B 1F 00	ESC US (0)

Select Bottom-Up Printing

Bottom-up printing is enabled. The last page is printed first.

Format:

Decimal	Hex	ASCII
27 31 1	1B 1F 01	ESC US (1)

Select Unidirectional Printing

Unidirectional mode is turned on, causing the print head to print from left-to-right only. This allows more accurate print positioning during text mode printing.

Format:

Decimal	Hex	ASCII
27 85 1*	1B 55 01*	ESC "U" 1*

Cancel Unidirectional Printing

Unidirectional mode is turned off (factory default), allowing the print head to print in both directions.

Format:

Decimal	Hex	ASCII
27 85 0*	1B 55 00*	ESC "U" 0*

Select Unidirectional (one line) Printing

Unidirectional printing is turned on, for the current line only. The contents of the print buffer is printed, and cleared, before setting this mode. This allows more accurate print positioning during text mode printing, for the current line.

Format:

Decimal	Hex	ASCII
27 60	1B 3C	ESC "<"

Page Formatting Functions

This set of functions consists of control codes that change the formatting for the page, such as page length, margins, line spacing, etc. The page length (form length) and margin settings are used to define the printable area on the page. These settings need to conform to the actual size of the paper being used in the printer.

Page Length

Set Page Length (lines)

The length of the paper is set, in lines, where the range of n (number of lines) is 1-127 (default = 66). Keep in mind the line spacing and actual length of the paper when specifying this value, since this function is dependent on those parameters. Top-of-Form is reset to the current line and the *Skip Over Perforation* setting is canceled.

Format:

Decimal	Hex	ASCII
27 67 n	1B 43 n	ESC "C" n

Set Page Length (inches)

The length of the paper is set, in inches, where the range of n (number of inches) is 1-22 (default = 11). Keep in mind the line spacing and actual length of the paper when specifying this value, since this function is dependent on those parameters. Also, Top-of-Form is reset to the current line and the *Skip Over Perforation* setting is canceled.

Format:

Decimal	Hex	ASCII
27 67 0 n	1B 43 00 n	ESC "C" NUL n

Line Spacing

These functions set the amount of space from one line to the next, for line feeds. The factory default is 1/6 inch (6 lines per inch).

The Page Length, Vertical Tab, and Skip Over Perforation functions are also dependent upon this function.

Select 1/8-inch Line Spacing

Line spacing is set to 1/8 of an inch (8 lines per inch), for subsequent lines.

Format:

Decimal	Hex	ASCII
27 48	1B 30	ESC "0"

Select 7/72-inch Line Spacing (7 dots)

Line spacing is set to 7/72 of an inch (approximately 9.7 lines per inch), for subsequent lines.

Format:

Decimal	Hex	ASCII
27 49	1B 31	ESC "1"

Select 1/6-inch Line Spacing

Line spacing is set to 1/6 of an inch (6 lines per inch), for subsequent lines (factory default). 1/6 inch is equal to 12 dot spacing.

Format:

Decimal	Hex	ASCII
27 50	1B 32	ESC "2"

Select n/216-inch Line Spacing

Line spacing is set to n/216 of an inch, for subsequent lines. A spacing of 1/216 inch is 1/3 the distance between pins of the print head (approximately 1/3 of a dot) and 27/216 is 8 lines per inch.

Range of n: 0-255

Format:

Decimal	Hex	ASCII
27 51 n	1B 33 n	ESC "3" n

Select n/72-inch Line Spacing (n dots)

Line spacing is set to $n/72$ of an inch, for subsequent lines. A spacing of $1/72$ inch (1 point in font size) is the distance between pins on the print head (approximately 1 dot) and $9/72$ is 8 lines per inch.

Range of n: 0-85

Format:

Decimal	Hex	ASCII
27 59 n	1B 41 n	ESC "A" n

Set Margins

Margin settings are used to define the horizontal print area on the page. The minimum space between margins is the width of one double-wide pica character.

Set Right Margin

All text in the print buffer is cleared, then the right margin is set to **n** columns, using the current character pitch. This is the number of the characters from column 1 (at the left edge of the paper) to the last column before the right margin (factory default = 80).

The minimum space between margins is the width of one double-width pica character. The maximum value for this setting is the maximum number of characters (based on the current pitch) that would fit between the left margin and the right edge of the default printable area of the page. Ranges shown below could vary, depending on values of other parameters that affect character width. If the value specified is not within the allowed range, it is ignored.

Format:

Decimal	Hex	ASCII
27 81 n	1B 51 n	ESC "Q" n

Range of n: 2-80 (in Pica mode)
 2-96 (in Elite mode)
 2-136 (in Compressed mode)

Set Left Margin

All text in the print buffer is cleared, then the left margin is set, relative to the number of columns to the left of the first column to be printed (factory default = 0).

The minimum space between margins is the width of one double-width pica character. The maximum value must be less than the right margin. Ranges shown below could vary, depending on values of other parameters that affect character width. If the value specified for this function is not within the allowed range, it is ignored.

Format:

Decimal	Hex	ASCII
27 108 n	1B 6C n	ESC "I" n

Range of n: 0-78 (in Pica mode)
 0-93 (in Elite mode)
 0-133 (in Compressed mode)

Set Skip Over Perforation

This function is valid for continuous paper only. The number of lines, to be skipped between the last printed line on the page and the first printed line on the next page, is set. If the value specified for this function is greater than the page length, it is ignored. This function is canceled by the use of one of the *Set Page Length* functions (factory default = disabled).

Format:

Decimal	Hex	ASCII
27 78 n	1B 4E n	ESC "N" n

The amount of space left blank at the bottom of the printed page is dependent upon the current Line Spacing.

Cancel Skip Over Perforation

The *Skip Over Perforation* is canceled, which allows the maximum number of lines to be printed on each page.

Format:

Decimal	Hex	ASCII
27 79	1B 4F	ESC "O"

Character Style and Text Mode Functions

The following set of functions affect the appearance of text on the printed page. This could involve size, typeface, or other characteristics of the text.

Select Condensed Mode (compressed)

The condensed mode is selected, which prints characters at approximately sixty percent of the normal width. This results in character pitches, as shown below (for exact pitch values, see *Master Select*, on page 3-12):

Condensed Mode	Condensed + Expanded Mode	Condensed + Elite
17 cpi (approx.)	9 cpi (approx.)	20 cpi (approx.)

This function empties the print buffer and turns compressed mode on, and stays on until canceled by *Cancel Compressed Mode*, ESC SI (0) or DC2 (factory default = disabled).

NOTE:

This function is not supported in Double-byte Character Sets (DBCS).

Format:

Decimal	Hex	ASCII
27 15	1B 0F	ESC SI
15	0F	SI

Cancel Condensed Mode (compressed)

This function cancels the compressed mode, enabled by *Select Compressed Mode*, SI or ESC SI (1).

" **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 18	1B 12	ESC DC2
18	12	DC2

Select Double-Strike Mode

Double-strike printing is enabled, until *Cancel Double-Strike Mode* is encountered. Factory default disables double-strike. Text is made bolder by printing each dot twice, with the second dot slightly below the first dot. This mode is not available in NLQ, yet is not canceled by the selection of NLQ.

" **NOTE:** *This function is not supported in Double-byte Character Sets (DBCS).*

Format:

Decimal	Hex	ASCII
27 71	1B 47	ESC "G"

Cancel Double-Strike Mode

The effect of *Select Double-Strike Mode* is canceled.

" **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 72	1B 48	ESC "H"

Select Double-Wide (expanded) Mode (one-line-only)

Expanded print is enabled, for current line only. The mode set previously returns on subsequent lines. However, expanded print can be canceled with *Cancel Expanded Print*, DC4 or ESC "W" (0), before end of current line, or wrapping of the print buffer. This works with all three pitches (Pica, Elite, Compressed).

" **NOTE:** *This function is not supported in Double-byte Character Sets (DBCS).*

Format:

Decimal	Hex	ASCII
27 14	1B 0E	ESC SO
14	0E	SO

This mode is also terminated by the execution of a *Carriage Return*, *Line Feed*, *Form Feed*, *Vertical Tab* or wrapping of the print buffer.

Cancel Double-Wide (expanded) Print (one-line-only)

Double-Wide (expanded) print mode is canceled for the current line only. Modes set previously return on subsequent lines. However, it does not cancel expanded mode set by *Select Double-Wide (expanded) Mode*, ESC “W” (1) or *Master Select*, ESC “!”.

” **NOTE:** *This function is not supported in Double-byte Character Sets (DBCS).*

Format:

Decimal	Hex	ASCII
27 20	1B 14	ESC DC4
20	14	DC4

Select Double-Wide (expanded) Mode

Expanded print mode is enabled, until *Cancel Expanded Print* is encountered. Factory default disables double-wide mode.

” **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 87 1*	1B 57 01*	ESC “W” 1*

Cancel Double-Wide (expanded) Mode

Double-wide print mode (previously set by *Select Double-Wide Mode*) is canceled.

” **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 87 0*	1B 57 00*	ESC “W” 0*

Select Elite Pitch

A character pitch of 12 cpi (characters per inch) is selected. This also cancels Pica Pitch (factory default = Pica).

” **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 77	1B 4D	ESC “M”

Select Emphasized Mode

Emphasized printing is enabled, until *Cancel Emphasized Mode* is encountered. The text is made bolder by printing each dot twice, with the second dot slightly to the right of the first dot. Factory default disables Emphasized mode.

” **NOTE:** *This function is not supported in Double-byte Character Sets (DBCS).*

Format:

Decimal	Hex	ASCII
27 69	1B 45	ESC “E”

Cancel Emphasized Mode

The effect of the *Select Emphasized Mode* is canceled.

" **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 70	1B 46	ESC "F"

Define Intercharacter Space

This function defines the amount of space to the right of each character, in addition to the space allowed in the character design. The variable **n** represents the number of units of space, with each unit equal to 1/120 of an inch. Range of values for **n**: 0-63 (factory default = 0).

Format:

Decimal	Hex	ASCII
27 32 n	1B 20 n	ESC SP n

Select Italic Mode

The text (nongraphic) characters are italicized. Factory default disables Italic mode.

" **NOTE:** *This function does not work well with DBCS or alternate Single byte Character Sets (SBCS).*

Format:

Decimal	Hex	ASCII
27 52	1B 34	ESC "4"

Cancel Italic Mode

The italic mode, set by the *Select Italic Mode* function, is canceled.

" **NOTE:** *This function does not work well with Double-byte Character Sets (DBCS) or alternate SBCS.*

Format:

Decimal	Hex	ASCII
27 53	1B 35	ESC "5"

Master Select

Combinations of modes are allowed with this function. The variable **n** is determined by combining values for the desired modes, by adding them together.

" **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 33 n	1B 21 n	ESC "!" n

Valid combinations of the values in the following table include any combinations except that Pica cannot be combined with Elite.

An example of combining values: Pica Compressed Italic Underlined, by adding values (00h + 04h + 40h + 80h), which results in C4h for the value of n.

Hex Value	Mode
00h	Pica
01h	Elite
04h	Condensed (compressed)
08h	Emphasized
10h	Double-Strike
20h	Double-Width (expanded)
40h	Italic
80h	Underlined

Comments:

The following print conflicts occur between modes. A mode in any column takes precedence over all modes in the columns to its right.

1	2	3
Elite	Emphasized	Compressed

The following print modes can be combined producing different pitches:

Pitch	Modes
5 cpi	Expanded
6 cpi	Expanded Elite
8.58 cpi	Expanded Compressed
10 cpi	Pica
12 cpi	Elite
17.16 cpi	Compressed

Select Pica Pitch

A character pitch of 10 cpi (characters per inch) is selected (factory default). This also cancels Elite pitch.

" **NOTE:** *This function is not supported in Double-byte Character Sets (DBCS).*

Format:

Decimal	Hex	ASCII
27 80	1B 50	ESC "P"

Select Superscript Mode

All subsequent characters are printed approximately two-thirds the normal height in the upper part of the character space, until *Cancel Subscript/Superscript* is encountered.

" **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 83 0*	1B 53 00*	ESC "S" 0*

Select Subscript Mode

All subsequent characters are printed approximately two-thirds the normal height in the lower part of the character space, until *Cancel Subscript/Superscript* is encountered.

" **NOTE:** *This function is not supported in Double-byte Character Sets (DBCS).*

Format:

Decimal	Hex	ASCII
27 83 1*	1B 53 01*	ESC "S" 1*

Cancel Subscript/Superscript Mode

The effects produced by *Select Superscript Mode* and *Select Subscript Mode* are canceled. Factory default also disables both of these modes.

" **NOTE:** *This function is not supported in DBCS.*

Format:

Decimal	Hex	ASCII
27 84	1B 54	ESC "T"

Select Underline Mode

The underlining of all subsequent characters (including spaces) is enabled, until the *Cancel Underline Mode* function is encountered.

Format:

Decimal	Hex	ASCII
27 45 1*	1B 2D 01*	ESC "-" 1*

Cancel Underline Mode

The effect of the *Select Underline Mode* function is canceled. Factory default also disables the Underline mode.

Format:

Decimal	Hex	ASCII
27 45 0*	1B 2D 00*	ESC "-" 0*

Tabs and Tab Setting Functions

Horizontal Tabs

This set of functions deals with horizontal tabs: set tabs, tab to next tab stop, clear tabs, and set tab increments.

Comments:

- " Tab settings are not affected by subsequent changes in pitch.
- " Tabs may range up to maximum width for the character and printer size.
- " All previous tab stops are cleared when new tab stops are set. Also, if the left margin is changed after the horizontal tabs are set, then all tab stops are cleared.
- " Tabs become absolute positions and are not affected by any subsequent change in character size.
- " All tabs set outside of the printable area are ignored.

Perform Horizontal Tab

The print position is moved to the next horizontal tab stop. The tab positions, set by ESC "D", the *Set Horizontal Tabs* function, are not affected by any changes in character pitch.

The factory default tab settings are at intervals of eight characters, in the currently selected pitch. For the default tabs, the actual distance to each tab position is affected by changes in character pitch.

Format:

Decimal	Hex	ASCII
9	09	HT

Set Horizontal Tabs

The current horizontal tabs are reset, and new horizontal tabs are set up, based on the current character width (pitch).

Format:

Decimal	Hex	ASCII
27 68 n1 n2 ... nk 0	1B 44 n1 n2 ... nk 00	ESC "D" n1 n2 ... nk NUL

where: n1= first tab (range of values for tab stops: 1-255)
 n2= second tab (all tabs must be in ascending order)
 ... = subsequent tabs (maximum number of tabs: 32)
 nk= last tab to set (any value less than the previous tab value acts as a terminating character)
 NUL= terminating character

Clear Horizontal Tabs

All horizontal tab stops are cleared. It is merely a variant behavior of the *Set Horizontal Tabs* function, where the NUL acts as an early terminating character, since the function normally clears the existing tabs before setting any new tabs.

Format:

Decimal	Hex	ASCII
27 68 0	1B 44 00	ESC "D" NUL

Vertical Tabs

This set of functions deals with vertical tabs: set tabs, tab to next tab stop, clear tabs, set tab increments, set tabs in channels, and select a tab channel.

Comments:

- Tab positions are line numbers, counting from the Top of Form.
- All tabs set beyond the page length are stored, but are not used.
- Any tab set within the SOP range (Skip Over Perforation), during the time SOP is active, are stored but not used until SOP is canceled.
- If a vertical tab is encountered, and the next tab stop is outside the printable page area, a form feed is executed placing the print head at the next Top of Form.
- All previous tab stops are cleared when new tab stops are set.
- Tab settings are not affected by subsequent changes in line spacing.

Perform Vertical Tab

The contents of the current print buffer are printed first, then the print position is moved to the next vertical tab stop. If no channel has been selected, then channel 0 is used. The carriage position is changed to the start of the next print line. If the vertical tab is performed beyond the last tab position set or beyond the last line of a form, then a form feed is performed. If no vertical tabs have been defined, then the paper advances one line, using the currently selected line spacing, without changing the carriage position.

Format:

Decimal	Hex	ASCII
11	0B	VT

Set Vertical Tabs

The current tabs are reset, and vertical tabs are set up, based on the current line spacing. Tab settings are not affected by subsequent changes in line spacing.

Format:

Decimal	Hex	ASCII
27 66 n1 n2 ... nk 0	1B 42 n1 n2 ... nk 00	ESC "B" n1 n2 ... nk NUL

where: n1= first tab (range of values for tab stops: 1-255)
 n2= second tab (all tabs must be in ascending order)
 ... = subsequent tabs (maximum number of tabs: 16)
 nk= last tab to set (any value less than the previous tab value acts as a terminating character)
 NUL= terminating character

All tab settings with this function are stored in channel 0.

Clear Vertical Tabs

All vertical tab stops are cleared. It is merely a variant behavior of the *Set Vertical Tabs* function, where the NUL acts as an early terminating character, since the function normally clears the existing tabs before setting any new tabs.

Format:

Decimal	Hex	ASCII
27 66 0	1B 42 00	ESC "B" NUL

Set Vertical Tabs in Channel

This function works the same as the *Set Vertical Tabs* function, except that it stores the tabs into a specified channel, as specified by the variable *c*. This channel is selected for use by the *Select Vertical Tab Channel* function.

Format:

Decimal	Hex	ASCII
27 98 c n1 n2 ... nk 0	1B 62 c n1 n2 ... nk 00	ESC "b" c n1 n2 ... nk NUL

where: c = channel number (range: 0-7)
 n1= first tab (range of values for tab stops: 1-255)
 n2= second tab (all tabs must be in ascending order)
 ... = subsequent tabs (maximum number of tabs: 16)
 nk= last tab to set (any value less than the previous tab value acts as a terminating character)
 NUL= terminating character

Clear Vertical Tabs in Channel

All vertical tab stops in the specified channel are cleared. This is merely a variant behavior of the *Set Vertical Tabs in Channel* function, where the NUL acts as an early terminating character, since this function normally clears the existing tabs before setting any new tabs.

Format:

Decimal	Hex	ASCII
27 98 c 0	1B 62 c 00	ESC "b" c NUL

Select Vertical Tab Channel

A specified tab channel is selected. It sets up the current tabs from that channel. Once this function has been performed, all subsequent *Perform Vertical Tab* commands use the tab stops from the list retrieved from the specified channel. At power on, the printer uses the tabs stored in channel 0.

Format:

Decimal	Hex	ASCII
27 47 c	1B 2F c	ESC "/" c

where:

c = channel number (range: 0-7)

Character Sets and User-Defined Functions

Different character sets may be installed in the 6820 printer. In some cases more than one character set may be present at one time, depending on the amount of available font memory. The 6820 reserves 437K of memory for installable fonts in FLASH memory. These character sets can be installed by the end user using NPCP protocol or the flash configuration tool available in the 6820 tool kit. They can also be installed in flash at the time of manufacture or service. A printer tool kit is available for installing selected font modules.

Single Byte Character Sets

Single byte character sets (SBCS) are supported for MS-DOS, PL/N, and Norand application compatibility. NFT000000.MOD is the default character set (font) for compatibility with the 4820. NFT00437.MOD is the IBM/Microsoft compatible character set for codepage 437.

Double-Byte Character Sets

Double-byte character sets (DBCS) are a new feature of the 6820 printer. These character sets require two bytes to be sent to the printer, in order to define the character to be printed. The first byte of the character code sent to the printer is known as a lead-in byte. The second byte of the character code is known as the trailing byte. Different character sets have different requirements for the values of both lead-in and trailing byte. When the lead-in byte does not fall in the range listed for the character set, a character from a SBCS may be printed. The following double-byte character sets are supported by the 6820 printer.

Table 3-1
Double-Byte Character Sets

Font Module	Code Page	DBCS Language	Lead-in Byte	Trailing Byte
NFT00936.MOD	936	GB 2312 Chinese (simplified)	A1h-ABh B0h-F7h	A1h-FEh
NFT00950.MOD	950	big 5 Traditional Chinese	A1h-C6h C9h-F9h	40h-FEh (except 7Fh)
NFT00932.MOD	932	Shift JIS Japanese	81h-9Fh E0h-FCh	40h-FCh (except 7Fh)
NFT00949.MOD	949	KSC 5601 Korean	A1h-ACh B0h-C8h CAh-FDh	A1h-FEh

Multi-Byte Character Sets

Double byte character sets and single byte character sets can be mixed when printing a report. This mixture is referred to as a multi-byte character set (MBCS). When a DBCS is selected, the characters from the SBCS codepage currently selected are used for rendering character codes and control codes from 0 to 127. Codes above 127 (that fall within the range of lead-in bytes for the selected character set) cause the byte that follows to be treated as a trailing byte for that character set. Otherwise, for character codes above 128, the character code from the selected SBCS is printed. NFT00950.MOD (BIG 5 DBCS) does not allow the MBCS mode. For this character set, only control codes from 0-31 are treated as single byte characters when they are not preceded by a lead-in byte. All escape sequence character strings are treated as SBCS.

Codepage Selection

Multiple codepages can be present in printer font memory at one time. One SBCS and one DBCS codepage can be selected as the active codepages at any time for MBCS mode. The active codepage can be changed at any time, by substituting the appropriate value into n1 and n2, from *Table 3-2, International Character Sets*.

Format:

Decimal	Hex	ASCII
27 82 n0 n1 n2	1B 52 n0 n1 n2	ESC "R" n0 n1 n2

Where:

- n0 = 255
- n1 = high byte of codepage to select
- n2 = low byte of codepage to select

Select National Character Set

By default, codepage 0 is selected by the printer at reset. The following escape sequence may be used to select international character support, and is only allowed for codepage 0. All other codepages use direct character code mapping to select the appropriate font for rendering.

Format:

Decimal	Hex	ASCII
27 82 n	1B 52 n	ESC "R" n

Where

$$n = 0-14$$

where **n** is the country code, as shown in *Table 3-2, International Character Sets*, below. The default value for **n** is zero (USA).

A full 256 character set is not provided for these sets. There are 64 international characters stored in ROM: 32 in Roman and 32 in Italic. They are stored as codes 0-31 and 128-255. These codes are normally not accessible.

However, the ESC "R" command makes these codes available, but only 12 characters at a time. These 12 characters are available in the following positions of the ASCII character table: 35, 36, 64, 91, 92, 93, 94, 96, 123, 124, 125, and 126, as shown in *Table 3-2, International Character Sets*, below.

Table 3-2
International Character Sets

Country	Country Number	35	36	64	91	92	93	94	96	123	124	125	126
USA	0	#	\$	@	[\]	^	'	{		}	~
France	1	#	\$	à	°	ç	§	^	'	é	ù	è	¨
Germany	2	#	\$	§	Ä	Ö	Ü	^	'	ä	ö	ü	β
England (UK)	3	£	\$	@	[\]	^	'	{		}	~
Denmark 1	4	#	\$	@	Æ	Ø	Å	^	'	æ	ø	å	~
Sweden	5	#	¤	É	Ä	Ö	Å	Ü	é	ä	Ö	å	ü
Italy	6	#	\$	@	°	\	é	^	ù	à		è	ì
Spain 1	7		\$	@	ı	Ñ	ı	^	'	¨	ñ	}	~
Japan	8	#	\$	@	[¥]	^	'	{		}	~
Norway	9	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Denmark 2	10	#	\$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Spain 2	11	#	\$	á	ı	Ñ	ı	é	'	ı	ñ	ó	ú
Latin America	12	#	\$	á	ı	Ñ	ı	é	ü	ı	ñ	ó	ú
Hebrew	13	Note: Hebrew and Greek fonts are available											
Greek	14	in the supplied font files.											

The selected set stays in effect until the printer is reset and receives a Master Reset command, or a new international character set is selected.

" **NOTE:** *This function is only used with the default Character Set.*

User Defined Characters

The following code deals with user defined characters and their selection into memory.

- " **NOTE:** *RAM based definition or redefinition of standard characters is only useful when the default SBCS codepage is selected. There is no method to redefine characters in the other codepages, since unique codepages can be created and loaded into the printer font memory (flash) for use.*

Copy ROM to RAM

The characters in ROM are copied into RAM, so a complete user-defined character set is created by editing selected characters. This ensures that all characters are defined when a user-defined character set is selected. This eliminates the need to unselect the user-defined character set when printing defined characters.

- " **NOTE:** *This function is only useful with the default SBCS character set.*

Format:

Decimal	Hex	ASCII
27 58 0 0 0	1B 3A 00 00 00	ESC “:” NUL NUL NUL

Define User-Defined Characters

Characters are redefined by the user, in the currently selected mode. However, they can only be used in draft mode.

- " **NOTE:** *This function is only useful with the default SBCS character set.*

Format:

Decimal	Hex	ASCII
27 38 0 k1 k2 s1 d1 ... d11	1B 26 00 k1 k2 s1 d1 ... d11	ESC “&” NUL k1 k2 s1 d1 ... d11

where: k1 = character code of first character to redefine
 k2 = character code of last character to redefine
 (any character between 0-255 can be redefined)
 (k1 could equal k2, if only one character is being defined)

For each character defined, 12 bytes of data must be supplied, as follows:

where: s1 = the first byte (s1) describes the character format.

Bits 0-3 represent the end position in the grid.

Bits 4-6 represent the start position in the grid.

Bit 7 determines if the character uses the top 8 pins or the bottom eight pins of the print head.

If bit 7 = 0, the top 8 pins are used.

If bit 7 = 1, the bottom 8 pins are used.

The start and end positions are ignored during character imaging, but must be accurate to redefine the character code.

d1...d11 = the data that comprises the dot image pattern of the character being defined.

When printable code expansion is enabled with ESC “I”, the *Printable Code Area Expansion* function, and the user defined character set is selected with ESC “%”

(1), the *Select User-Defined Set* function, then the codes (less than 20h and greater than 7Fh) can be defined for use and are printable.

When printable code expansion is enabled with the *Enable Printing of Codes 128-255* function, and the user defined character set is selected with the *Select User-Defined Set* function, then codes (between 80h and 9Fh) can be defined for use and are printable.

For a list of these characters, refer to *Table 3-3, Printable Code Expansion Characters*, on page 3-22.

Select User-Defined Character Set

A user-defined character set can be selected, after the *Define User-Defined Characters* function has been used to define the character set.

" **NOTE:** *This function is only useful with the default SBCS Character Set.*

Format:

Decimal	Hex	ASCII
27 37 1	1B 25 01	ESC “%” (1)

Select Default Character Set

If the *Select User-Defined Set* function had been previously set, this function switches back to the default character set.

" **NOTE:** *This function is only useful with the default SBCS Character Set.*

Format:

Decimal	Hex	ASCII
27 37 0	1B 25 00	ESC “%” (0)

Enable Printing of Codes 128-255

All codes (128 through 255) are treated as printable characters, rather than control codes, with this function. This allows the use of these characters for user-defined characters. A user defined set must be selected, using the *Select User-Defined Set* function, before these characters can be printed. Factory default disables printing of these codes.

" **NOTE:** *This function is only useful with the default SBCS Character Set.*

Format:

Decimal	Hex	ASCII
27 54	1B 36	ESC “6”

This function is only available when the default SBCS character set is selected.

Disable Printing of Codes 128-255

This disables the printing of codes (128 through 255), set by *Enable Printing of Codes 128-255*. By default, these codes are disabled.

Format:

Decimal	Hex	ASCII
27 55	1B 37	ESC “7”

Expand Printable Code Area

This function allows certain ASCII codes (00h to 1Fh) and codes (80h to 9Fh) to be printable when the variable *n* is set to the value of 1. This allows the use of these codes for user-defined characters. If *n* = 0, the function returns these two ranges of characters to non-printable control codes. A user-defined character set must be selected by ESC “%” (1), the *Enable Printing of Codes 128-255* function, before these codes can print. In both ranges, only the following codes can be redefined as printable characters. Codes not listed, within the range (00h-1Fh), will print as standard control codes. Codes not listed, within the range (80h-9Fh), will be converted to a control code in the range of (00h-1Fh), by subtraction of 80h.

” **NOTE:** *This function is only useful with the default **SBCS** Character Set.*

Format:

Decimal	Hex	ASCII
27 73 n	1B 49 n	ESC “I” n

Table 3-3
Printable Code Expansion Characters

Hex	ASCII	Hex	ASCII	Hex	ASCII	Hex	ASCII
00	NUL	11	DC1	80	none	91	none
01	SOH	15	NAK	81	none	95	none
02	STX	16	SYN	82	none	96	none
03	ETX	17	ETB	83	none	97	none
04	EOT	1C	FS	84	none	9C	none
05	ENQ	1D	GS	85	none	9D	none
06	ACK	1E	RS	86	none	9E	none
10	DLE	1F	US	90	none	9F	none

Enable Printing of Character Graphics

The printing of character graphics is enabled, until disabled with the *Disable Printing of Character Graphics* function.

” **NOTE:** *This function is only useful with the default **SBCS** Character Set.*

Format:

Decimal	Hex	ASCII
27 116 1	1B 74 01	ESC “t” (1)

For character values from 0 to 31 (00h-1Fh):

- When the default SBCS codepage is selected:
the FX-86e IBM character graphics symbol set is printed.
- When other SBCS codepages are selected:
the codes (00h-1Fh), listed above in *Table 3-3, Printable Code Expansion Characters*, are printed.

For character values from 32 to 126 (20h-7Eh):

- When the default SBCS codepage is selected:
the selected international character set is printed.
- When other SBCS codepages are selected:
the international character set selection is not in effect.
- For the character value 127 (7Fh):
- When the default SBCS codepage is selected:
a space is printed
- When other SBCS codepages are selected:
the character associated with the codepage is printed.

For character values from 128 to 255 (80h-FFh):

- The FX-86e Epson Character Graphics set is printed.

Disable Printing of Character Graphics

The printing of character graphics is disabled. Factory default disables this function.

Format:

Decimal	Hex	ASCII
27 116 0	1B 74 00	ESC "t" (0)

Print Character Graphics

This function allows printing of character graphics from the currently selected SBCS codepage, by sending a graphics string to the printer. The values of the graphics data bytes can range between 0-255.

Format:

Decimal	Hex	ASCII
27 43 n d1 ... dn	1B 2B n d1 ... dn	ESC "+" n d1 ... dn

where: n = the length of the character graphic string
d1 ... dn = the character graphics data stream

The number of data bytes must be equal to the value of the variable n.

The range of values (for the characters in each graphics data byte): 0-255

For character values from 0 to 31 (00h-1Fh):

- When the default SBCS codepage is selected:
the FX-86e IBM character graphics symbol set is printed.
- When other SBCS codepages are selected:
currently selected single byte codepage character graphics are printed.

For character values from 32 to 126 (20h-7Eh):

- When the default SBCS codepage is selected:
the selected international character set is printed.
- When other SBCS codepages are selected:
the character from the currently selected codepage are printed.
- For the character value 127 (7Fh):
- When the default SBCS codepage is selected:
a space is printed

- When other SBCS codepages are selected:
the character graphics symbol is printed.

For character values from 128 to 255 (80h–FFh):

- When the default SBCS codepage is selected:
the FX-86e Epson Character Graphics set is printed.
- When other SBCS codepages are selected:
the corresponding character is printed.

Graphics Functions

Eight-Pin Graphics Modes

All 8-pin graphics functions require parameters, $n1$ and $n2$, which represent the length of the graphics string that follows the *Select Graphics Mode* command, and are calculated as follows (assuming a temporary variable n):

n = total number of graphics dots needed for the graphic string

$n2$ = integer of (n divided by 256)

$n1$ = remainder of the $n2$ calculation

The simplest calculation, is to divide n (total number of dots needed for the graphics string) by 256. Then $n2$ is the quotient (the whole number) and $n1$ is the remainder. If you require less than 256 dots (columns), then $n1$ indicates the number of dots and $n2$ is set to zero.

Select Graphics Mode

The graphic mode, represented by the variable m (*Table 3-4, Graphics Modes*) is enabled. The total number of dot columns to be printed is represented by $n1$ and $n2$ (see parameter descriptions above). Any graphic string that exceeds the length of the print line is discarded.

Format:

Decimal	Hex	ASCII
27 42 m n1 n2	1B 2A m n1 n2	ESC "*" m n1 n2

Reassign Graphics Mode

Graphic modes (shown in table below) can be changed with this function.

Format:

Decimal	Hex	ASCII
27 63 s n	1B 3F s n	ESC "?" s n

where: s = one of the following characters (K, L, Y, or Z)

n = one of the modes (0-7), as shown in Table 3-4 on the next page.

Table 3-4
Graphics Modes

Mode	m	Dots per Inch / Dots per 8" Line
Single-density	0	60 dots per inch, 480 dots per 8 inch line
Low Speed Double-density	1	120 dots per inch, 960 dots per 8" line
High Speed Double-density * (see note below)	2	120 dots per inch, 920 dots per 8" line
Low-Speed Quadruple-density * (see note below)	3	240 dots per inch, 1920 dots per 8" line
CRT I	4	60 dots per inch, 480 dots per 8" line
Single-Density Plotter	5	72 dots per inch, 576 dots per 8" line
CRT II	6	90 dots per inch, 720 dots per 8" line
Double-Density Plotter * (see note below)	7	144 dots per inch, 1152 dots per 8" line

NOTE: Adjacent dots, in a given row, cannot be printed in modes listed with an asterisk.

Select Single Density Graphics Mode

This is a simple method of printing graphics. The resolution is 60 dots per inch. Each 8 inch line can accommodate 480 columns of graphic dots. A graphic string that exceeds the length of the print line is discarded.

Calculating the parameters, n1 and n2, is described on page 3-24.

Format:

Decimal	Hex	ASCII
27 75 n1 n2	1B 4B n1 n2	ESC "K" n1 n2

Select Low-Speed Double Density Graphics Mode

If Single Density graphics does not produce high enough density, try this mode. The number of dots per inch is doubled. However, the speed is reduced to half of what it would be with single density.

Calculating the parameters, n1 and n2, is described on page 3-24.

This is 8-pin single density graphics. The resolution is now 120 dots per inch. Each 8 inch line can accommodate 960 columns of graphic dots. A graphic string that exceeds the length of the print line will be discarded.

Format:

Decimal	Hex	ASCII
27 76 n1 n2	1B 4C n1 n2	ESC "L" n1 n2

Select High-Speed Double Density Graphics Mode

This 8-pin graphics mode produces the same density as the Low-Speed Double Density mode, however, the speed is doubled.

Calculating the parameters, n1 and n2, is described on page 3-24.

Format:

Decimal	Hex	ASCII
27 89 n1 n2	1B 59 n1 n2	ESC "Y" n1 n2

The resolution is still 120 dots per inch. Each 8-inch line can accommodate 960 columns of graphic dots. A graphic string that exceeds the length of the print line will be discarded. Care must be taken so that adjacent dots in a given dot row are not printed.

Select Low-Speed Quadruple Density Graphics Mode

With this 8-pin graphics mode, the number of dots per inch has gone up to four times what it was in single density.

Calculating the parameters, $n1$ and $n2$, is described on page 3-24.

Format:

Decimal	Hex	ASCII
27 90 $n1$ $n2$	1B 5A $n1$ $n2$	ESC "Z" $n1$ $n2$

The resolution is now 240 dots per inch. Each 8-inch line can accommodate 1920 columns of graphic dots. A graphic string that exceeds the length of the print line will be discarded. Care must be taken so that adjacent dots in a given dot row are not printed.

Nine-Pin Graphics Modes

These 9-pin graphics functions also require two parameters, $n1$ and $n2$.

However, they are calculated slightly different than in the 8-pin graphics modes. Since each dot column to be printed must be represented by two data bytes, the total length of the graphic string (following the *Select ... Graphics Mode* command) needs to be divided by two, first. These parameters are calculated as follows (assuming a temporary variable n):

n = total number of dots needed, divided by 2

$n2$ = integer of (n divided by 256)

$n1$ = remainder of the $n2$ calculation

First, divide n (the total number of dots needed for the graphics string) by 2, then divide the result by 256. Then $n2$ is the quotient (the whole number) and $n1$ is the remainder. If you require less than 256 dots (columns), then $n1$ indicates the number of dots and $n2$ is set to zero.

Select 9-Pin Single Density Graphics Mode

Single density, 9-pin graphics mode is enabled.

Calculating the parameters, $n1$ and $n2$, is described above, in the *Nine-Pin Graphics Modes* paragraph.

Format:

Decimal	Hex	ASCII
27 94 0 $n1$ $n2$	1B 5E 00 $n1$ $n2$	ESC "^" (0) $n1$ $n2$

The resolution is 60 dots per inch. Each 8-inch line can accommodate 480 columns of graphic dots. A graphic string that exceeds the length of the print line will be discarded.

Select 9-Pin Double Density Graphics Mode

Double density, 9-pin graphics mode is enabled.

Calculating the parameters, $n1$ and $n2$, is described above, in the *Nine-Pin Graphics Modes* paragraph.

Format:

Decimal	Hex	ASCII
27 94 1 $n1$ $n2$	1B 5E 01 $n1$ $n2$	ESC "^" (1) $n1$ $n2$

The resolution is now 120 dots per inch. Each 8-inch line can accommodate 960 columns of graphic dots. A graphic string that exceeds the length of the print line is discarded.

Page Layout for Fanfold Paper

Printable Area

The figure below shows the printable area of the lower section of a page of fanfold paper and the upper section of the next page. The *Assured Print Area* is the best overall area in which to use for printing:

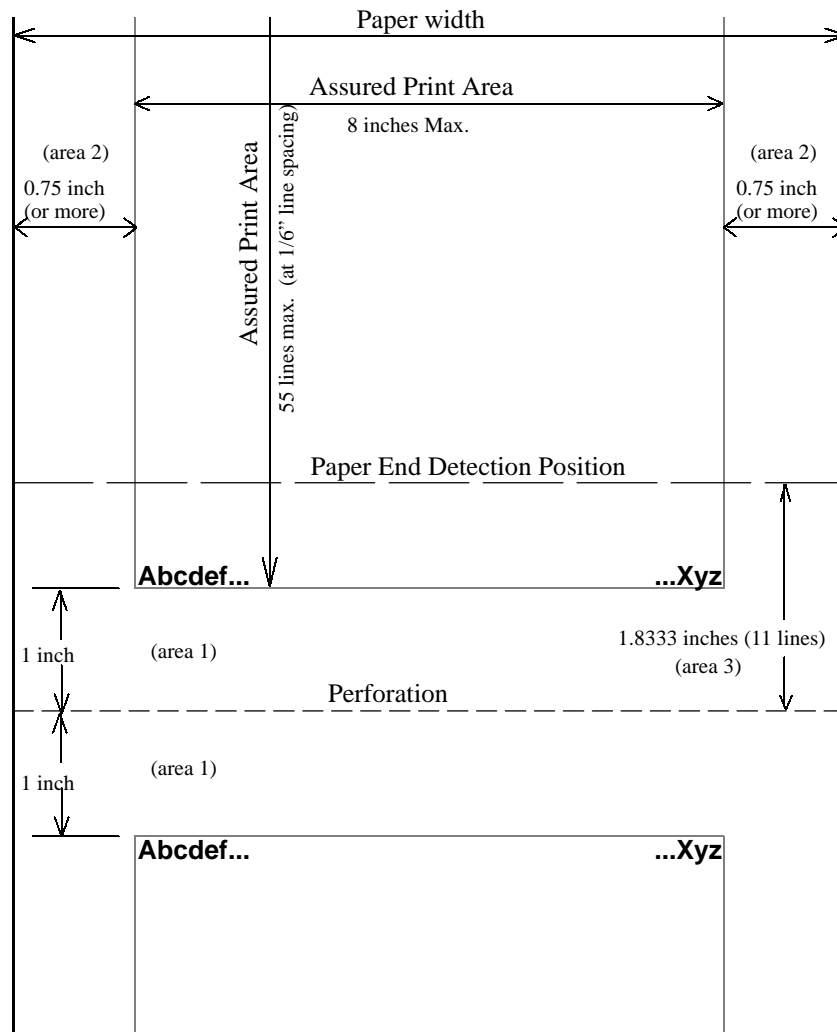


Figure 3-1
Printable Area for Fanfold Paper

Generally, you should leave a 1-inch margin at both the top and the bottom of the page. This provides for a margin of six lines at 1/6 inch line spacing. Even though printing in area 1 (before or after the perforation) may be possible, you should keep in mind that paper feed precision is reliable only within the *Assured Print Area*. However, the following comments should be considered.

The top and bottom margins are represented by **Area 1**, as shown in Figure 3-1 above. The top margin is defined as the distance between the top edge of the paper and the first row of printed characters. The bottom margin is defined as the distance between the last row of printed characters and the bottom edge of the paper.

There is a possibility that printing can start within one line below the perforation and printing could continue beyond the *Assured Print Area*, however paper feed precision is only reliable with top and bottom margins of approximately one inch. Basically, you should consider there are only 55 lines available for reliable printing.

The left and right margins are represented by **Area 2**. For reliable printing, a margin of at least 0.75 inch should be used at the left and right edges of the paper.

Paper End Detection

The *Paper End Detection* line, shown in Figure 3-1 above, represents the point at which the *Paper Out* sensor detects the bottom edge of the paper.

Area 3 represents the the distance between the the Paper End Detection position and the bottom edge of the page.

Once the last page of the fanfold paper stack is in the printer, and the print head has advanced past this *Paper End Detection* line, printing is no longer reliable.

Also, once the bottom end of the last page has advanced through the printer, past the spring plate along the front of the platen, the paper should not be reversed back through the printer, because the printer could jam and cause paper feed problems. Applications should be designed to prevent any reverse paper feed from occurring after the *Paper Out* sensor has detected the bottom edge of the paper.

Section 4

Troubleshooting and Diagnostics

This section contains troubleshooting strategies for the 6820 printer, as well as a detailed listing of the Diagnostics Information table.

Topic Summary

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Error Handling	4-3
several classes of errors are described, including: run-time errors, POST errors, and fatal errors (which includes: flash and EEPROM configuration errors)	
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Troubleshooting

The printing system is composed of four basic components: Printer, Computer, Power Source, and Communications. Any one of these components can prevent the printer from functioning properly.

Verifying the Printer Components

Power Source Verification

Start by verifying that power is available at the printer. Visually inspect the control panel to verify that the power indicator (Green LED) is lit. If it is not, press the **SET PAGE** button and note if the power indicator lights up. If it does, the power system is all right. If it does not, press the printer reset button. If the power indicator still does not light, check the power cable, by connecting it to a different printer. If the power indicator works on the new printer, then the cable is all right, and the printer that was originally connected is suspect. If it does not light, then the problem is most likely the cable or the power source. Depending on the results, either replace the cable or return the printer for service.

Printer Verification

If the power indicator works properly and the printer still does not print, then printer errors are noted. If any indicators light when the **SET PAGE** button is pressed, or the printer beeps, then refer to *Table 4-1, Printer Failure Indicators*, to determine the problem.

If none of the listed conditions are indicated by the beep codes and LEDs, yet the printer does not perform properly, then perform a printer self-test. Press and hold (for several seconds) the **FORM FEED** and **SET PAGE** buttons at the same time, until the printer beeps and all indicator lights come on. The lights change throughout the test, as it progresses.

At the end of the self-test, the printer generates a report. This report verifies the following: errors detected during self-test, the error history, and the communication configuration. If the printer self-test report does not print, then the printer should be reset. If the report does print after resetting, then the printer is all right and the reason the printer does not respond to host computer print requests is probably communications or host computer related. If the report is partially completed, and a printer error occurs during the printing of self-test, refer to *Table 4-1, Printer Failure Indicators*, for the cause of the printer failure.

Perform a Power On Self-Test (POST) to test for errors either by resetting the printer or powering it up. If any errors, audible error codes, along with indicator light status, are produced during POST (see *Table 4-2, POST Error Codes*).

If the POST completes without error, try the printer self-test again. If self-test prints correctly this time, but the printer does not respond to the host computer, then the problem may be communications or host computer related. If errors are encountered during POST, contact the Customer Response Center for assistance.

Communications / Host Computer Verification

Use the self-test report to verify that the communications protocol options, selected at the printer, match those expected by the host. If they do not match

the expected results, reconfigure the printer using the control panel configuration modes described below in the Configuration part of this section.

If the protocol options match, then the communications cable may be defective. To determine if the cable is working, substitute a new cable. If the host computer is suspect, substitute a different host computer. A defective computer dock might be another possibility.

Error Handling

Printer Errors are divided into several classes: POST errors, Run-Time errors, and Fatal errors (consisting of flash write errors and EEPROM block errors).

Run-Time Errors

Run-time errors can occur during the course of printing. These errors are displayed on the LEDs, along with beep sequences. This causes the printer to stop printing and enter an error state. Then beep sequences are emitted, LED codes are displayed, the error status may be sent to the host (depending on the protocol), and the printer goes into suspend mode.

The printer exits from the suspend mode when the user presses one of the keyboard keys or communications is resumed from the host. The printer also places the print head in its home position and attempts to recover from the error condition. Until the error condition is corrected, the error procedure does not end, and the error state is not removed.

For **PAPER OUT** errors, the user must load paper and press the **SET PAGE** button before printing begins. The paper may be loaded to the top of form, either manually or automatically, by pressing the **FORM FEED** button to wake the printer from suspend mode.

For a listing of run-time errors, refer to the following table.

Table 4-1
Printer Failure Indicators

Sets of Beeps	PAPER OUT	HEAD JAM	LOW BATT	Meaning
1 set	OFF	OFF	ON	12V under voltage fault (Low Battery)
1 set of 2 beeps	OFF	OFF	2 blinks	12V over voltage fault (Input Voltage too high)
1 set of 3 beeps	OFF	OFF	3 blinks	24V under voltage fault (internal power supply failure)
1 set of 4 beeps	OFF	OFF	4 blinks	24V over voltage fault (internal power supply failure)
1 set of 13 beeps	OFF	OFF	OFF	Configuration error
2 sets of 2 beeps	OFF	2 blinks	2 blinks	Print head over temperature
2 sets of 3 beeps	ON	OFF	OFF	Paper Out
2 sets of 4 beeps	4 blinks	4 blinks	OFF	Print head short (Print head failure)
2 sets of 5 beeps	5 blinks	5 blinks	5 blinks	Paper feed current fault (Possible paper jam or paper feed motor failure)
3 sets of 2 beeps	3 blinks	OFF	3 blinks	Print head over current (Print head failure)
3 sets of 4 beeps	OFF	3 blinks	OFF	Home switch failure
4 sets of 2 beeps	OFF	ON	OFF	Head Jam
4 sets of 4 beeps	Erratic	Erratic	Erratic	Flash write error
12 sets of 12 beeps	OFF	OFF	OFF	Operating System software failure

The most common errors consist of Paper Out, Low Battery, and Head Jam. The other errors listed would be rare occurrences, but are provided for good printer diagnostics in the event failures should occur.

Power-On Self-Test (POST)

When the printer is reset it performs a POST to verify other reasons the printer might be failing. Audible error codes, along with indicator light status, are produced during POST if an error is encountered, as listed in *Table 4-2, POST Error Codes*.

A printer diagnostic cable, connected between the host computer and the printer, is used during POST to: configure the printer, access printer diagnostics, update software, and install new fonts.

To install the diagnostic cable: connect the phone plug into the phone jack on the printer, then connect the 9-pin dsub plug into the host computer.

After installing the diagnostic cable, reset the printer to initiate POST.

POST Errors

POST errors only occur after a push button reset, or an initial application of power to the printer. After the reset button is pressed, the LEDs (on the printer's control panel) indicate the progress of post. The first LED to light should be the power indicator (Green LED). A single beep should be heard immediately after this LED lights up. This indicates the printer is active.

During the course of POST, the other LEDs light to indicate progress throughout the tests. If a POST failure is detected, the printer emits one of the following printer LED error codes and beep sequences.

*Table 4-2
POST Error Codes*

Long Beep	Short Beep	PAPER OUT	HEAD JAM	LOW BATT	Power	Meaning
0	1	OFF	OFF	OFF	ON	Operational
0	0	OFF	OFF	OFF	OFF	No Power
0	0	OFF	OFF	OFF	ON	Control program IPL successful
0	0	ON	OFF	OFF	ON	Diagnostic mode command check
0	0	ON	ON	ON	ON	Control program IPL
1	1	OFF	ON	OFF	ON	Invalid CRC on boot block
1	2	OFF	ON	ON	ON	Invalid CRC on control program or control program not found
1	4	OFF	OFF	OFF	ON	Lower 64K RAM failure
1	4	OFF	OFF	ON	ON	Upper 64K RAM failure
1	5	ON	OFF	ON	ON	Diagnostic flash memory check failed or is not initialized
1	5	ON	ON	OFF	ON	Diagnostic memory write failure

After completion of the tests, all LEDs are turned off and there is an attempt to place the head in the home position. Until the next time the printer is reset and POST is performed, only run-time errors or fatal errors are reported.

Fatal Errors

Two types of fatal errors exist: Flash Write Errors and Printer Configuration Block Errors. These errors are extremely rare, but measures are built into the printer diagnostics for tracking possible occurrences.

Flash Errors

Errors related to writing or erasing flash are critical errors. These critical errors cause the printer to stop all processing and output an LED code and a sequence of beeps. The LED code represents the address of the segment that the error occurred on in octal notation. The octal digit changes every four beeps until 4 octal digits have been output. Only four octal digits are output since blocks are 256 bytes in size and flash can be addressed with a total of 0x7ff blocks. It should be noted that the segment address output is the runtime address of the flash block and not the offset of the block within flash. To obtain the block offset within the flash subtract 0x800 from the address output.

After the error code is processed. The printer will enter suspend state. When the printer resumes the error will again be output and suspend re-entered. A reset is required to eliminate the error condition. Flash write errors may be unrecoverable. If this is the case the printer requires servicing by qualified technicians.

EEPROM Configuration Errors

Errors related to an invalid configuration block (diagnostic block) produce 13 beeps once, and then the printer suspends. It continues to produce this symptom, until the configuration block error is corrected. No LEDs light. This error may have been caused by a flash write error or merely lack of proper printer configuration. If the error cannot be corrected by a reset of the printer, then the printer needs to be serviced by a qualified technician.

Self-Test Function Descriptions

Self-test consists of the following functions.

Boot Block Program Verification

A CRC (Cyclic Redundancy Check) is performed on the bootblock program. The calculated CRC is compared to the CRC embedded in the program module.

Control Program Verification

A CRC is performed on the control program, which is loaded into writable flash program memory. The calculated CRC is compared to the CRC embedded in the program module. The results of this test are printed on the self-test report.

Font Module Verification

A CRC is performed on the font modules, which are loaded into writable flash font memory. The calculated CRC is compared to the CRC embedded in the program module. The results of this test are printed on the self-test report.

A2D Check

Current reading of the A2D sources are performed, and the results are printed on the self-test report.

Nonvolatile Diagnostic Memory Verification

A CRC is performed on the area of the nonvolatile diagnostic memory that has a CRC over it. The results of this test are printed on the self-test report.

Nonvolatile Diagnostic Memory Update

The nonvolatile diagnostic memory is updated from the nonvolatile diagnostic memory data shadowed in memory.

Detailed Printer Self-test

Overview

Self-test is user selectable, verifies printer functions, and provides reporting of printer diagnostics. It performs a series of internal diagnostics and prints the results. When self-test begins, the beeper sounds for half a second and all LEDs turn ON for half a second.

Initiating Self-test

Self-test is initiated by simultaneously pressing both the **LINE FEED** and **SET PAGE** buttons on the control panel, while the printer is idle or asleep.

Terminating Self-test

Self-test can be terminated manually, during the test, by simultaneously pressing both the **LINE FEED** and **SET PAGE** buttons.

Self-test Report

The self-test report has two pages. The first page is diagnostic information, and is printed after determining the results of the self-test. The second page verifies printer mechanics. At the end of printing, the paper advances to the expected top of page, the carriage returns to the home position, and self-test terminates. You can also end self-test manually, preventing it from printing both pages.

Page 1 of Report

A sample self-test printout of the the first page of the self-test report is shown below. It is important to note the (bold) line numbers in the left column of this listing are not on the actual self-test printout. They have been placed in this sample printout for the sake of the explanations that reference the text next to those numbers. See the *Format Explanation* paragraph, on page 4-8.

Page 2 of Report

The second page of the self-test printout has not been printed here, but is a typical rotating print pattern, used to diagnose mechanical behavior for most printers. The rotating pattern continuously prints the ASCII characters between 33 and 126 decimal, inclusive for the entire page, or until the operator cancels the print out.

Sample Self-Test Printout

YY

1 NP6820 Copyright 1997, 1998, Intermecc Technologies Corporation, All Rights Reserved

2 Serial# MFG Date Hardware Check Repairs Svc Date
3 12345678 mm/dd/yy ddd-ddd-ddd/ddd (TOP) GO/NG 00 mm/dd/yy
4 ddd-ddd-ddd/ddd (MLB)
5 ddd-ddd-ddd/ddd (PS)
6 ddd-ddd-ddd/ddd (IOB)

7 Revisions: 0000000000303100
8 Bootblock: NPBB6820.MOD - Version XX.XX XXXX XXXX GO/NG
9 Control Program: NPFL6820.MOD - Version XX.XX XXXX XXXX GO/NG
10 Font Module: NFTxxxxx.MOD - Version XX.XX XXXX XXXX GO/NG
11 Font Module: NFTxxxxx.MOD - Version XX.XX XXXX XXXX GO/NG
12 Font Module: NFTxxxxx.MOD - Version XX.XX XXXX XXXX GO/NG
13 RAM Check: GO/NG
14 Battery Voltage: 012.34 Low.../.....High
15 Total Pages: 00109
16 Zero Font Style: 0
17 Auto Feed: CR
18 Interface mode: NPCP
19 Bit Rate: 19200
20 Cold Starts: 00024
21 Warm Starts: 00050

22 A2D History

Table with 9 columns: Curr, Low, High, Min, Max, Error, Page, Count. Rows 23-26 show voltage and temperature data.

27 Head Jam History

28 Total Head Jams 00002
29 Home Motion Direction Ramp Step Speed Temp Position Page
30 Print Right Const 002 H/L/C -010 00440 00087

31 NPCP History

32 Disk Addr Parity IFTS Seq CRC Frame Bind IPLDU
33 00000 00000 00000 00000 00000 00000 00000 00000 00000

34 IRDA History

35 FramesOk TotalBytes Broadcasts Hardware CRC/TMO DISCARD
36 rx 0000000000 0000000000 0000000000 0000000000 0000000000 0000000000
37 tx 0000000000 0000000000

38 HEAD DOT PATTERN

==

YY

Format Explanation for Page 1

All numeric data is blank padded to the left of the most significant digit.

Line 1: The printer name (NP6820) and copyright notice are listed first.

Lines 2-6: Line 2 is a caption line for lines 3 through 6. The first two lines will always appear here. However, there could be any number of additional lines.

- Under *Serial#* caption, the serial number stored in nonvolatile diagnostic memory is printed here.
- Under *MFG Date* caption, the manufacture date stored in nonvolatile diagnostic memory is listed as mm/dd/yy format.
- Under *Hardware* caption, the hardware configuration information is stored in nonvolatile diagnostic memory. The top level number is on line 3, control board number on line 4, power supply board on line 5, and I/O board on line 6.
- Under *Check* caption, the CRC of the nonvolatile diagnostic memory is listed. If valid, GO (go) is printed, otherwise NG (no go).
- Under *Repairs* caption, the total number of service repairs from nonvolatile diagnostic memory is printed.
- Under *Svc Date* caption, the last date of service repair is printed in mm/dd/yy format.

Line 7, *Revisions*: stored in nonvolatile diagnostic memory, and printed as 16 hex digits.

Line 8, *Bootblock*: the results of the boot block check function. It includes the following: program name, version number, calculated CRC, and either GO (go) or NG (no go) depending upon a match of the CRC with the CRC stored in the boot block at manufacture.

Line 9, *Control Program*: the results of the control program check function. It includes: program name, version number, calculated CRC, and either GO (go) or NG (no go) depending upon a match of the CRC with the CRC stored in the control program.

Line 10-12, *Font Module*: the results of the font module check function. This includes: font module names, version numbers, calculated CRCs, and either GO (go) or NG (no go) depending upon a match of the CRC with the CRC stored in each font module. There may also be more, or less, of these lines, depending on the number of font modules.

Line 13, *RAM Check*: the results of the RAM check function. It is either: GO (go) or NG (no go), depending on the outcome of the test.

Line 14, *Battery Voltage*: the most current battery voltage is listed to the nearest 0.01 volt. A simple fuel gauge is represented by the "Low.../.....High". Low represents 11.5 volts and High represents 13.5 volts. And each dot represents an increment of 0.2 volts between empty and full, with empty being the first dot and full being the last dot. One slash is printed to represent the current voltage on the scale.

Line 15, *Total Pages*: the total number of pages; a value that is stored in the nonvolatile diagnostic memory.

Line 16, *Zero Font Style*: the current configuration for zero font style.

Line 17, *Auto Feed*: the current configuration for auto feed.

Line 18, *Interface Mode*: the current protocol configuration stored in nonvolatile memory is printed on this line.

Line 19, *Bit Rate*: this is the current bit rate stored in nonvolatile memory.

Lines 20-21, *Cold Starts, Warm Starts*: the reset information maintained in nonvolatile diagnostic memory is printed here.

Lines 22-26, *A2D History*: Current A2D readings and history information maintained in nonvolatile diagnostic memory is printed. Line 23 contains captions for each of the 8 columns.

- Under caption, *Curr*, the current A2D readings are printed.
- Under caption, *Low*, the minimum reading over the last 50 reports.
- Under caption, *High*, the maximum reading over the last 50 reports.
- Under caption, *Min*, the minimum reading over the printer's history.
- Under caption, *Max*, the maximum reading over the printer's history.
- Under caption, *Error*, the last reading that resulted in an error.
- Under caption, *Page*, the page number at which the error occurred.
- Under caption, *Count*, the number of times an error condition has occurred.

Lines 27-30, *Head Jam History*: is maintained in the nonvolatile diagnostic memory. Total jams are printed on line 28. Line 29 contains captions for each of the 9 items in line 30.

- Under *Home* caption, if the home detect switch caused a Head Jam to be reported, the text "ERR" is printed, otherwise the field is left blank.
- Under *Motion* caption, "Home", "Print", or "Seek" is printed, indicating the type of printer motion.
- Under *Direction* caption, either "Left" or "Right" is printed.
- Under *Ramp* caption, "Accel", "Decel", or "Const" is printed.
- Under *Step* caption, the acceleration or deceleration step count is printed. If not valid, the field is left blank.
- Under *Speed* caption, "H" (for high), "L" (for low), or "C" (for constant) initialization is printed.
- Under *Temp* caption, the temperature (in degrees Celsius) is printed.
- Under the *Position* caption, the carriage position (in 1/720 inch increments) is printed.
- Under *Page* caption, the page at which the Head Jam occurred, is printed.

Lines 31-33, *NPCP History*: the NPCP diagnostic information is stored in nonvolatile diagnostic memory. Line 32 is a header for line 33.

Lines 34-37 *IrDA History*: the IrDA diagnostic information is stored in nonvolatile diagnostic memory. Line 35 is a header for lines 36 and 37.

Line 38: *Head Dot Pattern*: A representation of the standard head dot pattern is printed (under line 38) as an aide to diagnosing the print solenoids. However, each of the dashes, shown in the pattern here, should appear as a series of 7 dots in the actual output report.

Miscellaneous Troubleshooting Tips

The following is a list of problems with possible solutions.

Table 4-3
Problems and Solutions

Category	Problem	Possible Solution
Configuration:	A printer configuration needs changing: Zero Print Option, Autofeed Protocol Bit Rate	Reconfigure by keypad or Configuration Tool. <ul style="list-style-type: none"> • Keypad (see the <i>Maintenance</i> section of User's Guide). • Configuration Tool (see <i>Summary of Configuration Functions</i> in the <i>Using the Configuration Tool</i> section).
Defaults:	Need to restore default configuration settings.	See <i>Restore Defaults to Printer</i> in the <i>Using the Configuration Tool</i> section for a list of defaults. Reconfigure by keypad or Configuration Tool: <ul style="list-style-type: none"> • Keypad (see the <i>Maintenance</i> section of User's Guide). • Configuration Tool (see <i>Summary of Configuration Functions</i> in the <i>Using the Configuration Tool</i> section).
Drivers:	Need to print forms from an off-the-shelf application using Windows 95.	Install Epson FX-80 driver—use the Configuration Tool (see <i>Summary of Configuration Functions</i> in <i>Using the Configuration Tool</i> section).
Error Handling:	Errors, relating to the state of DTR and RTS, do not seem to be handled properly.	The application needs to control the state of DTR and RTS, so it can properly handle the resulting errors.
Fonts:	Need to install, delete, or copy printer fonts.	Use the Configuration Tool (see <i>Summary of Configuration Functions</i> in <i>Using the Configuration Tool</i> section). For a list of available font modules, see <i>Character Sets and User Defined Functions</i> in Control Code Definitions section of Technical Reference.
Forms:	Nonstandard form length only works for first ticket, but on subsequent tickets it reverts to the default.	Send form-length command to printer, each time ESC @ is sent (e.g., reset at top of each ticket), since configuration is cleared and set to default by reset command.
	Need to print forms from an off-the-shelf application.	See the <i>Install Epson FX-80 driver</i> solution, above in the <i>Drivers</i> category.
Installation:	Using offshelf 25-pin cable, printer works, but hand-held computer does not charge.	Check cable wiring. One or more pins may not be connected through cable. Wire on pin 9 carries +charge from printer to remote holder. Only certain remote holders work (e.g., 6100, 6210, 4000).
	Installing vehicle wiring for printer.	Install 15 Amp fuse. Total power required is 180 watts.
Paper Movement:	Using linefeed to capture signature, then roll back with reverse feed, does not work on last page.	Reverse feeds do not work on last page (e.g., at end of paper stack) because once paper out sensor is activated, paper movement is disabled.
	Printing of ticket on last page does not complete.	If page layout goes beyond <i>End of Paper Detection</i> position, paper movement is disabled before last page is printed, because paper out sensor is activated (see <i>Page Layout Specifications</i> in <i>Control Codes Definitions</i> section).

Table 4-3 (Continued)
Problems and Solutions

Category	Problem	Possible Solution
Power Requirement:	Vehicle battery went dead overnight.	Printer only uses 3-4 milliamps in idle. Look for problem in truck wiring, or equipment loading on battery.
	Wiring vehicle for power.	Install 15 Amp fuse. Total power required is 180 watts.
Self-test:	Initiated self-test, but it did not work, several lights flash, and now printer does not work.	<ul style="list-style-type: none"> " Put the printer into the configuration mode. " Press the SET PAGE and FORM FEED buttons. " Shut off the printer, then initiate self-test again.
	Self-test shows a configuration setting is wrong.	Reconfigure by keypad or Configuration Tool: <ul style="list-style-type: none"> " Keypad (see the <i>Maintenance</i> section of User's Guide). " Configuration Tool (see <i>Summary of Configuration Functions</i> in the <i>Using the Configuration Tool</i> section).
Software:	Need to install new or updated software in printer.	Use Configuration Tool (see <i>Summary of Configuration Functions</i> in the <i>Using the Configuration Tool</i> section).

Compatibility Issues

Use the following information to determine some compatibility issues that come up, relative to the 6820 Printer.

Table 4-4
Compatibility Issues and Conclusions

Issue	Conclusion
Does 4820 Ribbon work with 6820 Printers?	Yes.
Do 4820 Applications work with 6820 Printers?	Yes. Applications that work on the 4820 Printer also work on the 6820 Printer.
Does the 6820 Printer work with an application that downloads some custom characters to the printer?	Yes. The "downloadable character set" feature is the same for both the 4820 and 6820 Printers.
Can 4820 Fixed Mount Printers be replaced with 6820 Printers?	Yes. 6820 Fixed Mount Printers can be installed on existing flat and angle mounts for the 4820 Printer.
Do NC4000 Power Supplies work with the 6820 Printer?	In some cases, printing while charging hand-held computers may not be supported. If so, order a new charger (PN: 851-027-003).
Do off-the-shelf 25-pin cables work between the dock and the 6820 Printer?	Most likely. If it does not, refer to comments in <i>Table 4-3, Problems and Solutions</i> , above.

Diagnostic Information

Nonvolatile Flash Storage

Diagnostic information is stored in flash to support the hardware configuration, both at time of manufacture and in the field. This includes recording the initial configuration changes to hardware and software, and various environmental statistics helpful in determining why failures are occurring in the field. The flash is provided for storage of critical data that must remain in the unit after power to the unit is lost. The data in the flash will be used for diagnostic information for a catastrophic failure, or over the phone with a customer.

Updating Diagnostic Information

The FLASH diagnostic information is updated and maintained by the printer. All diagnostic information is shadowed in RAM. At the end of every 50 forms, the FLASH information is updated from the RAM. The printer also updates the information upon the occurrence of any nonrecoverable error, printer reset, printer self-test and remote polling of Diagnostic information.

Fields are stored with ID first, then length, then data. The details of the data and the length of the entire field, including ID and Length bytes, are shown in the table below.

Accessing Diagnostic Information

The amount of Flash memory reserved for nonvolatile diagnostic memory is 2k bytes. Printer self-test prints most of the information contained in the Diagnostic Memory for remote and end-user diagnostic access.

Table 4-5
Diagnostic Information

Field ID	Length	Description	Stored as	Total Length
01	4	Serial #	7 digit BCD set at MFG	39 bytes
	3	Date of Manufacture. yy/mm/dd	6 digit BCD set at MFG	
	7	Hardware Configuration: ddd-ddd-ddd/ddd (top level part #) ddd-ddd-ddd/ddd (control board) ddd-ddd-ddd/ddd (power supply) ddd-ddd-ddd/ddd (i/o board)	52 digit BCD set at MFG	
	7			
	7			
	7			
2	CRC of preceding fields.	2 byte binary set at MFG		
08	8	Hardware Revisions: ECNs applied. 64 ECNs can be recorded separately by number 1-64.	8 byte bit field	11 bytes
	1	Service Repairs: a two-digit field indication of number of times unit is serviced.	2 BCD Digits	
	3	Date of last Repair. yy/mm/dd	6 BCD digits	
09	2	Cold Starts since MFG or last repair.	binary digits	8 bytes
	2	Warm Starts since last cold start.	binary digits	
	2	Pages printed over life.	binary digits	
10	2	Last high & low voltage extremes on 24-volt input over last 50 reports. Extremes stored as 8-bit A2D conversions.	2 bytes	11 bytes
	2	Voltage extreme history stores max. & min. 24-volt A2D conversions over printer life.	2 bytes	
	1	24-volt voltage error. Voltages greater than 10% considered errors. A2D value recorded.	1 byte	
	2	Form number at last voltage error.	2 bytes	
	2	24-volt error count.	2 bytes	

Table 4-5 (Continued)
Diagnostic Information

Field ID	Length	Description	Stored as	Total Length
20	2	Last high and low voltage extremes on 12-volt input over last 50 reports. Extremes stored as 8-bit A2D conversions.	2 bytes	11 bytes
	2	Voltage extreme history stores min. & max. 12-volt A2D conversions over printer life.	2 bytes	
	1	12V voltage error. Voltages less than 10.5 volts and greater than 14.5 volts considered errors. A2D value is recorded.	1 byte	
	2	Page number at last 12-volt error.	2 bytes	
	2	12-volt error count.	2 bytes	
30	2	Temperature, minimum and maximum over last 50 reports. Set A2D value.	2 byte	11 bytes
	2	Temperature, minimum and maximum over printer life. Set A2D value.	2 byte	
	1	Temperature error. Last A2D conversion below -10 or above +60 Celsius recorded.	1 byte	
	2	Page number at last temperature error.	2 bytes	
	2	Total number of temperature errors.	2 bytes	
40	2	Total number of head-jams	2 bytes binary	11 bytes
	1	0 = No Home detect switch error 1 = Home switch engagement error	bit 0	
		0 = Seeking; 1 = Printing	bit 1	
		0 = Left; 1 = Right	bit 2	
		00 = Acceleration 01 = Constant speed 10 = Deceleration	bits 3-4	
		00 = 250 PPS (initialization) 01 = Low speed 10 = High speed	bits 5-6	
		0 reserved	bit 7	
		Acceleration or deceleration step motor value when jam occurred	1 byte binary	
1	Ambient temperature when Head Jam occurred. Set A2D value.	1 byte		
2	Form number where Head Jam occurred.	2 bytes binary		
2	Carriage Position where Head Jam occurred.	2 bytes binary in 1/720"		

Table 4-5 (Continued)
Diagnostic Information

Field ID	Length	Description	Stored as	Total Length
50	2	NPCP NDM (normal disconnect mode) error count. Increments when normal disconnect mode entered.	2 bytes	20 bytes
	2	NPCP address error count. Increments when invalid printer address received.	2 bytes	
	2	NPCP length parity error count. Increments when parity of length field in frame incorrect.	2 bytes	
	2	NPCP IFTS (invalid frame this state) error count. Increments when invalid session layer command received.	2 bytes	
	2	NPCP sequence error count. Increments when LLC sequence numbers incorrect.	2 bytes	
	2	NPCP CRC error count. Increments when MAC CRC error encountered.	2 bytes	
	2	NPCP Frame error count. Increments when IFRAMES received when session is not bound.	2 bytes	
	2	NPCP Bind error count.	2 bytes	
	2	NPCP IPLDUR (Invalid presentation layer data unit) error count. Increments when bad presentation layer command received.	2 bytes	
60	4	IrDA rxFramesOk - total frames received OK.	4 bytes	46 bytes
	4	IrDA rxFramesCrcErr - total frames received with CRC error.	4 bytes	
	4	IrDA rxTotalBytes - total Bytes received OK.	4 bytes	
	4	IrDA rxFramesDiscardBuf - total frames discarded due to no buffer space.	4 bytes	
	4	IrDA rxBroadcastFrames - total broadcast frames received OK.	4 bytes	
	4	IrDA rxFramesDiscardHwErr - total received frames discarded, due to hardware error.	4 bytes	
	4	IrDA txFramesOk - total frames transmitted OK.	4 bytes	
	4	IrDA txTotalBytes - total bytes transmitted OK.	4 bytes	
	4	IrDA txBroadcastFrames - total broadcast frames transmitted OK.	4 bytes	
	4	IrDA txFramesNotTxTimeout - total frames not transmitted due to time-out.	4 bytes	
	4	IrDA txFramesNotTxHwErr - total frames not transmitted due to hardware error.	4 bytes	

Table 4-5 (Continued)
Diagnostic Information

Field ID	Length	Description	Stored as	Total Length
70	1	Zero font selection for codepage 437 0 = Ø; 1 = 0	1 byte	6 bytes
	1	Autofeed configuration 0 = CR; 1 = LF+CR	1 bit	
	1	Protocol Selection: 00h = NPCP 20h = DTR No Parity 21h = DTR ODD Parity 22h = DTR EVEN Parity (all other values reserved)		
	1	Bit Rate 0 = 9600; 1 = 19.2k		

Cross-Reference Tables

Introduction

A set of cross-reference tables are provided to assist you in locating control codes and escape sequences. The default settings are also included.

Topic Summary

Topics	Page
Control Codes and Escape Sequences	5-1
Table 5-1, Control Codes and Escape Sequences Index	5-1
a complete list of control codes and escape sequences (organized alphabetical, using several major keywords)	
Table 5-2, Single Character Control Code Definitions	5-7
a list of single character control codes (organized by value of the control codes) including definitions of those codes used in the Quick Reference table	
Table 5-3, Escape Sequences Quick Reference	5-8
a quick means of locating escape sequences if you know the actual control code values (organized numerically, by value)	
Printer Defaults	5-10
Table 5-4, Factory Default Printer Settings	
all of the factory defaults, excluding those which can be set using the configuration tool	
Table 5-5, Configuration Default Printer Settings	
all of the defaults that can be set using the configuration tool	

Control Codes and Escape Sequences

Table 5-1 contains a complete alphabetized list of control codes, including single character control codes and escape sequences, as an aid to locating the control codes defined in the *Control Code Definitions* section. For detailed definitions of these control codes, refer to the pages shown in the *Page* column of this table.

Table 5-1
Control Codes and Escape Sequences Index

Description	Category	Page
A		
Absolute Print Position, Set	General Printer Control	3-5

Table 5-1 (Continued)
Control Codes and Escape Sequences Index

Description	Category	Page
B		
Backspace	General Printer Control	3-2
Beeper	General Printer Control	3-3
Bottom-Up Printing, Select	General Printer Control	3-6
Byte:		
Double Byte Character Sets	Char. Sets, User Defined	3-17
Multi-Byte Character Sets	Char. Sets, User Defined	3-18
Single Byte Character Sets	Char. Sets, User Defined	3-17
C		
Cancel Line	General Printer Control	3-3
Carriage Return	General Printer Control	3-3
Channel:		
Clear Vertical Tabs in Channel	Tabs and Tab Setting	3-17
Select Vertical Tab Channel	Tabs and Tab Setting	3-17
Set Vertical Tabs in Channel	Tabs and Tab Setting	3-16
Character:		
Define Intercharacter Space	Char. Style & Text Mode	3-12
Define User-Defined Characters	Char. Sets, User Defined	3-20
Disable Printing of Character Graphics	Char. Sets, User Defined	3-23
Double Byte Character Sets	Char. Sets, User Defined	3-17
Enable Printing of Character Graphics	Char. Sets, User Defined	3-22
Multi-Byte Character Sets	Char. Sets, User Defined	3-18
Print Character Graphics	Char. Sets, User Defined	3-23
Select Default Character Set	Char. Sets, User Defined	3-21
Select National Character Set	Char. Sets, User Defined	3-19
Select User-Defined Character Set	Char. Sets, User Defined	3-21
Single Byte Character Sets	Char. Sets, User Defined	3-17
User Defined Characters	Char. Sets, User Defined	3-20
Code:		
Cancel Printing of Codes 128-255	Char. Sets, User Defined	3-21
Codepage Selection	Char. Sets, User Defined	3-18
Enable Printing of Codes 128-255	Char. Sets, User Defined	3-21
Expand Printable Code Area	Char. Sets, User Defined	3-22
Condensed: (compressed)		
Cancel Condensed Mode	Char. Style & Text Mode	3-9
Select Condensed Mode	Char. Style & Text Mode	3-9
Copy ROM to RAM	Char. Sets, User Defined	3-20
D		
Default Character Set, Select	Char. Sets, User Defined	3-21
Define Intercharacter Space	Char. Style & Text Mode	3-12
Define User-Defined Characters	Char. Sets, User Defined	3-20
Delete	General Printer Control	3-3

Table 5-1 (Continued)
Control Codes and Escape Sequences Index

Description	Category	Page
Double:		
Cancel Double Strike Mode	Char. Style & Text Mode	3-10
Cancel Double Wide Mode	Char. Style & Text Mode	3-11
Cancel Double Wide Mode (one line only)	Char. Style & Text Mode	3-11
Double Byte Character Sets	Char. Sets, User Defined	3-17
Select Double Strike Mode	Char. Style & Text Mode	3-10
Select Double Wide Mode	Char. Style & Text Mode	3-11
Select Double Wide Mode (one line only)	Char. Style & Text Mode	3-10
E		
Elite Pitch, Select	Char. Style & Text Mode	3-11
Emphasized Mode, Cancel	Char. Style & Text Mode	3-12
Emphasized Mode, Select	Char. Style & Text Mode	3-11
Expand:		
Cancel Double Wide (expanded) Mode	Char. Style & Text Mode	3-11
Cancel Double Wide Mode (one line only)	Char. Style & Text Mode	3-11
Expand Printable Code Area	Char. Sets, User Defined	3-22
Select Double Wide (expanded) Mode	Char. Style & Text Mode	3-11
Select Double Wide Mode (one line only)	Char. Style & Text Mode	3-10
F		
Form Feed	General Printer Control	3-3
G		
General Printer Control Functions	General Printer Control	3-2
Graphics:		
Disable Printing of Character Graphics	Char. Sets, User Defined	3-23
Eight-Pin Graphics Modes	Graphics Functions	3-24
Reassign Graphics Mode	Graphics Functions	3-24
Select Graphics Mode	Graphics Functions	3-24
Select High-Speed Double Density Mode	Graphics Functions	3-25
Select Low-Speed Double Density Mode	Graphics Functions	3-25
Select Low-Speed Quadruple Density Mode	Graphics Functions	3-26
Select Single Density Graphics Mode	Graphics Functions	3-25
Enable Printing of Character Graphics	Char. Sets, User Defined	3-22
Nine-Pin Graphics Modes	Graphics Functions	3-26
Select 9-Pin Double Density Graphics Mode	Graphics Functions	3-26
Select 9-Pin Single Density Graphics Mode	Graphics Functions	3-26
Print Character Graphics	Char. Sets, User Defined	3-23
H		
Half Speed:		
Cancel Half-speed Printing	General Printer Control	3-4
Select Half-speed Printing	General Printer Control	3-4
Horizontal:		
Clear Horizontal Tabs	Tabs and Tab Setting	3-15
Perform Horizontal Tab	Tabs and Tab Setting	3-15
Set Horizontal Tabs	Tabs and Tab Setting	3-15

Table 5-1 (Continued)
Control Codes and Escape Sequences Index

Description	Category	Page
I		
Inactivity:		
Set Inactivity Time for Sleep Mode	General Printer Control	3-4
Intercharacter Space, Define	Char. Style & Text Mode	3-12
Italic:		
Cancel Italic Mode	Char. Style & Text Mode	3-12
Select Italic Mode	Char. Style & Text Mode	3-12
L		
Left Margin, Set	Page Formatting	3-8
Length:		
Set Page Length (inches)	Page Formatting	3-7
Set Page Length (lines)	Page Formatting	3-6
Line, Cancel	General Printer Control	3-3
Line Feed:		
Perform Line Feed	General Printer Control	3-4
Perform n/216 inch Line Feed	General Printer Control	3-4
Perform n/216 inch Reverse Line Feed	General Printer Control	3-4
Line Spacing:		
Select 1/6 inch Line Spacing	Page Formatting	3-7
Select 1/8 inch Line Spacing	Page Formatting	3-7
Select 7/72 inch Line Spacing	Page Formatting	3-7
Select n/72 inch Line Spacing	Page Formatting	3-8
Select n/216 inch Line Spacing	Page Formatting	3-7
M		
Margin:		
Set Left Margin	Page Formatting	3-8
Set Right Margin	Page Formatting	3-8
Master Select	Char. Style & Text Mode	3-12
Master Reset, Perform	General Printer Control	3-5
Mode:		
Cancel Condensed Mode (compressed)	Char. Style & Text Mode	3-9
Cancel Double Strike Mode	Char. Style & Text Mode	3-10
Cancel Double Wide (expanded) Mode	Char. Style & Text Mode	3-11
Cancel Double Wide Mode (one line only)	Char. Style & Text Mode	3-11
Emphasized Mode, Cancel	Char. Style & Text Mode	3-12
Cancel Italic Mode	Char. Style & Text Mode	3-12
Cancel Subscript/Superscript Mode	Char. Style & Text Mode	3-14
Cancel Underline Mode	Char. Style & Text Mode	3-14
Select Condensed Mode (compressed)	Char. Style & Text Mode	3-9
Select Double Strike Mode	Char. Style & Text Mode	3-10
Select Double Wide (expanded) Mode	Char. Style & Text Mode	3-11
Select Double Wide Mode (one line only)	Char. Style & Text Mode	3-10
Emphasized Mode, Select	Char. Style & Text Mode	3-11
Select Elite Pitch	Char. Style & Text Mode	3-11
Select Italic Mode	Char. Style & Text Mode	3-12

Table 5-1 (Continued)
Control Codes and Escape Sequences Index

Description	Category	Page
Select Pica Pitch	Char. Style & Text Mode	3-13
Select Subscript Mode	Char. Style & Text Mode	3-14
Select Superscript Mode	Char. Style & Text Mode	3-13
Select Underline Mode	Char. Style & Text Mode	3-14
Set Inactivity Time for Sleep Mode	General Printer Control	3-4
Multi-Byte Character Sets	Char. Sets, User Defined	3-18
N		
National Character Set, Select	Char. Sets, User Defined	
O		
One Line Only:		
Cancel Double Wide Mode (one line only)	Char. Style & Text Mode	3-11
Select Double Wide Mode (one line only)	Char. Style & Text Mode	3-10
Select Unidirectional Printing (one-line-only)	General Printer Control	3-6
P		
Page:		
Set Page Length (inches)	Page Formatting	3-7
Set Page Length (lines)	Page Formatting	3-6
Perforation:		
Cancel Skip Over Perforation	Page Formatting	3-9
Set Skip Over Perforation	Page Formatting	3-9
Pitch:		
Select Elite Pitch	Char. Style & Text Mode	3-11
Select Pica Pitch	Char. Style & Text Mode	3-13
Position:		
Set Print Position (absolute)	General Printer Control	3-5
Set Print Position (relative)	General Printer Control	3-5
Print:		
Cancel Half-speed Printing	General Printer Control	3-4
Cancel Printing of Codes 128-255	Char. Sets, User Defined	3-21
Cancel Unidirectional Printing	General Printer Control	3-6
Enable Printing of Character Graphics	Char. Sets, User Defined	3-22
Enable Printing of Codes 128-255	Char. Sets, User Defined	3-21
Expand Printable Code Area	Char. Sets, User Defined	3-22
Disable Printing of Character Graphics	Char. Sets, User Defined	3-23
Print Character Graphics	Char. Sets, User Defined	3-23
Select Bottom-Up Printing	General Printer Control	3-6
Select Half-speed Printing	General Printer Control	3-4
Select Top-Down Printing	General Printer Control	3-5
Select Unidirectional Printing	General Printer Control	3-6
Select Unidirectional Printing (one line only)	General Printer Control	3-6
Set Print Position (absolute)	General Printer Control	3-5
Set Print Position (relative)	General Printer Control	3-5

Table 5-1 (Continued)
Control Codes and Escape Sequences Index

Description	Category	Page
R		
Reset:		
Master Reset, Perform	General Printer Control	3-5
Reverse n/216 inch Line Feed, Perform	General Printer Control	3-4
Right Margin, Set	Page Formatting	3-8
ROM to RAM, Copy	Char. Sets, User Defined	3-20
S		
Single Byte Character Sets	Char. Sets, User Defined	3-17
Skip:		
Cancel Skip Over Perforation	Page Formatting	3-9
Set Skip Over Perforation	Page Formatting	3-9
Sleep:		
Set Inactivity Time for Sleep Mode	General Printer Control	3-4
Space:		
Define Intercharacter Space	Char. Style & Text Mode	3-12
Select 1/6 inch Line Spacing	Page Formatting	3-7
Select 1/8 inch Line Spacing	Page Formatting	3-7
Select 7/72 inch Line Spacing	Page Formatting	3-7
Select n/72 inch Line Spacing	Page Formatting	3-8
Select n/216 inch Line Spacing	Page Formatting	3-7
Strike:		
Cancel Double Strike Mode	Char. Style & Text Mode	3-10
Select Double Strike Mode	Char. Style & Text Mode	3-10
Subscript/Superscript:		
Cancel Subscript/Superscript Mode	Char. Style & Text Mode	3-14
Select Subscript Mode	Char. Style & Text Mode	3-14
Select Superscript Mode	Char. Style & Text Mode	3-13
T		
Tab:		
Clear Horizontal Tabs	Tabs and Tab Setting	3-15
Clear Vertical Tabs	Tabs and Tab Setting	3-16
Clear Vertical Tabs in Channel	Tabs and Tab Setting	3-17
Perform Horizontal Tab	Tabs and Tab Setting	3-15
Perform Vertical Tab	Tabs and Tab Setting	3-16
Select Vertical Tab Channel	Tabs and Tab Setting	3-17
Set Horizontal Tabs	Tabs and Tab Setting	3-15
Set Vertical Tabs	Tabs and Tab Setting	3-16
Set Vertical Tabs in Channel	Tabs and Tab Setting	3-16
Time:		
Set Inactivity Time for Sleep Mode	General Printer Control	3-4
Top-Down Printing, Select	General Printer Control	3-5

Table 5-1 (Continued)
Control Codes and Escape Sequences Index

Description	Category	Page
U		
Underline:		
Cancel Underline Mode	Char. Style & Text Mode	3-14
Select Underline Mode	Char. Style & Text Mode	3-14
Unidirectional:		
Cancel Unidirectional Printing	General Printer Control	3-6
Select Unidirectional Printing	General Printer Control	3-6
Select Unidirectional Printing (one-line-only)	General Printer Control	3-6
User Defined Characters:		
Cancel Printing of Codes 128-255		3-20
Cancel Printing of Codes 128-255	Char. Sets, User Defined	3-21
Copy ROM to RAM	Char. Sets, User Defined	3-20
Define User-Defined Characters	Char. Sets, User Defined	3-20
Disable Printing of Character Graphics	Char. Sets, User Defined	3-23
Enable Printing of Character Graphics	Char. Sets, User Defined	3-22
Enable Printing of Codes 128-255	Char. Sets, User Defined	3-21
Expand Printable Code Area	Char. Sets, User Defined	3-22
Select Default Character Set	Char. Sets, User Defined	3-21
Select User-Defined Character Set	Char. Sets, User Defined	3-21
Print Character Graphics	Char. Sets, User Defined	3-23
V		
Vertical:		
Clear Vertical Tabs	Tabs and Tab Setting	3-16
Clear Vertical Tabs in Channel	Tabs and Tab Setting	3-17
Perform Vertical Tab	Tabs and Tab Setting	3-16
Select Vertical Tab Channel	Tabs and Tab Setting	3-17
Set Vertical Tabs	Tabs and Tab Setting	3-16
Set Vertical Tabs in Channel	Tabs and Tab Setting	3-16
W		
Wide:		
Cancel Double Wide (expanded) Mode	Char. Style & Text Mode	3-11
Cancel Double Wide Mode (one line only)	Char. Style & Text Mode	3-11
Select Double Wide (expanded) Mode	Char. Style & Text Mode	3-11
Select Double Wide Mode (one line only)	Char. Style & Text Mode	3-10

Table 5-2 below contains a list of control codes (between 00h and 7Fh), and provides definitions for the ASCII symbols, as they are used in *Table 5-3, Escape Sequences Quick Reference* (later in this section), and in the format definitions (throughout the *Control Code Definitions* section).

Table 5-2
Single Character Control Code Definitions

Dec	Hex	ASCII	Description	Page
0	00	NUL	Used as a terminator for several of the escape sequences.	
1	01	SOH		
2	02	STX		
3	03	ETX		

Table 5-2 (Continued)
Single Character Control Code Definitions

Dec	Hex	ASCII	Description	Page
4	04	EOT		
5	05	ENQ		
6	06	ACK		
7	07	BEL	Beeper: sounds buzzer for 1/10 of a second.	3-3
8	08	BS	Backspace: moves print head one space to left.	3-2
9	09	HT	Horizontal Tab: moves print head to next tab stop.	3-15
10	0A	LF	Line Feed: moves paper to next line.	3-4
11	0B	VT	Vertical Tab: moves paper to next vertical tab stop	3-16
12	0C	FF	Form Feed: advances paper to top of next page.	3-3
13	0D	CR	Carriage Return: moves print head to left margin.	3-3
14	0E	SO	Shift Out: selects Double-wide Mode (one-line-only)	3-10
15	0F	SI	Shift In: selects Condensed (compressed) mode	3-9
16	10	DLE		
17	11	DC1	Device Control 1: sets printer online (not currently used)	
18	12	DC2	Device Control 2: cancels condensed mode (compressed)	3-9
19	13	DC3	Device Control 3: sets printer offline (not currently used)	
20	14	DC4	Device Control 4: cancels double-wide mode (online only)	3-11
21	15	NAK		
22	16	SYN		
23	17	ETB		
24	18	CAN	Cancel Line: clears all characters out of print buffer.	3-3
25	19	EM		
26	1A	SUB		
27	1B	ESC	Escape: defines start of escape sequence.	
26	1C	FS		
27	1D	GS		
28	1E	RS		
29	1F	US		
32	20	SP	Space Character	
127	7F	DEL	Delete: deletes last character in print buffer.	3-3

Table 5-3 is a quick reference between the escape sequences and their definitions. They are listed in ascending order, according to the numeric values of the escape sequences.

For detailed definitions of these escape sequences, refer to the *Control Code Definitions* section.

Table 5-3
Escape Sequences Quick Reference

Decimal	Description
ESC SO	Select Double-Wide (expanded) Mode (one line only)
ESC SI	Select Condensed Mode (compressed)
ESC DC2	Cancel Condensed Mode
ESC DC4	Cancel Double-Wide (expanded) Mode (one line only)

Table 5-3 (Continued)
Escape Sequences Quick Reference

Decimal	Description
ESC US (0)	Select Top-Down Printing
ESC US (1)	Select Bottom-Up Printing
ESC SP n	Define Inter-Character Space
ESC “!” n	Master Select
ESC “\$” n1 n2	Set Print Position (absolute)
ESC “%” (0)	Select Default Character Set
ESC “%” (1)	Select User-Defined Character Set
ESC “&” NUL k1 k2 s1 d1...d11	Define User-Defined Characters
ESC “*” m n1 n2	Select Graphics Mode
ESC “+” n d1...dn	Print Character Graphics
ESC “_” 0*	Cancel Underline Mode
ESC “_” 1*	Select Underline Mode
ESC “/” c	Select Vertical Tab Channel
ESC “0”	Select 1/8 inch Line Spacing
ESC “1”	Select 7/72 inch Line Spacing
ESC “2”	Select 1/6 inch Line Spacing
ESC “3” n	Select n/216 inch Line Spacing
ESC “4”	Select Italic Mode
ESC “5”	Cancel Italic Mode
ESC “6”	Enable Printing of Codes 128–255
ESC “7”	Disable Printing of Codes 128–255
ESC “<”	Select Unidirectional Printing (one-line-only)
ESC “:” NUL NUL NUL	Copy ROM to RAM
ESC “?” s n	Reassign Graphics Mode
ESC “@”	Perform Master Reset
ESC “A” n	Select n/72 inch Line Spacing
ESC “B” NUL	Clear Vertical Tabs
ESC “B” n1 n2 ... nk NUL	Set Vertical Tabs
ESC “C” n	Set Page Length (lines)
ESC “C” NUL n	Set Page Length (inches)
ESC “D” NUL	Clear Horizontal Tabs
ESC “D” n1 n2 ... nk NUL	Set Horizontal Tabs
ESC “E”	Select Emphasized Mode
ESC “F”	Cancel Emphasized Mode
ESC “G”	Select Double-Strike Mode
ESC “H”	Cancel Double-Strike Mode
ESC “I” n	Expand Printable Code Area
ESC “J” n	Perform n/216 inch Line Feed
ESC “K” n1 n2	Select Single-density Graphics Mode
ESC “L” n1 n2	Select Low-Speed Double-Density Graphics Mode
ESC “M”	Select Elite Pitch
ESC “N” n	Set Skip Over Perforation
ESC “O”	Cancel Skip Over Perforation

Table 5-3 (Continued)
Escape Sequences Quick Reference

Decimal	Description
ESC "P"	Select Pica Pitch
ESC "Q" n	Set Right Margin
ESC "R" n0 n1 n2	Codepage Selection
ESC "R" n	Select National Character Set
ESC "S" 0*	Select Superscript Mode
ESC "S" 1*	Select Subscript Mode
ESC "T"	Cancel Superscript/Subscript Mode
ESC "U" 0*	Cancel Unidirectional Printing
ESC "U" 1*	Select Unidirectional Printing
ESC "W" 0*	Cancel Double-Wide (expanded) Mode
ESC "W" 1*	Select Double-Wide (expanded) Mode
ESC "Y" n1 n2	Select High-Speed Double-Density Graphics Mode
ESC "Z" n1 n2	Select Low-Speed Quadruple-Density Graphics Mode
ESC "^" (0) n1 n2	Select 9-pin Single Density Graphics Mode
ESC "^" (1) n1 n2	Select 9-pin Double Density Graphics Mode
ESC "b" c NUL	Clear Vertical Tab Channel
ESC "b" c n1 n2 ... nk NUL	Set Vertical Tabs in Channel
ESC "j" n	Perform n/216 inch Reverse Line Feed
ESC "l" n	Set Left Margin
ESC "s" 0*	Cancel Half-speed Printing
ESC "s" 1*	Select Half-speed Printing
ESC "t" (0)	Disable Printing of Character Graphics
ESC "t" (1)	Enable Printing of Character Graphics
ESC "z" n	Set Inactivity Time for Sleep mode
ESC "\" n1 n2	Set Print Position (relative)

Printer Defaults

The Table 5-4 settings are installed in the printer at the factory. To restore these defaults, refer to the *Changing the Printer Settings* paragraph, in the *Maintenance* section of the User's Guide.

Table 5-4
Factory Default Printer Settings

Function	Default Value
Carriage position	At left margin
Character set	Normal (not user defined)
Codepage	0
Codes 128-255	Disabled
Condensed (compressed)	Disabled
Double-strike	Disabled
Double-Wide	Disabled
Emphasized	Disabled
Graphics mode	Not selected
Half-speed printing	Disabled

Table 5-4 (Continued)
Factory Default Printer Settings

Function	Default Value
Intercharacter space	Zero (0)
International character sets	Disabled
Italic	Disabled
Justification	Left justification
Keyboard, printer	Enabled
Language	USA
Line Spacing	1/6 inch
Margin, left	0
Margin, right	80
MSB control	Disabled
NLQ	Disabled
Page length	11 inch (66 lines with Pica pitch)
Paper end sensor	Enabled
Pitch	Pica (10 characters per inch)
Power off sleep timer	10 seconds
Printer Code Area Expansion	Disabled
Printing direction	Top-down, bidirectional
Redefinition of graphic modes	Disabled
Skip over perforation	Disabled
Subscript/Superscript	Disabled
Tabs, horizontal	Set to default tabs (every 8 column)
Tabs, vertical	1 line feed each tab, channel = 0
Top of form	Set to current line
Underline	Disabled
Unidirectional printing	Disabled (bidirectional)
User defined character set	Removed

The default settings listed below can be restored to the printer, as described in the *Using the Configuration Tool* section of this publication.

Table 5-5
Configuration Defaults Printer Settings

Function	Default Value
Zero print option	Zeros are printed with a slash
Autofeed configuration	CR (carriage return added at end of line without line feed)
Protocol	NPCP (NORAND Portable Communications Protocol)
Parity	N/A (for NPCP)
Bit Rate	19.2K

NOTE:

This index covers all topics. Page numbers in italics are figures, those in bold are tables.

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