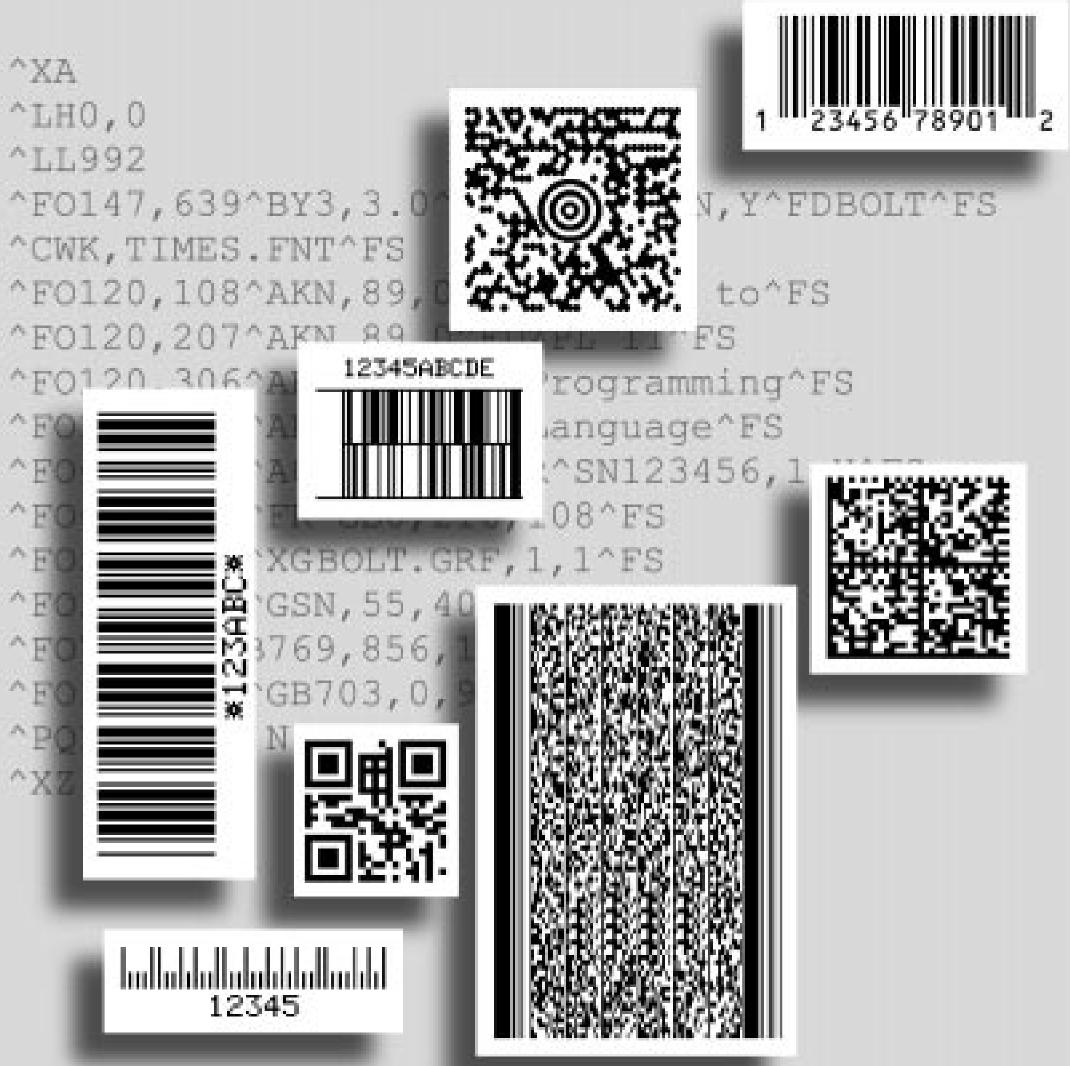
ZPL II®

PROGRAMMING GUIDE



Zebra®

ZPL II®

PROGRAMMING GUIDE

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Zebra

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CHAPTER 1
Introduction to ZPL II®

Scope of This Manual

This manual is a guide to the functions and features of the Zebra Programming Language II (ZPL II). This manual is effective for the firmware versions listed below and all firmware versions prior to these:

14.8.0	Zebra 105*S* and *S*500 printers
18.8.0	Zebra 90*Xi*II, 140*Xi*II, 170*Xi*II & 220*Xi*II printers
21.8.0	Zebra 105*Se* & 160*S* printers
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Zebra Programming Language II (ZPL II)

Zebra Programming Language II (ZPL II) is a high-level label definition and printer control language. Labels may be defined in ZPL II Language and generated by a host computer system. A commercial label preparation system or a software package which automatically generates ZPL II Code may also be used. For information about label preparation systems, consult your distributor, systems integrator, or computer software vendor.

Why ZPL II and How it Differs from Standard ZPL

The primary reason for the development of ZPL II was to substantially reduce the time between when a printer begins receiving label format data and when the first label begins to print. This was accomplished primarily by changing the way ZPL scripts are written.

NOTE: ZPL II scripts are not 100% compatible with standard ZPL scripts.

In reality, the differences between ZPL II and Standard ZPL scripts is minor. Most existing Standard ZPL scripts can be easily modified to take advantage of ZPL II. You can also write ZPL II scripts that are compatible with Standard ZPL printers.

There are two major differences between ZPL II and Standard ZPL.

1. With ZPL II, ***all*** data fields are formatted as received. In Standard ZPL, the data fields are not processed until after the **^XZ** (End Format) instruction is received.

2. Many new ZPL II commands (instructions) have been added.

In order to take advantage of ZPL II, it is ***mandatory*** that when the following ZPL II instructions are used in a label format, ***they must come before the first ^FD (Field Data) command.***

^JM, ^LH, ^LL, ^LR, ^LS, ^PM, ^PO, ^PR, and **^PF**

NOTE: If these instructions are used in a label format and are not placed before the first ^FD (Field Data) command, the label may not print correctly.

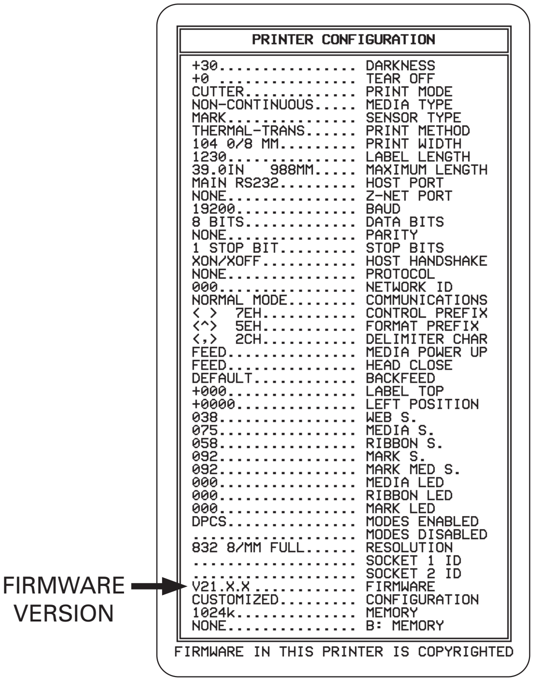
NOTE: In the past, ZPL II instructions could only be entered in upper-case characters. ZPL II instructions can now be entered in either uppercase characters, lowercase characters, or a combination of both.

★★IMPORTANT★★

The ZPL II commands listed in this Programming Guide are available depending on which version of firmware is installed in your printer and which printer you are using. Please consult the Command Quick Reference Chart in Appendix A to see which commands are available for your version of firmware and printer.

To determine which version of firmware resides in your printer, you will need to print out a Printer Configuration Label. Consult your printer user's guide for instructions on how to print the label. The label provides valuable information about your printer's configuration, memory, options, etc. A sample of the

Printer Configuration Label is shown below with an arrow pointing to the firmware information.



FIRMWARE
VERSION

```
                 PRINTER CONFIGURATION
+30................ DARKNESS
+0 ................ TEAR OFF
CUTTER............. PRINT MODE
NON-CONTINUOUS..... MEDIA TYPE
MARK............... SENSOR TYPE
THERMAL-TRANS...... PRINT METHOD
104 0/8 MM......... PRINT WIDTH
1230............... LABEL LENGTH
39.0IN   988MM..... MAXIMUM LENGTH
MAIN RS232......... HOST PORT
NONE............... Z-NET PORT
19200.............. BAUD
8 BITS............. DATA BITS
NONE............... PARITY
1 STOP BIT......... STOP BITS
XON/XOFF........... HOST HANDSHAKE
NONE............... PROTOCOL
000................ NETWORK ID
NORMAL MODE........ COMMUNICATIONS
< >  7EH........... CONTROL PREFIX
<^>  5EH........... FORMAT PREFIX
<,>  2CH........... DELIMITER CHAR
FEED............... MEDIA POWER UP
FEED............... HEAD CLOSE
DEFAULT............ BACKFEED
+000............... LABEL TOP
+0000.............. LEFT POSITION
038................ WEB S.
075................ MEDIA S.
058................ RIBBON S.
092................ MARK S.
092................ MARK MED S.
000................ MEDIA LED
000................ RIBBON LED
000................ MARK LED
DPCS............... MODES ENABLED
................... MODES DISABLED
832 8/MM FULL...... RESOLUTION
................... SOCKET 1 ID
................... SOCKET 2 ID
V21.X.X ........... FIRMWARE
CUSTOMIZED......... CONFIGURATION
1024k.............. MEMORY
NONE............... B: MEMORY
FIRMWARE IN THIS PRINTER IS COPYRIGHTED
```

Printer Configuration Label

Working with Examples

Examples are used throughout this guide to assist and instruct both new and more experienced users. Each example has two parts; the actual instructions sent to the printer and the results (usually in the form of a printed label) of those instructions.

It is strongly suggested that new users go through each of the examples, comparing their results with the one shown. Experienced users may only need to read over the examples, making sure they understand how the results were obtained.

Most of the examples are "stand-alone" and can be completed on an individual basis. However, some examples assume that a previous example has already been completed. For instance, an example may delete a previously saved graphic image.

Before working with the examples, be sure the supplies (ribbon and media) have been loaded and that the printer has been properly adjusted for the media (labels). If unfamiliar with these procedures, refer to the printer user’s guide for assistance.

The examples shown in this guide assume a media size of at least 80mm wide and 60mm long. Media of different sizes can be used, however parameters affecting size or location of printed data may need to be modified.

Continuous media can also be used for these examples. Be sure to set the label length using the **^LL** instruction. We recommend using a label length of 480 dot rows by adding the instruction sequence **^LL480^FS** after the **^XA** instruction line. Both of these instructions are covered in detail in the Command Reference section.

The examples are designed for a Zebra printer controlled by a “stand-alone” (i.e. not part of a network) IBM®-compatible personal computer. The ZPL II Language uses only printable ASCII characters. Although a Zebra printer may be controlled by mainframes or mini-computers, we’ve chosen the personal computer as a programming source because of its relative familiarity among users.

Any word processor or text editor capable of creating ASCII-only files (files without formatting codes and other extraneous information) can be used to create the programs in these examples. For instance, if you are using Microsoft Word®, you would open a Text (.txt) file.

Most of the examples are made up of a series of instruction lines. When you finish typing a line, press the RETURN or ENTER key. Then type in the next line. Continue this process for all of the lines in the example.

NOTE: Factory Default printer settings were used for the examples in this guide and the printer is set up for tear off operation.

WARNING: The Factory Default for the Darkness (“burn temperature”) setting is set to a low “safe” value at the factory. When using a printer right out of the box, this value may have to be changed for proper printing. Refer to the printer user’s guide for information on how to change this value.

CHAPTER 2
ZPL II Basics

ZPL II is Zebra Technologies Corporation's registered trademark for its *Zebra Programming Language II*. ZPL II instructions sent to a Zebra printer give you the ability to create a wide variety of labels from the simple to the very complex. The labels can include any combination of text, bar codes, and graphics.

More Information About ZPL II

ZPL II contains a variety of printable character font styles and bar codes. Various ZPL II instructions let you position print fields anywhere on a label in a horizontal orientation or rotated 90, 180 or 270 degrees clockwise. Graphic images can be read and interpreted provided they are in a binary or "hexadecimal format." Therefore, if you can convert a scanned or computer-generated image (i.e. image created using a draw or paint software program) into hexadecimal format, you can print it on a label. You can use the ***ZTools™ for Windows*** program (available from Zebra) to convert the bitmap graphic into the pure hexadecimal graphic format.

ZPL II instructions consist of a prefix character, a two-character mnemonic code and, where applicable, a parameter string. The entire language is programmable in printable ASCII characters, which allows easy passage of formats and data through computer networks and protocol converters. ZPL II instructions do not use escape sequences or control codes. A few instructions do have ASCII control code equivalents, which are noted as they apply.

ZPL II is both powerful and flexible, providing all of the following features:

- Compatibility with PCs, minicomputers, mainframe computers and networks.
- Serialized label fields, with user-selected starting value and increment/decrement value.
- Programmable label replicate count, batch quantity control, and printer pauses that enable batching of labels into usable groups.
- Simple line graphics to eliminate label preprinting.
- Scalable fonts.
- Bitmap image graphics, with library function capability (to store more than one graphic and recall as needed), for freeform graphic designs.

You can create and use ZPL II scripts (label formats) one at a time from any word processor capable of generating an ASCII text file. You can integrate your Zebra printer into your operations by using database programs and other languages to generate ZPL II programs. The ZPL II program is then sent to the Zebra printer through an appropriate interface (combination of proper cabling, printer configuration, and software settings). The examples in this guide use printable ASCII characters in all instructions, unless otherwise noted.

There are two types of ZPL II instructions: **Format Instructions** and **Control Instructions**. A discussions of these instructions follows.

Format Instructions

Format instructions are the blueprint of a label. These instructions define label length, field origin, type of field, field data, and other information. Format instructions are always preceded by the caret **(^)** character. All format instructions are processed in the order received.

Most format instructions are, for the most part, “order-independent.” For example, instructions to print text at the bottom of a label can come before the instruction to print a bar code at the top of the same label.

However, due to the processing method used, some format instructions must be placed before others within the label format. These are:

^LH (Label Home)
^LR (Label Reverse)
^JM (Set Dots/Millimeter)
^PO (Print Orientation)
^LL (Label Length)
^LS (Label Shift)
^PM (Mirror Image)
^PF (Slew Dot Rows)

These commands are explained in detail in the Command Reference section of this guide.

Multiple label formats are acted on in the order they are received by the printer.

Format instructions fall into several categories:

- Format bracket instructions
- Label definition instructions
- Field definition instructions
- Field default instructions
- Format default instructions
- Format rotation instructions
- Printer control instructions
- Alphanumeric field instructions
- Bar code field instructions
- Graphic image instructions

Control Instructions

Control instructions are usually preceded by a tilde (~) character. In most cases, they cause the printer to take a specific action immediately, such as clearing the memory or feeding a blank label. Control instructions may interrupt and preempt any format instructions waiting in the printer's received data buffer.

Prefix Rules and Syntax for Control and Format Instructions

Format instructions use the caret (^) prefix.
An "RS" (HEX 1E) can be substituted for the (^).

Control instructions use the tilde (~) prefix.
A "DLE" (HEX 10) can be substituted for the (~).

NOTE: Both Format and Control prefix characters can be changed via ZPL II.

In ZPL II instructions, the caret (^) is treated as an ordinary ASCII character like any other character you would type in from the keyboard.

★★IMPORTANT★★

In this manual, when you see the caret (^) character, it indicates that you are to type the caret (^) character. The caret (^) character is not to be confused with pressing the Control (Ctrl) key on the keyboard.

The caret (^) is a single printable ASCII character having the code 5E HEX or 94 decimal. Similarly, the tilde (~) is a single printable ASCII character having the code 7E HEX or 126 decimal.

A few ZPL II instructions can be sent to the printer as either a Format Instruction or a Control Instruction. The action performed by the printer will be the same in either case. These instructions must be preceded by the appropriate prefix (i.e. a ^ or a ~) for the context in which they are used.

Many ZPL II instructions have parameter strings associated with them. Changing the value of one or more of these parameters affects the outcome of the printed label.

If the default value for an instruction parameter suits your application, you need not specify that parameter. However, parameters are "position-specific." If you want to change just the third parameter, for example, you must indicate that it is the third parameter that you want to change. To do so, use a **comma**, *the ZPL II delimiter character*, to mark each parameter's place (i.e. **^AA,,60**). If you enter a parameter, all further parameters to the right are to be defaulted, no further commas are required.

★★IMPORTANT★★

Some instructions include the following abbreviation: {I.V.P. = } This signifies the Initial Value at Power-up *regardless* of the value when the printer was turned off.

NOTE: To permanently save configuration settings in the printer's configuration memory, you will need to send a ^JUS command at the end of the ZPL II script. (See ^JU on page 270)

An Example of a Basic Label

This exercise is designed to guide you through the basic steps to create a common label which contains text and a bar code.

Refer to Chapter 4, Introduction, for more information on how to set up your printer and how to enter ASCII text to send to your printer.

Type the programming instructions (**shown in bold**) in the order given. An explanation of what each instruction does is in brackets [ ]. A printed example of the label is on the next page with arrows pointing to the different parts that make up the label and an indication of the ZPL II command that was used to create it.

^ XA

[^XA - Indicates start of label format.]

^ LH30,30

[^LH - Sets label home position 30 dots to the right and 30 dots down from top edge of label.]

^ FO20,10 ^ AD ^ FDZEBRA ^ FS

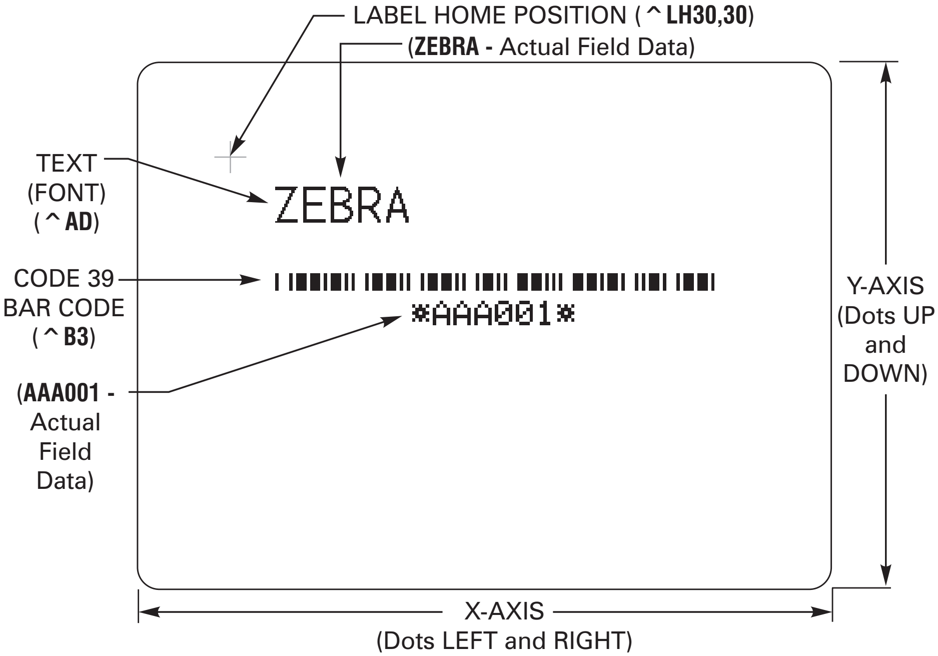
[^FO20,10 - Set field origin 20 dots to the right and 10 dots down from the home position defined by the ^LH instruction.]
[^AD - Select font "D."]
[^FD - Start of field data.]
[ZEBRA - Actual field data.]
[^FS - End of field data.]

^ FO20,60 ^ B3 ^ FDAAA001 ^ FS

[^FO20,60 - Set field origin 20 dots to the right and 60 dots down from the home position defined by the ^LH instruction.]
[^B3 - Select Code 39 bar code.]
[^FD - Start of field data for the bar code.]
[AAA001 - Actual field data.]
[^FS - End of field data.]

^ XZ

[^XZ - Indicates end of label format.]



Basic Label Example with Text and Bar Code

Zebra Fonts

Most Zebra printers come standard with 8 bitmapped fonts and one scalable font. Additional downloadable bitmapped and scalable fonts are also available.

Character size and density (how dark it appears) depends on the density of the printhead and the media used. Three different printheads are available: 6 dots/mm, 8 dots/mm and 12 dots/mm.

Internal bitmapped fonts can be magnified from 2 to 10 times their normal (default) size. The magnification factor is in whole numbers. Therefore, if the normal size of a bit mapped font is 9 dots high and 5 dots wide, a magnification factor of 3 would produce a character of 27 dots high and 15 dots wide. Height and width can be magnified independently.

Understanding Bitmapped Font Magnification Factors

The font instructions in this chapter contain parameters for entering the height and width of printed characters. The values are always entered in dots. When entering these values for bitmapped fonts, use the following formula:

Base Height x Magnification Factor = Height Parameter Value. (Same principle applies to width.)

EXAMPLE:

Base height of bitmap character is 9 dots.
Base width of bitmap character is 5 dots.

To magnify the character 3 times,
the height parameter is 27
the width parameter is 15.

NOTE: For consistent results, always use the correct parameter values. See the specific font tables in Appendix C.

Font Selection

To use a text font, you must either use the change alphanumeric default font instruction (**^CF** - *explained fully in the Command Reference section, page 180*) or specify an alphanumeric field instruction (**^A** - *explained in the Command Reference section, page 96).*

Font	Matrix	Type[*]	ICG and Baseline	
	H×W (in dots)		Intercharacter Gap (in dots)	Baseline (in dots)
A	9 x 5	U-L-D	1	7
B	11 x 7	U	2	11
C,D	18 x 10	U-L-D	2	14
E	28 x 15	OCR-B	5	23
F	26 x 13	U-L-D	3	21
G	60 x 40	U-L-D	8	15
H	21 x 13	OCR-A	6	21
GS	24x24	SYMBOL	PROPORTIONAL	3 x HEIGHT/4
Ø	DEFAULT: 15x12		PROPORTIONAL	3 x HEIGHT/4

Table 1. Intercharacter Gap and Baseline Parameters

Proportional Spacing

Proportional spacing is different than fixed spacing. In Table 1, the Intercharacter Gap (space between characters) is constant for fonts A thru H. The spacing between all characters is the same. For example, the spacing between ‘MW’ is the same as between ‘IE.’

The baseline is the imaginary line on which the bottom (base) of all characters (except any decenders) rest. The area between the baseline and the bottom of the matrix is used for any character “descenders.” Baseline numbers given in Table 1 define where the baseline is located in relationship to the top of the matrix. For example, the baseline for font ‘E’ is 23 dots down from the top of the matrix.

Bitmap Font Size

Alphanumeric field instruction (**^A**) parameters ***h*** and ***w*** control the magnification and therefore, the ultimate size, of the font. The parameter is specified in dots, but ZPL II actually uses an integer multiplier times the original height/width of the font. For example, if you specify

```
^ AD,54
```

you get characters three times their normal size (54 dots high), but if you specify

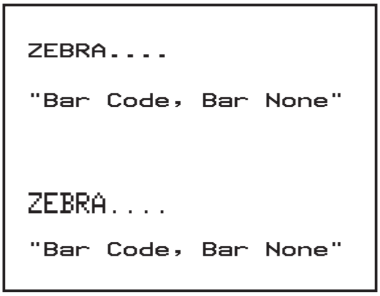
```
^ AD,52
```

you get the same result (not characters 52 dots high).

Defining only the height or width forces the magnification to be proportional to the parameter defined. If neither is defined, the **^CF** height and width are used. For example, if the height is twice the standard height, the width will be twice the standard width.

NOTE: If a ^CF instruction, with height and width parameters defined, is used to set the first font, any ^A instructions (to select a different font) that follow must have the height and width parameter filled in. If this is not done, the newly selected font will be magnified using values for the ^CF height and width parameters. The following is an example of what happens.

```
^XA
^FO50,50^CFD,26,10^FDZEBRA....^FS
^FO50,100^FD"Bar Code, Bar None"^FS
^FO50,200^AA^FDZEBRA....^FS
^FO50,250^FD"Bar Code, Bar None"
^XZ
```



```
ZEBRA....

"Bar Code, Bar None"


ZEBRA....

"Bar Code, Bar None"
```

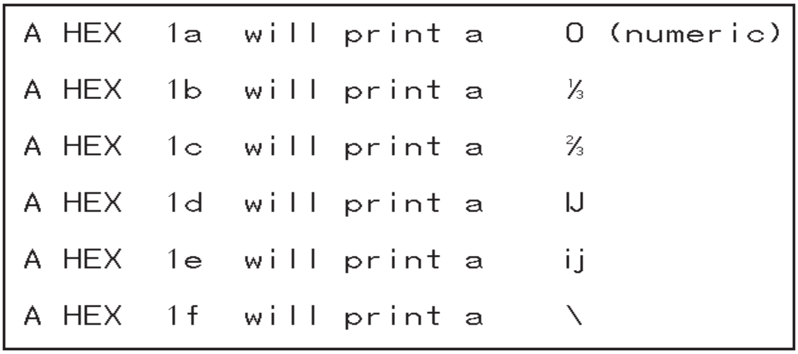
Differences Between Download Scalable Fonts and Bitmap Fonts

For scalable fonts, setting the height and width equally produces the most balanced looking characters. Balanced characters are very pleasing to the eye since actual height and width are approximately equal to each other. This is achieved through the use of a smooth-scaling algorithm in the printer.

In the case of a bitmap font this balancing is built into the font. In actuality, the height of a bitmap font is slightly larger than the width. Bitmap fonts are always at the maximum size of the characters cell.

The standard Zebra character set is Code 850 for character values greater than 20 HEX. There are six HEX character values below 20 HEX that are also recognized. The following chart shows how these character values are printed.

NOTE: Unidentified character values should default to a space.



```
A HEX   1a   will print a    0 (numeric)
A HEX   1b   will print a    ⅓
A HEX   1c   will print a    ⅔
A HEX   1d   will print a    IJ
A HEX   1e   will print a    ij
A HEX   1f   will print a    \
```

Downloadable Scalable Fonts

All dot parameters used in the instructions to create Scalable Fonts are translated into a point size. The printer will convert the dot parameter to some "point" size, since scalable fonts work in point sizes, not dots.

To determine how many dots must be entered to obtain a particular point size, use the following formula:

$$Dots = \frac{(Point\ \ Size)\ x\ \ (Dots\ \ Per\ \ Inch\ \ of\ \ Printer)}{72}$$

For printers using a 6 dot/mm print head the "dots per inch of printer" value is 152.4.

For printers using a 8 dot/mm print head the "dots per inch of printer" value is 203.

For printers using a 12 dot/mm print head the "dots per inch of printer" value is 304.8.

NOTE: Actual point size will be an approximate value.

The actual height and width of the character in dots will vary, depending on font style and the particular character. Therefore, some characters will be smaller and some will be larger than the actual dot size requested.The base lines for all scalable fonts are now calculated against the dot size of the cell. The base line will be 3/4 down from the top of the cell. For example, if the size of the cell is 80 dots, the base line will be 60 dots (3/4) down from the top of the cell.

For more information concerning fonts and related commands, see **~DB** (Download Bitmap Font) and **~DS** (Download Scalable Font) in the Command Reference section of this guide.

Bar Codes

Zebra printers can print the following kinds of bar codes:

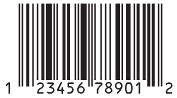
- ANSI Codabar
- Data Matrix
- Code 39
- Code 93
- EAN-8
- Industrial 2 of 5
- LOGMARS
- PDF417
- Plessey
- Standard 2 of 5
- UPC-E
- Micro-PDF417
- CODABLOCK
- Code 11
- Code 49
- Code 128 (subsets A, B, and C)
- EAN-13
- Interleaved 2 of 5
- MSI
- UPS Maxicode
- PostNet
- UPC-A
- UPC/EAN Extensions
- QR Code

Basic Format for Bar Codes

The basic format for bar codes is: quiet zone, start character, data, check digit, stop character and quiet zone. Refer to the Sample bar Code figure below. Not all bar codes require each of these elements.

Every bar code requires a *quiet zone*. A quiet zone (sometimes called a "clear area") is an area adjacent to the machine-readable symbols that ensure proper reading (decoding) of the symbols. No printing is permissible within this area. Preprinted characters, borders, and background color are acceptable if they are invisible to the reading device; these are used in some applications but restricts the type of reading device that can be used. The size of the quiet zone depends on the size of bar widths (usually 10 times the width of the narrow bar).

Every bar code contains data made up of a sequence of light spaces and dark bars that represent letters, numbers, or other graphic characters. The usable characters differ among the various kinds of bar codes. Each bar code section in the Command Reference provides a table of applicable characters. Start and stop characters and check digits are used by many, but not all, bar codes. These will be indicated in the specific bar code discussions found in the Command Reference section.



Sample Bar Code

Bar Code Field Instructions

To create a bar code, a bar code field instruction must be contained in the label format. Table 2 shows all of the bar code field instructions. The number in brackets denotes the print ratio. Each instruction produces a unique bar code.

^B1	Code 11 (USD-8)	[2.0 - 3.0]
^B2	Interleaved 2 of 5	[2.0 - 3.0]
^B3	Code 39 (USD-3 & 3 of 9)	[2.0 - 3.0]
^B4	Code 49 **(*)**	[Fixed]
^B7	PDF417 **(*)**	[Fixed]
^B8	EAN-8 **(*)**	[Fixed]
^B9	UPC-E **(*)**	[Fixed]
^BA	Code 93 (USS-93) **(*)**	[Fixed]
^BB	CODABLOCK A, E, F **(*)**	[Fixed]
^BC	Code 128 (USD-6) **(*)**	[Fixed]
^BD	UPS MaxiCode	[Fixed]
^BE	EAN-13 **(*)**	[Fixed]
^BF	Micro-PDF417	[Fixed]
^BI	Industrial 2 of 5	[2.0 - 3.0]
^BJ	Standard 2 of 5	[2.0 - 3.0]
^BK	ANSI Codabar (USD-4 & 2 of 7)	[2.0 - 3.0]
^BL	LOGMARS	[2.0 - 3.0]
^BM	MSI	[2.0 - 3.0]
^BP	Plessey	[2.0 - 3.0]
^BQ	QR Code	[Fixed]
^BS	UPC/EAN Extensions **(*)**	[Fixed]
^BU	UPC-A **(*)**	[Fixed]
^BX	Data Matrix	[Fixed]
^BZ	PostNet **(*)**	[Fixed]

(*) Fixed Printing Ratio - This means that the ratio between the width of the bars in the code is a fixed standard and cannot be changed.

Table 2. Available Bar Codes

Additionally, each bar code field instruction can be issued with a definition parameter string. The parameter string defines field rotation, height, and interpretation line status for all bar codes. For some bar codes, the parameter string also sets a check digit, start character, and/or stop character. Use the definition parameter string to command the printer to print bar codes of appropriate heights and densities that conform to the specifications of the application.

The use of the parameter string is optional since all parameters have default values. If the default values for all of the bar code parameters suit the application, then only the bar code instruction needs to be entered.

Parameters in bar code field instructions are 'position specific.' If a value (other than the default value) is manually entered for one parameter, a **comma " , "** the *ZPL II delimiter character,* must be used to mark the position of the preceding parameters in the string.

To change just the third parameter, enter two commas and then the value for the third parameter. The default values will be automatically used for the first and second parameters. The following is an example of how this would actually be entered in the ZPL II label format.

In our sample label example from Chapter 4, Exercise #9 on page63, a **^B3** bar code field instruction is selected that has five parameters. The third parameter defines the height of the bar in dots. The bar code is to be printed using default values for the first two parameters EXCEPT the height of the bar. This is to be 228 dots. Finally, the "**N**" indicates that a print interpretation line will **not** print with the bar code. The instruction would be entered as follows:

```
^ B3,,228,N  )
```

NOTE: Delimiters (commas) are not required for parameters between a manually entered value and the end of the parameter string.

The bar code instructions are organized into four groups. Each group represents a particular type of bar code. These groups and the bar codes they contain are as follows:

NUMERIC-ONLY BAR CODES

^B1	Code 11
^B2	Interleaved 2 of 5
^BI	Industrial 2 of 5
^BJ	Standard 2 of 5
^BK	ANSI Codabar (or NW-7)
^BM	MSI
^BP	Plessey
^BZ	POSTNET

RETAIL LABELING BAR CODES

^B8	EAN-8
^B9	UPC-E
^BE	EAN-13
^BS	UPC/EAN extensions
^BU	UPC-A

ALPHANUMERIC BAR CODES

^B3	Code 39
^BA	Code 93
^BC	Code 128
^BL	LOGMARS

TWO-DIMENSIONAL BAR CODES

^B4	Code 49
^B7	PDF417
^BB	CODABLOCK
^BD	UPS MaxiCode
^BF	Micro-PDF417
^BQ	QR Code
^BX	Data Matrix

Further ZPL II Basic Concepts

An understanding of the following concepts and terms related to ZPL II will be helpful in rounding out your knowledge of ZPL II Basics.

Introduction to Device Names

Device Names have been assigned to the various storage areas for ZPL II objects (graphic images, label formats, downloaded fonts, etc.) Device Names are used to identify the DRAM, RAM, EPROM, etc. This allows for Storage, Recall, Copy, and Deletion of ZPL II Objects to/from specific areas.

Each of these areas has been assigned a device name as a way of identification. The Device Name is a single letter followed by a colon. The defined devices are:

- R: Printer DRAM library (read/write)
- B: Optional memory (a card or factory installed)
- E: Extra added EPROM stored objects (read only)
- Z: Internal ZPL II stored object library (read only)

Several ZPL II instructions use these Device Names. The Device Name is an optional parameter with most ZPL II instructions. Its default is defined with the individual ZPL II instruction.

The default for the creation and deletion of objects is printer DRAM. For recalling of objects, the following search priority is used: DRAM, RAM, extra EPROM, internal ZPL II (R:, B:, E:, Z:, * or ? (All)).

For more information on Device Names and default memory IDs, please refer to Chapter 5, Advanced Techniques; Memory, Flash Cards, Font Cards on page 88.

Introduction to ZPL II Object Names and Extensions

Each ZPL II Object (graphic images, label format, etc.) must have a name. This name will consist of two parts: an Object Name and an Extension. Object names can be 1 to 8 alphanumeric characters in length. Extensions consist of a period followed by 3 *predefined* characters. Object name conventions and extensions are similar to MS-DOS file name conventions and extensions.

Several ZPL II instructions use these object names. Object names have no default and must be supplied. Extensions have the defaults defined below. Depending on the ZPL II instruction, if an extension is missing, incomplete or incorrect, a default will be used. Defined extensions for ZPL II Object names, along with their related ZPL II instructions are:

- .ZPL ZPL II label format (**^DF** or **^XF**)
- .FNT fonts in Zebra format (**~DB**, **~DS,** or **^XA**)
- .GRF Zebra bitmap format (**~DG**, **^IS, ^IL, ^XG** or **^IM)**

Depending on the ZPL II instruction, the Object name and Extension may support the use of the asterisk (*) and question mark (?) as wild cards.

Using Device and Object Names with ZPL II Instructions

The Device Names and Object Names just described can be used with ZPL II instructions which support a name parameter. The instructions are:

- **~DG** Download Graphic Image
- **^XG** Recall Graphic Image
- **^IS** Store format as a graphic image
- **^IL** Load Image
- **^IM** Move Image
- **^DF** Store ZPL II format as text
- **^XF** Recall ZPL II format
- **^ID** Image Delete
- **^HW** Host Directory List
- **^WD** Print Directory
- **~DB** Download Bitmap
- **~DS** Download Scalable Font

The name parameter can consist of either an alphanumeric string of from 1 to 8 characters, or a string containing a Device Name followed by an Object Name with an Extension.

Defaults and/or use of the asterisk (*) and question mark (?) as wild cards will be defined with the individual instruction.

CHAPTER 3 ZPL II Printer Configuration

In most cases, the printer can be configured from either the front panel or through various ZPL II instructions. Once a configuration instruction is received by the printer, the change will usually affect the current label format and any future label formats until changed, the printer is reset, or the printer power is turned off. The next label printed will reflect the new instruction.

This section discusses how to use the ZPL II printer configuration instructions. The following is a list of these instructions.

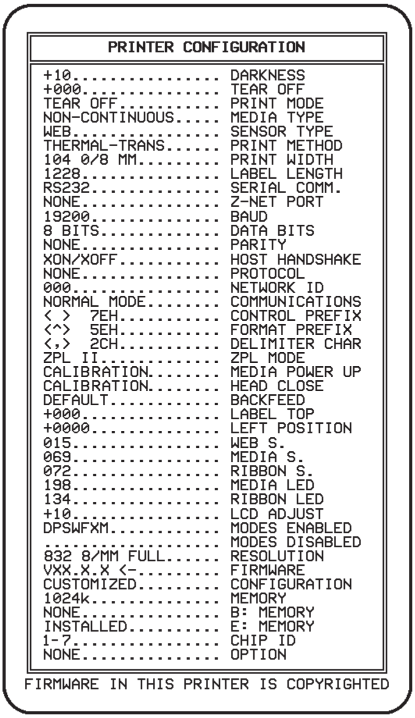
- **^MM** (Print Mode) - Sets the printer to one of its four basic printing modes; Tear-Off, Rewind, Peel-Off and Cutter.
- **^MN** (Media Tracking) - Sets the printer for either Non-Continuous or Continuous media.
- **^MT** (Media Type) - Sets the printer for either Direct Thermal media or Thermal Transfer media.
- **^MD** (Media Darkness) - Adjust how dark the printing will be by adjusting the “burn temperature” of the printhead.
- **^LT** (Label Top) - Shifts printing up to 64 (or ±120 dot rows based on firmware version) dot rows up or down from the current Label Home position.
- **^SS** (Set Media Sensors) - Allows the user to override all of the internal values established after running a media profile.
- **^MP** (Disable Mode Protection) - Used to disable the front panel Darkness, Position and Calibrate modes.
- **^JZ** (Reprint After Error) - Reprints a label if it was partially or incorrectly printed due to an error condition.

- **^JU** (Configuration Update) - Allows the user to save the current settings.
- **^SZ** (Set ZPL) - Allows the user to select either the ZPL or ZPL II Programming Language.

Printer configuration instructions must have a parameter in order to be valid. Instructions with a missing or invalid parameter will be ignored. For more information regarding these commands and their particular parameters, please consult the Command Reference section of this *ZPL II Programming Guide.*

To determine how your printer is currently configured, you can print out a Printer Configuration Label. Consult your printer user's guide for instructions on how to print the label. The label provides valuable information about your printer's configuration, memory, options, etc. A sample of the Printer Configuration Label is shown below.

Once a printer configuration instruction has been issued, it will stay in effect until the printer is powered down, the printer is reset, or it is changed by reissuing the instruction with a different set of parameters.



```
            PRINTER CONFIGURATION

+10................ DARKNESS
+000............... TEAR OFF
TEAR OFF........... PRINT MODE
NON-CONTINUOUS..... MEDIA TYPE
WEB................ SENSOR TYPE
THERMAL-TRANS...... PRINT METHOD
104 0/8 MM......... PRINT WIDTH
1228............... LABEL LENGTH
RS232.............. SERIAL COMM.
NONE............... Z-NET PORT
19200.............. BAUD
8 BITS............. DATA BITS
NONE............... PARITY
XON/XOFF........... HOST HANDSHAKE
NONE............... PROTOCOL
000................ NETWORK ID
NORMAL MODE........ COMMUNICATIONS
< >  7EH........... CONTROL PREFIX
<^>  5EH........... FORMAT PREFIX
<,>  2CH........... DELIMITER CHAR
ZPL II............. ZPL MODE
CALIBRATION........ MEDIA POWER UP
CALIBRATION........ HEAD CLOSE
DEFAULT............ BACKFEED
+000............... LABEL TOP
+0000.............. LEFT POSITION
015................ WEB S.
069................ MEDIA S.
072................ RIBBON S.
198................ MEDIA LED
134................ RIBBON LED
+10................ LCD ADJUST
DPSWFXM............ MODES ENABLED
................... MODES DISABLED
832 8/MM FULL...... RESOLUTION
VXX.X.X <-......... FIRMWARE
CUSTOMIZED......... CONFIGURATION
1024k.............. MEMORY
NONE............... B: MEMORY
INSTALLED.......... E: MEMORY
1-7................ CHIP ID
NONE............... OPTION

FIRMWARE IN THIS PRINTER IS COPYRIGHTED
```

If you want to save the changes you made using the ZPL II commands just described or through the front panel, there are two ways to do it.

1. Refer to your User's Guide for specific instructions on how to set up your front panel to manually save the instructions.

2. Use the **^JUa** instruction. *(See note on page 9.)*

Print Mode

The **^MM** (Print Mode) instruction determines the action the printer takes after a label or group of labels has been printed. There are four different modes of operation.

1. **Tear Off -** After printing, the label is advanced so that the web is over the tear bar. Label, with backing attached, can then be torn off manually.

2. **Rewind -** Label and backing are rewound on an *(optional) internal* rewind device. The next label is positioned under the printhead (no backfeed motion).

3. **Peel Off -** After printing, the label is partially separated from the backing. Printing stops until the label is completely removed. Backing is rewound using an internal *backing only* rewind spindle. (**NOTE**: Select only if printer is equipped with internal rewind spindle.)

4. **Cutter -** The web separating the printed label and the next blank label to be printed is extended into the cutter mechanism. The label is cut. The blank label is then pulled back into the printer so it can be printed.

Media Tracking

The **^MN** (Media Tracking) instruction tells the printer what type of media is being used (continuous or non-continuous) for purposes of tracking. There are two choices for this instruction:

1. **Continuous Media -** This media has no physical characteristic (i.e. a web, notch, perforation, etc.) to separate labels. Label Length is determined by the **^LL** instruction (described on page 278).

2. **Non-Continuous Media -** This media has some type of physical characteristic (i.e. a web, notch, hole, etc.) that can be detected by the printer to separate the labels.

Media Type

The **^MT** (Media Type) instruction selects the type of media being used in the printer. There are two choices for this instruction:

1. **Thermal Transfer Media -** This media uses a high carbon black or colored ribbon. The ink on the ribbon is bonded to the media.

2. **Direct Thermal Media -** The media is heat sensitive and requires no ribbon.

Media Darkness

The **^MD** (Media Darkness) instruction adjusts the darkness relative to the current darkness setting. The minimum value is -30 and the maximum value is 30.

Examples for Using the ^MD Instruction

If the current value (value on configuration label) is 16, entering the instruction **^MD-9** would decrease the value to 7.

If the current value (value on configuration label) is 1, entering the instruction **^MD15** would increase the value to 16.

If the current value (value on configuration label) is 25, entering the instruction **^MD10** would only increase the value to 30 since that is the maximum value allowed.

NOTE: Each ^MD instruction is treated separately with respect to the current value (value on configuration label).

For example, this is what would happen if two **^MD** instructions were received:

Assume the current value is 15. An **^MD-6** instruction is received that changes the current value to 9. Another instruction, **^MD2**, is received. The current value is changed 17. The two **^MD** instructions were treated individually with respect to the current value of 15.

Label Top Position

The **^LT** (Label Top) instruction moves the entire label format a maximum of 64 dot rows up or down from its current position with respect to the top edge of the label (newer firmware versions allow dot rows to adjust +120 to -120; see the **^LT** command on page 284). A negative value moves the format towards the top of the label; a positive number moves the format away from the top of the label.

This instruction can be used to fine-tune the position of the finished label without having to change any of the existing parameters.

NOTE: This instruction does not change the Media Rest position.

Set Media Sensors

The **^SS** (Set Media Sensors) instruction is used to change the sensor values for media, web, ribbon and label length that were set during the "media calibration" process. (consult the "Media Calibration" process as described in your printer user's guide.)

Mode Protection

The **^MP** (Mode Protection) instruction is used to disable the various Mode functions on the front panel. Once disabled, the settings for the particular mode function can no longer be changed and the LED associated with the function will not light.

Since this instruction has only one parameter, each mode will have to be disabled with an individual **^MP** instruction.

Reprint After Error

The **^JZ** (Reprint After Error) instruction is used to reprint a partially printed label caused by a Ribbon Out, Media Out or Head Open error condition. The label will be reprinted as soon as the error condition is corrected.

This instruction will remain active until another **^JZ** instruction is sent to the printer or the printer is turned off.

The **^JZ** instruction sets the error mode for the printer. (If **^JZ** is changed, only labels after the change will be affected.)

Configuration Update

The **^JU** (Configuration Update) instruction sets the active configuration for the printer.

There are three choices for this instruction. They are defined as follows:

S = Save Current Settings
The current configuration will be saved. This is the configuration that will be used at Power-On.

F = Reload Factory Values (Default)
The factory values (default values) will be loaded.
(These values will be lost at Power Off if they are not saved with the **^JUS** instruction.)

R = Recall Last Saved Values
The last values saved using this (**^JU**) instruction or the Mode Sequencing from the front panel will be loaded.

Set ZPL

The **^SZ** (Set ZPL) instruction is used to select the programming language used by the printer. This instruction gives you the ability to print labels formatted in both ZPL or ZPL II.

This instruction will remain active until another **^SZ** instruction is sent to the printer or the printer is turned off.

Setting Up Customized Configuration Formats

You can save a great deal of time by setting up your own configuration formats. If most of your printing is done on one or two types of media, you can easily create label formats specifically for those media.

If you need to print a special label, you change the various instructions and then you only need to change the media and load the new, specific configuration format.

Depending on your needs and specific application, the following is a list of the instructions you might want to put into a configuration format.

^XB	Suppress Backfeed
^PR	Print Rate
^LL	Label Length
^LT	Label Top
^MM	Print Mode
^MT	Media Type
^JZ	Reprint After Error
^SS	Set Media Sensors
^MD	Media Darkness
^MN	Media Tracking
^JU	Configuration Update
^SZ	Set ZPL

NOTE:You can have as many of these format configurations as you need. Just give them all a different name and send them to the printer when they are needed.

CHAPTER 4 ZPL II Programming Exercises

Introduction

These programming exercises are included to assist and instruct both the new and more experienced user in the use of various ZPL II instructions. If you're a new user, you may find it helpful to complete all of the exercises. The exercises are simple by design so they can be completed quickly. More experienced users may want to refer only to exercises detailing the use of specific instructions or features. Most exercises are "stand-alone" and can be completed individually. *However, some exercises assume that you've completed a previous exercise (such as exercises which delete or erase a previously saved format or graphic image).*

Be sure you know how to load supplies and set up the printer before you begin these exercises. If you haven't yet learned how to set up and load supplies into your printer, refer to your user's guide.

You should ensure that labels of sufficient size (*at least 80mm wide and at least 60mm long for printers with 8 dot/mm print heads*) and (*at least 80mm wide and at least 90mm long for printers with 6 dot/mm print heads*) have been loaded before starting these exercises. You can use media of different sizes for these exercises, however you may need to modify Field Origins (**^FO**) and other parameters affecting size or location of printed data.

You can also use continuous media for these exercises. If you do, you must set label length using the **^LL** instruction.

These examples are designed for a Zebra printer controlled by "stand-alone" (i.e. not part of a network) IBM®-compatible personal computers. The ZPL II Language uses only printable ASCII characters. Although a Zebra printer may be controlled by mainframes or minicomputers, we've chosen the personal computer as a programming source because of its relative familiarity among users.

Any word processor or text editor capable of creating ASCII-only files (files without formatting codes and other extraneous information) can be used to create the scripts in these examples. For instance, if you are using Microsoft Word®, you would open a Text (.txt) file.

Almost all of the examples are made up of a series of lines. When you finish typing a line, press the RETURN or ENTER key. Then type in the next line. Continue this process for all of the lines in the example.

NOTE: If the script is in two or more portions, then send the first portion to the printer and wait to see the result. You can then send the next potion and any additional scripts, waiting between each to see the results. Depending on the exercise, the result may be data uploading to the printer indicated by a flashing (DATA) LED (if available on your printer) or a sample label will be printed.

NOTE: The actual size of your printed examples may be different than those shown in the manual. The important thing is that the information displayed is the same.

NOTE: Factory Default printer settings were used for the examples in this guide and the printer is set up for tear off operation.

★★IMPORTANT★★

The ZPL II commands listed in this Programming Guide are available depending on which version of firmware is installed in your printer and which printer you are using. Please consult the Command Quick Reference Chart in Appendix A to see which commands are available for your version of firmware and printer.

To determine which version of firmware resides in your printer, you will need to print out a Printer Configuration Label. Consult your printer user's guide for instructions on how to print the label. The label provides valuable information about your printer's configuration, memory, options, etc. A sample of the Printer Configuration Label is shown in Chapter 1 on page 3 with an arrow pointing to the firmware information

►Exercise # 1 - Saving Label Formats as Graphic Images

This exercise illustrates how to save a label format as a graphic image in printer RAM and then recall (load) a label format for printing that has been previously saved. The exercise consists of two scripts. The first contains a label format and the instructions necessary to save the format as a graphic image. The second recalls and prints the label format that was saved as the graphic image.

While this exercise utilizes the **^IL** instruction to load a graphic image, the **^IM** instruction may also be used. These two instructions differ in that images loaded using the **^IL** instruction are always positioned relative to the **^FO**0,0 (Field Origin) command. The **^IM** command places the image anywhere on the label as specified by an **^FO** command preceding it.

The ZPL II instructions sent to the printer are:

```
^ XA
^ LH30,30
^ FO20,10 ^ AFN,56,30 ^ FR ^ FDZEBRA ^ FS
^ FO20,80 ^ B3N,Y,20,N,N ^ FDAAA001 ^ FS
^ FO10,160 ^ GB150,100,4 ^ FS
^ ISR:EXERPROG.GRF,N
^ XZ


^ XA ^ ILR:EXERPROG.GRF,N ^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets ([ ]).

^ XA

[^XA - Indicates start of label format.]

^ LH30,30

[^LH - Sets label home position 30 dots to right and 30 dots down from top edge of label.]

^FO20,10 ^ AFN,56,30 ^ FDZEBRA ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font "F" and sets character size to 56 dots high and 30 dots wide]
[^FD - Start of field data.]
[ZEBRA- Actual field data.]
[^FS - End of field data.]

^ FO20,80, ^ B3N,Y,20,N,N ^ FDAAA001 ^ FS

[^FO - Set field origin relative to label home.]
[^B3N,Y,20,N,N - Select Code 39 bar code. Calculate check digit, do not print interpretation line.]
[^FD - Start of field data for bar code.]
[AAA001 - Actual field data.]
[^FS - End of field data.]

^ ISR:EXERPROG.GRF,N

[^IS - Save format as a graphic image named "EXERPROG.GRF," do not print after saving.]

^ XZ

[^XZ - Indicates end of label format.]

(Data is uploaded to printer RAM.)

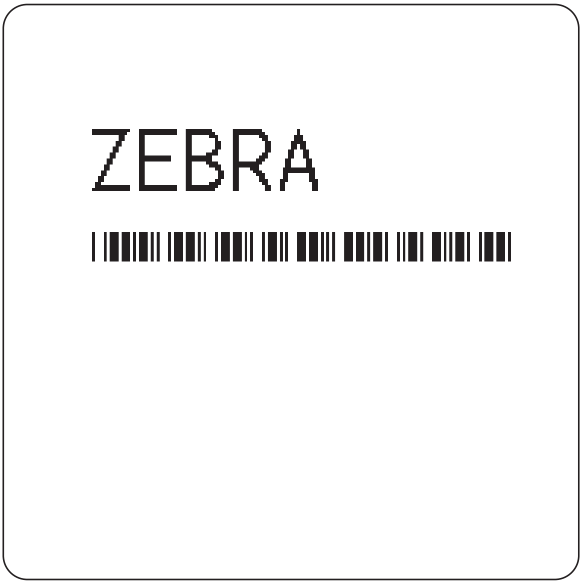
---

^ XA ^ ILR:EXERPROG.GRF,N ^ XZ

[^XA - Start of label format.]
[^ILR:EXERPROG.GRF,N - Load and print the graphic image saved as "EXERPROG.GRF"]
[^XZ - End of label format.]

Review

Save this file on your computer's harddrive, name it "EXER1.ZPL." Copy the file to the printer. Compare your results with those shown below.



If your label does not look like the one shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

▶Exercise # 2 - Downloading and Printing Graphic Images

This exercise illustrates how to create a hexadecimal graphic image and print it as part of your label.

In order to store graphic images, sufficient memory must be allocated (reserved) for them. Memory for storing graphic images is allocated "on the fly" as needed. The graphic images can then be recalled and integrated with additional label data without downloading the entire image each time a label is printed. Graphic Images are downloaded using the **~DG** (Download Graphic) instruction along with appropriate parameters to indicate the size of the graphic being downloaded.

Graphic images may be created using a drawing or painting program which creates files in the .PCX format, such as PC Paintbrush. These files must then be converted to ZPL II graphic format .GRF (pure hexadecimal data without headers or other extraneous information) for use as part of a label format. You can use the ***ZTools™ for Windows*** program (available from Zebra) to convert the .PCX graphic format into the pure hexadecimal .GRF graphic format. Hexadecimal data may also be directly input as part of a ZPL II program.

The **~DG** instruction requires parameters indicating the size of the graphic image. The format for this instruction is:

~DGd,o,x,t,w,DATA

where

~DG = **Set Printer to Download Graphic Mode**

d = **Destination Device to Store Image**

o = **Name of Image, 1-8 Alphanumeric Characters**

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .GRF}

t = **Total Number of Bytes in Graphic**

w = **Number of Bytes Per Row**

DATA = **ASCII Hexadecimal String that Defines Image**

Refer to the **~DG** command in the Command Reference section for detailed instructions on calculating the total number of bytes and the number of bytes per row.

For this exercise, please create a "smile" graphic in a drawing or paint program like the one shown below so that the graphic is 1.5 inches x 1.5 inches at 200 dpi.

Save the graphic in .PCX format and name it: SMILE.PCX. Convert this file to the .GRF format using ***ZTools™ for Windows.***

The ZPL II instructions you will use in this exercise are:

Format Bracket instructions	**^XA, ^XZ**
Label Field Definition Instructions	**^FO**, **^FS**
Recall Graphic Instruction	**^XG**

The ZPL II instructions sent to the printer are:

```
~DGR:SMILE.GRF,12012,39
```

(depending on the image size and how you created the graphic, there will be many lines of ASCII HEX data that follow the ***~DG*** *instruction line which is a HEX description of your image)*

```
^ XA
^ FO50,50 ^ XGR:SMILE.GRF,1,1 ^ FS
^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets ([ ]).

~DGR:SMILE.GRF,12012,39

[^DG - Download graphic named "SMILE," which has 12012 total bytes with 39 bytes per row]

(depending on the image size and how you created the graphic, there will be many lines of ASCII HEX data that follow the ***~DG*** *instruction line which is a HEX description of your image)*

---

^ XA

[^XA - Indicates start of label format.]

^FO50,50 ^ XGR:SMILE.GRF,1,1 ^ FS

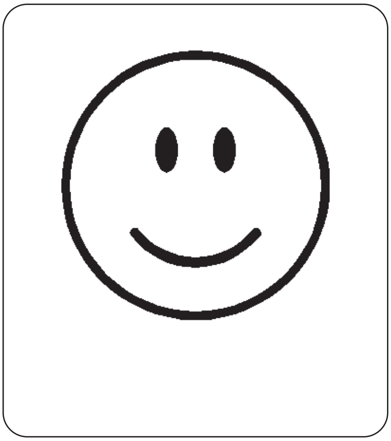
[^FO - Set field origin relative to label home.]
[^XG - Recall graphic named "SMILE" from memory with a magnification of 1:1 along X and Y axis.]
[^FS - End of field data.]

^ XZ

[^XZ - Indicates end of label format.]

Review

Save this file on your computer's harddrive, name it "EXER2.ZPL" Copy the file to the printer. Compare your results with those shown below.



If your label does not look like the one shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

►Exercise # 3 - Printing Quantities of Labels, Printing Entire Label in Inverted Orientation, Setting the Print Rate and Suppressing Backfeed

This exercise illustrates how to set the print speed, print a predetermined quantity of labels, suppress backfeed for tear-off and print entire labels in an inverted orientation.

The ZPL II instructions sent to the printer are:

```
^ XA ^ PRB ^ XZ


^ XA
^ LH360,30
^ FO20,10 ^ AF ^ FDZEBRA ^ FS
^ FO20,60 ^ B3 ^ FDAAA001 ^ FS
^ POI
^ PQ2
^ XB
^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets.

^ XA ^ PRB ^ XZ

[^XA - Indicates start of label format.]
[^PRB - Set print rate to speed "B." (3 inches/second)]
[^XZ - End of ZPL program.]

---

^ XA

[^XA - Indicates start of label format.]

^ LH360,30

[^LH - Sets label home position 360 dots to right and 30 dots down from top edge of label.]

^ FO20,10 ^ AF ^ FDZEBRA ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font "F"
[^FD - Start of field data.]
[ZEBRA- Actual field data.]
[^FS - End of field data.]

^ FO20,20, ^ B3 ^ FDAAA001 ^ FS

[^FO - Set field origin relative to label home.]
[^B3 - Select Code 39 bar code.]
[^FD - Start of field data for bar code.]
[AAA001 - Actual field data.]
[^FS - End of field data.]

^ POI

[^POI - Set print orientation to Invert the entire label.]

^ PQ2

[^PQ2 - Set print quantity to print 2 labels.]

^ XB

[^XB - Suppress Backfeed for tear-off modes.]

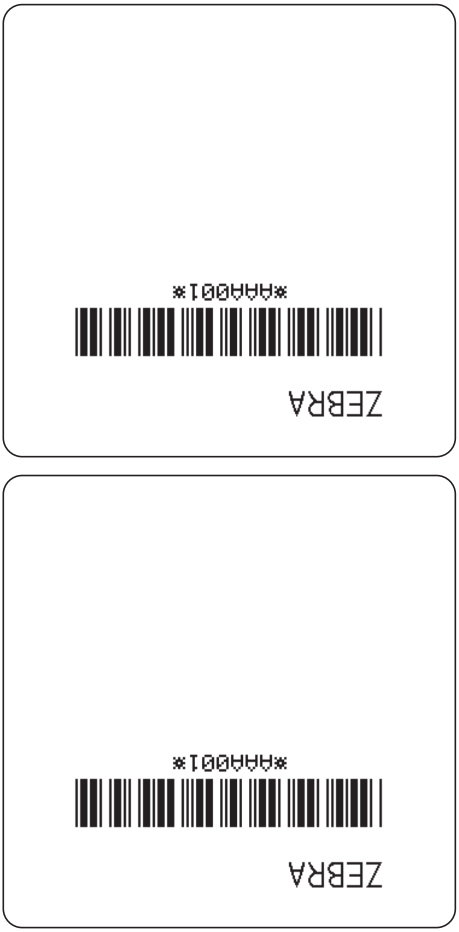
Instructions continued on next page.

^ XZ

[^XZ - Indicates end of label format.]

Review

Save this fileon your harddrive, name it “EXER3.ZPL” Copy the file to the printer. Compare your results with those shown below.



If your labels do not look like the ones shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

►Exercise #4 - Slew Instruction, Form Feed Instruction and Printing Entire Formats in Reverse

This exercise illustrates the slew and form feed (slew to home) instructions and the instructions required for printing the entire label in reverse.

The ZPL II instructions sent to the printer are:

```
^ XA
^ PR2
^ LRY
^ LH30,30
^ FO0,0 ^ GB400,300,300 ^ FS
^ FO20,10 ^ AF ^ FDZEBRA ^ FS
^ FO20,60 ^ B3,,40 ^ FDAAA001 ^ FS
^ PF50
^ FO20,160 ^ AF ^ FDSLEW EXAMPLE ^ FS
^ XZ
```

```
^ XA ^ PH ^ XZ
```

```
^ XA
^ PR2,6
^ FO20,10 ^ AF ^ FDZEBRA ^ FS
^ FO20,60 ^ B3,,40 ^ FDAAA001 ^ FS
^ PF250
^ FO20,160 ^ AF ^ FDSLEW EXAMPLE ^ FS
^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets.

^ XA

[^XA - Indicates start of label format.]

^ PR2

[^PR2 - Set print rate to speed of 2 inches/second]

^ LRY

[^LRY - Reverse print entire label.]

^ LH30,30

[^LH - Sets label home position 30 dots to right and 30 dots down from top edge of label.]

^ FO0,0 ^ GB400,300,300 ^ FS

[^FO - Set field origin relative to label home.]
[^GB - Create a filled graphic box to be used as background for reverse printed label. (May need to adjust parameters for different media size.]

^ FO20,10 ^ AF ^ FDZEBRA ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font "F."]
[^FD - Start of field data.]
[ZEBRA- Actual field data.]
[^FS - End of field data.]

^ FO20,60 ^ B3,,40 ^ FDAAA001 ^ FS

[^FO - Set field origin relative to label home.]
[^B3 - Select Code 39 bar code.]
[^FD - Start of field data for bar code.]
[AAA001 - Actual field data.]
[^FS - End of field data.]

^ PF50

[Slew 50 dot rows at bottom of label.]

^ FO20,160 ^ AF ^ FDSLEW EXAMPLE ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font "F."]
[^FD - Start of field data.]
[SLEW EXAMPLE - Actual field data.]
[^FS - End of field data.]

^ XZ

[^XZ - Indicates end of format.]

---

^ XA ^ PH ^ XZ

[Instructions to feed to next home position.]

---

^ XA

[^XA - Indicates start of format.]

^ PR2,6

[^PR2 - Set print rate to speed of 2 inches/second, set slew rate to speed of 6 inches/second]

^ FO20,10 ^ AF ^ FDZEBRA ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font "F."]
[^FD - Start of field data.]
[ZEBRA- Actual field data.]
[^FS - End of field data.]

^ FO20,60 ^ B3,,40 ^ FDAAA001 ^ FS

[^FO - Set field origin relative to label home.]
[^B3 - Select Code 39 bar code.]
[^FD - Start of field data for bar code.]
[AAA001 - Actual field data.]
[^FS - End of field data.]

^ PF250

[^PF250 - Slew 250 dot rows.]

Instructions continued on next page.

^ FO20,160 ^ AF ^ FDSLEW EXAMPLE ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font “F.”]

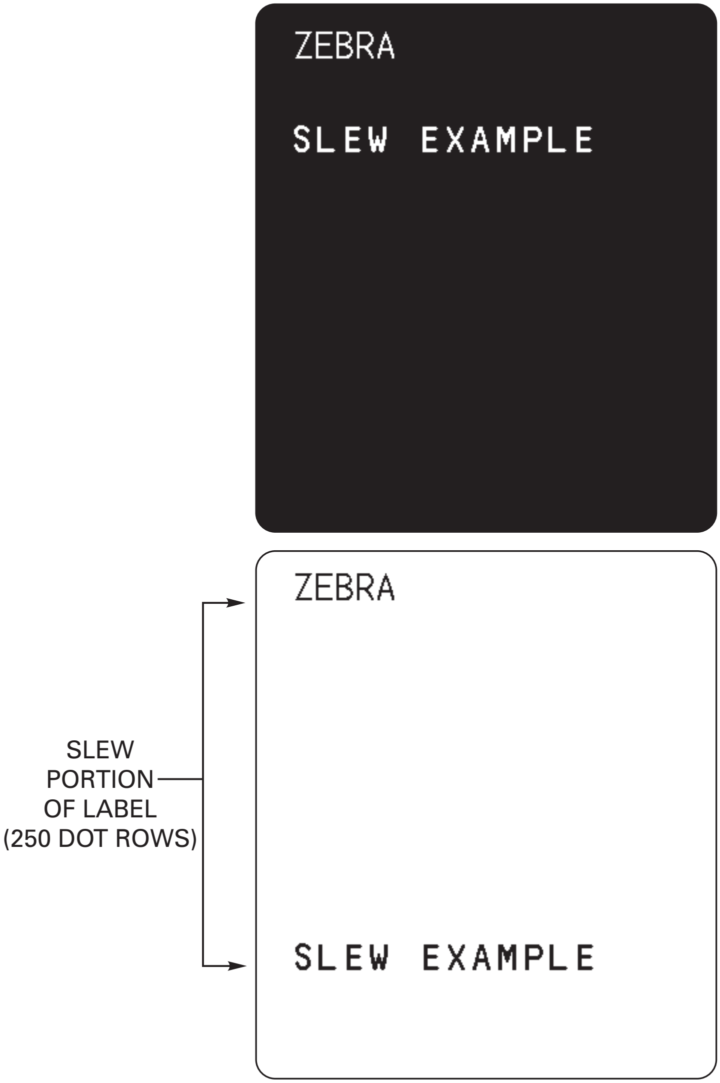
[^FD - Start of field data.]
[SLEW EXAMPLE - Actual field data.]
[^FS - End of field data.]

^ XZ

[^XZ - Indicates end of format.]

Review

Save this file on your harddrive, name it "EXER4.ZPL" Copy the file to the printer. Compare your results with those shown below.



If your labels do not look like the ones shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

►Exercise # 5 - Using Serialized Fields

This exercise discusses the instructions and parameters required to produce serialized fields as part of a label format.

The ZPL II instructions sent to the printer are:

```
^ XA
^ LH30,30
^ FO20,10 ^ AF ^ FDZEBRA ^ FS
^ FO20,60 ^ B3,,40,, ^ FDAA001 ^ FS
^ FO20,180 ^ AF ^ SNSERIAL NUMBER 00000000111,1,Y ^ FS
^ PQ10
^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets.

^ XA

[^XA - Indicates start of label format.]

^ LH30,30

[^LH - Sets label home position 30 dots to right and 30 dots down from top edge of label.]

^ FO20,10 ^ AF ^ FDZEBRA ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font "F."]
[^FD - Start of field data.]
[ZEBRA- Actual field data.]
[^FS - End of field data.]

^FO20,60 ^ B3,,40,, ^ FDAA001 ^ FS

[^FO - Set field origin relative to label home.]
[^B3 - Select Code 39 bar code.]
[^FD - Start of field data for bar code.]
[AA001 - Actual field data.]
[^FS - End of field data.]

^ FO20,180 ^ AF ^ SNSERIAL NUMBER 00000000111,1,Y ^ FS

[^FO - Set field origin relative to label home.]
[^AF^SNSERIAL NUMBER 00000000111,1,Y- Define serialized field, starting value of 111, increment by 1, insert leading zeros.]
[^FS - End of field data.]

^PQ10

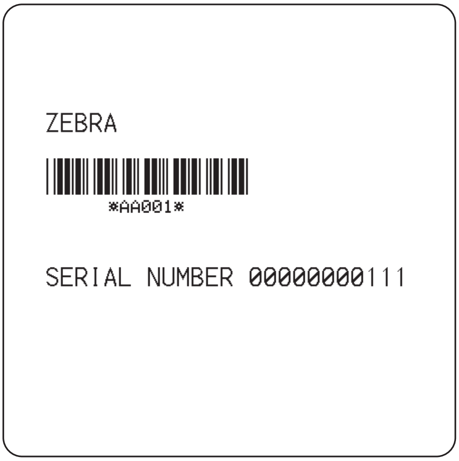
[^PQ10 - Set print quantity to 10.]

^ XZ

[^XZ- Indicates end of format.]

Review

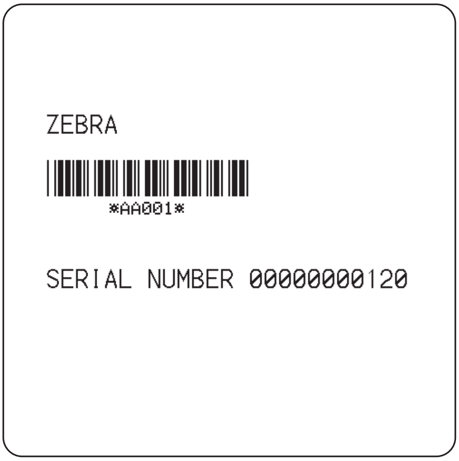
Save this file to your computer's harddrive, name it "EXER5.ZPL" Copy the file to the printer. Compare your results with those shown below.



ZEBRA

AA001

SERIAL NUMBER 00000000111



ZEBRA

AA001

SERIAL NUMBER 00000000120

A total of 10 labels should be printed. The first and last labels are shown here. If your labels do not look like the ones shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

►Exercise #6 - Stored Formats

This exercise illustrates the instructions and parameters required to use stored formats.

The ZPL II instructions sent to the printer are:

```
^ XA
^ DFFORMAT ^ FS
^ LH30,30
^ FO20,10 ^ AF ^ FN1 ^ FS
^ FO20,60 ^ B3,,40,, ^ FN2 ^ FS
^ XZ
```

```
^ XA
^ XFFORMAT
^ FN1 ^ FDZEBRA ^ FS
^ FN2 ^ FDAAA001 ^ FS
^ XZ
```

```
^ XA
^ XFFORMAT
^ FN1 ^ FDBEARS ^ FS
^ FN2 ^ FDZZZ999 ^ FS
^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets.

^ XA

[^XA - Indicates start of label format.]

^ DFFORMAT ^ FS

[^DF - Download and store format.]
[FORMAT - Name of format.]
[^FS - End of field data.]

^ LH30,30

[^LH - Sets label home position 30 dots to right and 30
dots down from top edge of label.]

^ FO20,10 ^ AF ^ FN1 ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font "F."]
[^FN1 - Assign field number 1.]
[^FS - End of field data.]

^ FO20,60 ^ B3,,40,, ^ FN2 ^ FS

[^FO - Set field origin relative to label home.]
[^B3 - Select Code 39 bar code.]
[^FN2 - Assign field number 2.]
[^FS - End of field data.]

^ XZ

[^XZ- Indicates end of format.]

---

^ XA

[^XA - Indicates start of label format.]

^ XFFORMAT ^ FS

[^XF - Recall stored format.]
[FORMAT - Name of format to be recalled.]
[^FS - End of field data.]

Instructions continued on next page.

^ FN1 ^ FDZEBRA ^ FS

[^FN1 - Indicate following data should be inserted in area allocated for field number 1.]

[^FD - Indicate start of field data.]

[ZEBRA - Field data.]

[^FS - End of field data.]

^ FN2 ^ FDAAA001 ^ FS

[^FN2 - Indicate following data should be inserted in area allocated for field number 2.]

[^FD - Indicates start of field data.]

[AAA001 - Field data.]

[^FS - End of field data.]

^ XZ

[^XZ- Indicates end of format.]

---

^ XA

[^XA - Indicates start of label format.]

^ XFFORMAT ^ FS

[^XF - Recall stored format.]

[FORMAT - Name of format to be recalled.]

[^FS - End of field data.]

^ FN1 ^ FDBEARS ^ FS

[^FN1 - Indicates following data should be inserted in area allocated for field number 1.]

[^FD - Indicates start of field data.]

[BEARS - Field data.]

[^FS - End of field data.]

^ FN2 ^ FDZZZ999 ^ FS

[^FN2 - Indicates following data should be inserted in area allocated for field number 2.]

[^FD - Indicates start of field data.]

[ZZZ999 - Field data.]

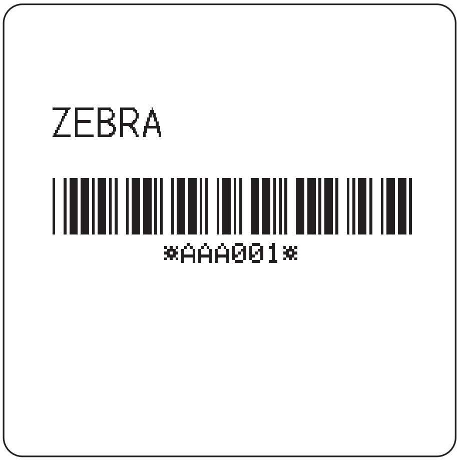
[^FS - End of field data.]

^XZ

[^XZ- Indicates end of format.]

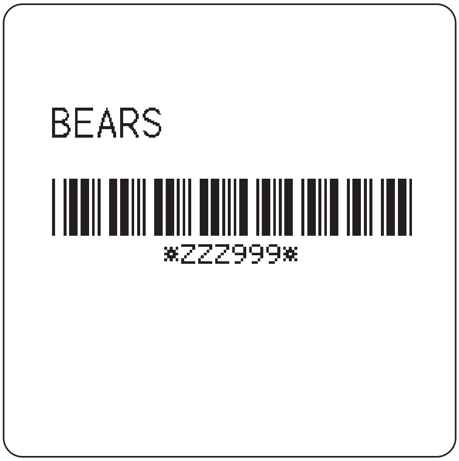
Review

Save this file to your computer's harddrive, name it "EXER6.ZPL" Copy the file to the printer. Compare your results with those shown below.



ZEBRA

AAA001



BEARS

ZZZ999

If your labels do not look like the ones shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

►Exercise #7 - Erasing Stored Formats

This exercise illustrates the instructions required to erase any stored formats saved in the printer memory.

The ZPL II instructions sent to the printer are:

```
^ XA
^ EF ^ FS
^ XZ


^ XA
^ XFFORMAT
^ FN1 ^ FDBEARS ^ FS
^ FN2 ^ FDZZZ999 ^ FS
^ FO30,30 ^ CFF ^ FDNO FORMAT TO RECALL ^ FS
^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets.

^ XA

[^XA - Indicates start of label format.]

^ EF ^ FS

[^EF - Erase all previously stored formats.]
[^FS - End of field data.]

^ XZ

[^XZ- Indicates end of format.]

---

^ XFFORMAT ^ FS

[^XF - Recall stored format.]
[FORMAT - Name of format to be recalled.]
[^FS - End of field data.]

^ FN1 ^ FDBEARS ^ FS

[^FN1 - Indicates following data should be inserted in area allocated for field number 1.]
[^FD - Indicates start of field data.]
[BEARS - Field data.]
[^FS - End of field data.]

^ FN2 ^ FDZZZ999 ^ FS

[^FN2 - Indicates following data should be inserted in area allocated for field number 2.]
[^FD - Indicates start of field data.]
[ZZZ999 - Field data.]
[^FS - End of field data.]

^ FO30,30 ^ CFF ^ FDNO FORMAT TO RECALL ^ FS

[^FO30,30 - Set field origin relative to label home.]
[^CFF - Change to font “F”.]
[^FD - Indicates start of field data.]

Instructions continued on next page.

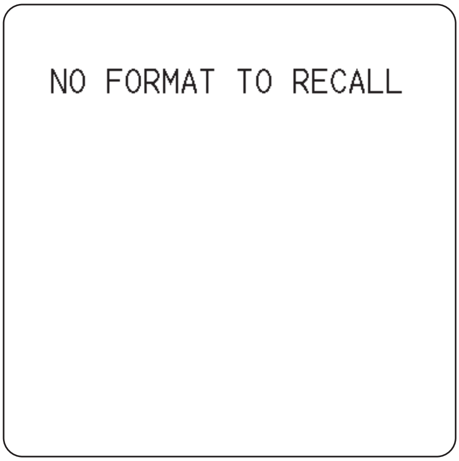
[NO FORMAT TO RECALL - Field data.]
[^FS - End of field data.]

```
^XZ
```

[^XZ- Indicates end of format.]

Review

Save this file to your computer's harddrive, name it "EXER7.ZPL" Copy the file to the printer. Compare your results with those shown below.



NO FORMAT TO RECALL

If your label does not look like the one shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

▶Exercise #8 - Using Variable Data Fields

This exercise illustrates the instructions and parameters required to produce serialized fields as part of a label format.

The ZPL II instructions sent to the printer are:

```
^ XA ^ MCY ^ XZ


^ XA
^ LH30,30
^ FO20,10 ^ AF ^ FVZEBRA ^ FS
^ FO20,60 ^ B3N,,100 ^ FDAAA001 ^ FS
^ MCN
^ XZ


^ XA
^ FO20,10 ^ AF ^ FVCUBS ^ FS
^ XZ


^ XA
^ FO20,10 ^ AF ^ FVBULLS ^ FS
^ XZ


^ XA
^ FO20,10 ^ AF ^ FVBEARS ^ FS
^ XZ


^ XA ^ MCY ^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets.

^ XA ^ MCY ^ XZ

[^XA - Indicates start of label format.]
[^MCY - Map Clear]
[^XZ - End of format.]

---

^ XA

[^XA - Indicates start of label format.]

^ LH30,30

[^LH - Sets label home position 30 dots to right and 30 dots down from top edge of label.]

^ FO20,10 ^ AF ^ FVZEBRA ^ FS

[^FO - Set field origin relative to label home.]
[^AF - Select font "F."]
[^FV - Indicates start of VARIABLE field data.]
[ZEBRA - Variable data.]
[^FS - End of field data.]

^ FO20,60 ^ B3N,,100 ^ FDAAA001 ^ FS

[^FO - Set field origin relative to label home.]
[^B3 - Select Code 39 bar code.]
[^FD - Start of field data for bar code.]
[AAA001 - Actual field data.]
[^FS - End of field data.]

^MCN

[^MCN - Set Map Clear to N=No.]

^ XZ

[^XZ - End of format.]

```
^ XA
```

[^XA - Indicates start of label format.]

```
^ FO20,10 ^ AF ^ FVCUBS ^ FS
```

[^FO - Set field origin relative to label home.]

[^AF - Select font “F.”]

[^FV - Indicates start of VARIABLE field data.]

[CUBS- Variable data.]

[^FS - End of field data.]

```
^ XZ
```

[^XZ - End of format.]

```
^ XA
```

[^XA - Indicates start of label format.]

```
^ FO20,10 ^ AF ^ FVBULLS ^ FS
```

[^FO - Set field origin relative to label home.]

[^AF - Select font “F.”]

[^FV - Indicates start of VARIABLE field data.]

[BULLS - Variable data.]

[^FS - End of field data.]

```
^ XZ
```

[^XZ - End of format.]

```
^ XA
```

[^XA - Indicates start of label format.]

```
^ FO20,10 ^ AF ^ FVBEARS ^ FS
```

[^FO - Set field origin relative to label home.]

[^AF - Select font “F.”]

[^FV - Indicates start of VARIABLE field data.]

[BEARS - Variable data.]

[^FS - End of field data.]

Instructions continued on next page.

^ XZ

[^XZ - End of format.]

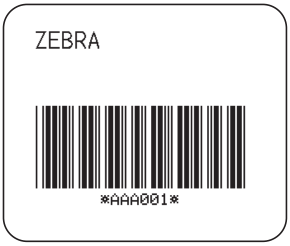
---

^ XA ^ MCY ^ XZ

[^XA - Indicates start of label format.]
[^MCY - Map Clear]
[^XZ - End of format.]

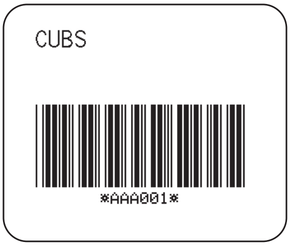
Review

Save this file to your computer's harddrive, name it "EXER8.ZPL" Copy the file to the printer. Compare your results with those shown below.



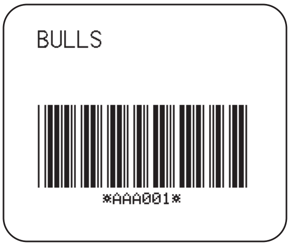
ZEBRA

AAA001



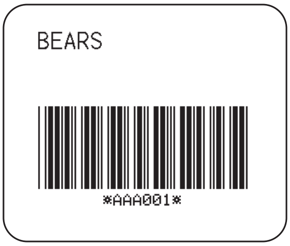
CUBS

AAA001



BULLS

AAA001



BEARS

AAA001

A total of 4 labels should be printed. They are shown here. If your labels do not look like the one shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

►Exercise #9 - Graphic Boxes, Graphic Symbols and Multiple Elements on One Label

This exercise illustrates the instructions and parameters required to produce a label which, when combined with elements from the previous exercises, will incorporate multiple graphic and text elements such as a graphic box, line, graphic symbol, bar code and a hexadecimal bitmapped graphic.

NOTE: For the sake of this label example, all dimensional or directional unit references are represented in DOTS. See the ^MU (Mode Units) command on page 296 for more information on setting units of measurement.

The ZPL II instructions sent to the printer are:

```
^ XA
^ LH0,0
^ LL992
^ FO147,639 ^ BY3,3.0 ^ B3N,,228,N ^ FDSMILE ^ FS
^ FO120,108 ^ A0N,89 ^ FDA Guide to ^ FS
^ FO120,207 ^ A0N,89 ^ FDZPL II ^ FS
^ FO120,306 ^ A0N,89 ^ FDProgramming ^ FS
^ FO120,405 ^ A0N,89 ^ FDLanguage ^ FS
^ FO696,149 ^ A0R,71,66 ^ FR ^ SN123456,1,Y ^ FS
^ FO683,135 ^ FR ^ GB0,216,108 ^ FS
^ FO591,636 ^ XGSMILE.GRF,1,1 ^ FS
^ FO377,216 ^ GSN,55,40 ^ FDA ^ FS
^ FO75,63 ^ GB769,856,10 ^ FS
^ FO113,559 ^ GB703,0,9 ^ FS
^ PQ1
^ PR6
^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets ([ ]).

^ XA

[^XA - Indicates start of label format.]

^ LH0,0

[^LH - Sets label home position at the upper left corner of the label.]

^ LL992

[^LL - Sets label length to 992 dots rows along the Y-axis.]

^ FO147,639 ^ BY3,3.0 ^ B3N,,228,N ^ FDSMILE ^ FS

[^FO - Set field origin relative to label home.]
[^BY - Set Bar Code Field Default values to 3 dots for narrow bar width and wide bar to narrow bar width ratio to 3.0 units.]
[^B3N,,228,N - Select Code 39 bar code. Do not calculate check digit, set bar code height to 228 dots, do not print interpretation line.]
[^FD - Start of field data for bar code.]
[SMILE- Actual field data.]
[^FS - End of field data.]

^ FO120,108 ^ A0N,89 ^ FDA Guide to ^ FS

[^FO - Set field origin relative to label home.]
[^A0 - Select default font "0", normal orientation, character height of 89 dots, standard width.]
[^FD - Start of field data.]
[A Guide to - Actual field data.]
[^FS - End of field data.]

^ FO120,207 ^ A0N,89 ^ FDZPL II ^ FS

[^FO - Set field origin relative to label home.]
[^A0 - Select default font "0", normal orientation, character height of 89 dots, standard width.]
[^FD - Start of field data.]
[ZPL II - Actual field data.]
[^FS - End of field data.]

```
^ FO120,306 ^ A0N,89 ^ FDProgramming ^ FS
```

[^FO - Set field origin relative to label home.]

[^A0 - Select default font “0”, normal orientation, character height of 89 dots, standard width.]

[^FD - Start of field data.]

[Programming - Actual field data.]

[^FS - End of field data.]

```
^ FO120,405 ^ A0N,89 ^ FDLanguage ^ FS
```

[^FO - Set field origin relative to label home.]

[^A0 - Select default font “0”, normal orientation, character height of 89 dots, standard width.]

[^FD - Start of field data.]

[Language - Actual field data.]

[^FS - End of field data.]

```
^ FO696,149 ^ A0R,71,66 ^ FR ^ SN123456,1,Y ^ FS
```

[^FO - Set field origin relative to label home.]

[^A0R - Select default font “0”, rotated 90 degrees clockwise, character height of 71 dots, character width of 66 dots.]

[^FR - Set field to be reverse print as white letters.]

[^SN123456,1,Y- Define serialized field, starting value of 123456, increment by 1, insert leading zeros.]

[^FS - End of field data.]

```
^ FO683,135 ^ FR ^ GB0,216,108 ^ FS
```

[^FO - Set field origin relative to label home.]

[^FR - Set field (box for serial numbers) to be reverse print as black.]

[^GB0,216,108 - Set graphic box to be width of 0, height of 216 dots, 108 dots thick (same as specifying width).]

[^FS - End of field data.]

```
^ FO591,636 ^ XGR:SMILE.GRF,1,1 ^ FS
```

[^FO - Set field origin relative to label home.]

[^XGSMILE.GRF,1,1 - Recall SMILE.GRF graphic from printer memory, magnification factor of 1 on the X-axis and 1 on the Y-axis.]

[^FS - End of field data.]

^ FO377,216 ^ GSN,55,40 ^ FDA ^ FS

[^FO - Set field origin relative to label home.]
[^GSN,55,40 - Set graphic symbol with normal orientation
to be height of 55 dots, width of 40 dots.]
[^FDA - Select field data of registered trademark character.]
[^FS - End of field data.]

^ FO75,63 ^ GB769,856,10 ^ FS

[^FO - Set field origin relative to label home.]
[^GB769,856,10 - Set graphic box (large box around
perimeter of label) to be width of 769 dots,
height of 856 dots and 10 dots thick.]
[^FS - End of field data.]

^ FO113,559 ^ GB703,0,9 ^ FS

[^FO - Set field origin relative to label home.]
[^GB703,0,9 - Set graphic line (horizontal line near middle
of label) to be width of 703 dots,
height of 0 dots and 9 dots thick.]
[^FS - End of field data.]

^ PQ1

[^PQ1 - Set print quantity of 1 label.]

^ PR6

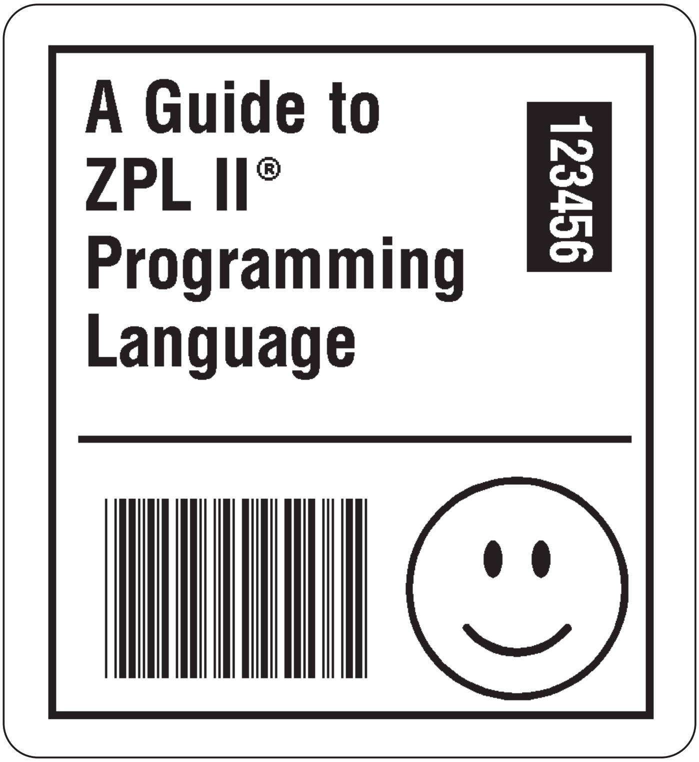
[^PR6 - Set print rate at 6 inches per second.]

^ XZ

[^XZ - Indicates end of label format.]

Review

Save this file on your computer's harddrive, name it "EXER9.ZPL" Copy the file to the printer. Compare your results with those shown below.



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123456

If your label does not look like the one shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

►Exercise # 10 - Deleting Graphic Images

This exercise illustrates how to delete a graphic image previously stored in printer memory. Graphic images may be deleted from printer memory using either the **^ID** instruction which is used to delete a specific graphic image stored in memory or the **^EG** (Erase Download Graphics) instruction which erases ALL graphic images stored in memory.

NOTE: A ~EG instruction sent to the printer will also delete ALL images stored in memory.

This exercise will erase the graphic image named "SMILE.GRF" which was previously stored in Exercise #2 and used in Exercise #9.

The ZPL II instructions sent to the printer are:

```
^ XA
^ IDR:SMILE.GRF
^ XZ


^ XA
^ FO50,50 ^ XGR:SMILE.GRF
^ FO50,90 ^ AF ^ FDLOOK, NO SMILE ^ FS
^ XZ
```

Programming Instructions

Type the instructions **(shown in bold)** in the order given. An explanation of what each instruction does is in brackets.

^ XA

[^XA - Indicates start of label format.]

^ IDR:SMILE.GRF

[^ID - Delete the image called SMILE from memory.]

^ XZ

[^XZ - Indicates end of label format.]

---

^ XA

[^XA - Indicates start of label format.]

^ FO50,50 ^ XGR:SMILE.GRF

[This line attempts to call the graphic image that was just deleted. If the deletion was successful, only the following line will print.]

^ FO50,90 ^ AF ^ FDLOOK, NO SMILE ^ FS

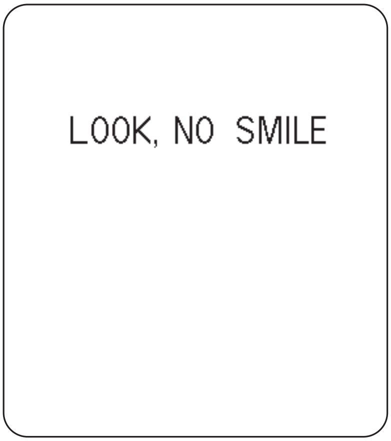
[^FO - Set field origin relative to label home.
[^AF - Select font “F.”]
[^FD - Start of field data.]
[LOOK, NO SMILE - Actual field data.]
[^FS - End of field data.]

^ XZ

[^XZ - Indicates end of label format.]

Review

Save this file on your computer's harddrive, name it "EXER10.ZPL" Copy the file to the printer. Compare your results with those shown below.



LOOK, NO SMILE

If your label does not look like the one shown, confirm that the file you created is identical to the listing at the beginning of this exercise and repeat the printing procedure.

CHAPTER 5 ZPL II Advanced Techniques

This chapter presents information and instructions for using more advanced techniques such as special effects, serialized data fields, control instructions, program delimiters, communications, and memory cards.

Special Effects for Print Fields

ZPL II includes a few "Special Effects" instructions which are outlined below.

Reverse Printing a Field

The **^FR** (Field Reverse Print) instruction allows a field to appear as white over black or black over white. When printing a field, if the dot would normally print black, it is made white; if the dot would normally be white, it is made black. For more information, see the **^FR** command on page 222.

Reverse Printing a Label

The **^LR** (Label Reverse Print) instruction reverses the printing of all fields in the label format. It allows a field to appear as white over black or black over white. When printing a field, if the dot would normally print black, it is made white; if the dot would normally be white, it is made black. For more information, see the **^LR** command on page 280.

Printing a Mirror Image

The **^PM** (Print Mirror Image of Label) instruction prints the entire printable area of the label as a mirror image. This instruction flips the image from left to right. For more information, see the **^PM** command on page 301.

Printing a Label Inverted 180 Degrees

The **^PO** (Print Orientation) instruction inverts the label format 180 degrees. In essence, the label is printed upside down. For more information, see the **^PO** command on page .

Serialized Data

The **^SN** (Serialization Data) instruction allows the printer to index data fields by a selected increment or decrement value (i.e., make the data fields increase or decrease by a specified value) each time a label is printed. This can be performed on up to 100 to 150 fields in a given format and can be performed on both alphanumeric and bar code fields. A maximum of 12 of the right-most integers are subject to indexing. The first integer found when scanning from right to left starts the indexing portion of the data field.

If the alphanumeric field to be indexed ends with an alpha character, the data will be scanned, character-by-character, from right to left until a numeric character is encountered. Serialization will take place using the value of the first number found. For more information, see the **^SN** command on page 314.

Variable Data

To increase throughput, you can set up a program that uses variable data fields. Then, instead of formatting the whole label each time a label is printed, the printer will have to format only the changed data field. To use this capability, you must use the **^MC** and **^FV** instructions. For more information, see the **^MC** command on page 285 and the **^FV** command on page 226.

Stored Formats

You can create formats and save them in volatile memory. A stored format can then be recalled and merged with downloaded data to form a complete label. This process saves transmission time but not formatting time. It is particularly useful if you are not working with an intelligent input device.

To create a format do the following:

- Design the label.
- Replace variable data fields with field numbers.
- Allocate space for the size of the field.
- Give the format a name.
- Save the format to the printer.

You can store multiple formats, limited by available DRAM. If you try to save a format that would overload memory, that format is not stored. You *DO NOT* receive an error message that the format is not stored. You will learn that the format was not stored only when you try to recall it (and are unable to do so) or if you print the List of Formats.

If the power is turned OFF, ALL stored formats in DRAM will be lost.

Initialize/Erase Stored Formats

The **^EF** or **~EF** (Erase Format) instruction erases all stored formats. If you use the erase format instruction, you erase all stored formats. (Stored formats can be selectively erased using the **^ID** instruction.) For more information, see the **^EF** or **~EF** commands on page 212.

Download Format Instruction

The **^DF** (Download Format) instruction saves the ZPL II format instructions as text strings to be later merged using **^XF** with variable data. The format to be stored may contain Field Number (**^FN**) instructions to be referenced when recalled.

While use of stored formats will reduce transmission time, no formatting time is saved since this instruction saves the ZPL II as text strings which need to be formatted at print time. For more information, see the **^DF** command on page 200

Field Number Instruction

The **^FN** (Field Number) instruction is used to number the data fields. This instruction is used in both Store Format and Recall Format operations.

In a stored format, the ^**FN** instruction is used where you would normally use the **^FD** (Field Data) instruction. In recalling the stored format, use **^FN** in conjunction with the **^FD** (Field Data) instruction. For more information, see the **^FN** command on page 219.

Field Allocate

Use the **^FA** (Field Allocate) instruction to allocate space for the field to be saved. For more information, see the **^FA** command on page 213.

Recall Stored Format Instruction

The **^XF** (Recall Format) recalls a stored format to be merged with variable data. There can be multiple **^XF** instructions and they can be located anywhere in the label format.

When recalling a stored format and merging data utilizing the **^FN** (Field Number) function, the calling format must contain the (**^FN**) instruction to properly merge the data.

While use of stored formats will reduce transmission time, no formatting time is saved since the ZPL II format being recalled was saved as text strings which need to be formatted at print time. For more information, see the **^XF** command on page 334.

More Examples of Using Stored Format

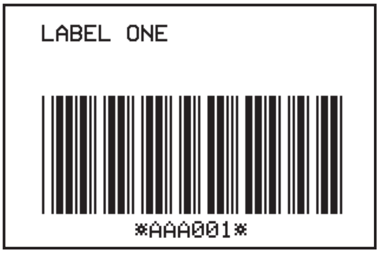
Working with Stored Format instructions involves designing and saving a stored format, then recalling and merging the format with some variable data.

The following is an example of how to use the various Stored Format instructions. First, enter the following format and send it to the printer. Notice that no label is printed. (DATA Indicator went On and Off.)

```
^XA^DFFORMAT^FS
^LH30,30
^BY2,3,100
^FO120,100^CFD^FN1^FA9^FS
^FO120,160^B3^FN2^FA6^FS
^XZ
```

Second, enter the following format and send it to the printer. The label shown will be printed.

```
^XA^XFFORMAT^FS
^FN1^FDLABEL ONE^FS
^FN2^FDAAA001^FS
^XZ
```



LABEL ONE

AAA001

Control Instructions

Control instructions may be sent from the host at any time to elicit an immediate response from the printer. Control instructions may be sent in a group or singly.

A control instruction causes the printer to take direct software action (such as clearing the memory), physical action (such as moving to next home position), or a combination (such as feeding a label and calculating and storing its length).

The basic format for using all of the control instructions is:

~(2 letter instruction)

Test and Setup Instructions

The following instructions, presented in alphabetical order, are used to test various elements of the printer and its status.

Sending the **~HM** (Memory Status) instruction to the printer, immediately returns a memory status message to host. Use this instruction whenever you need to know the status of the memory.

Sending the **~HS** (Host Status) instruction to the printer, immediately returns a three-line printer status message to the host. Use this instruction whenever you need to know the status of the printer.

The **~JR** (Power On Reset) instruction resets all of the printer's internal software, performs a power-on self-test, clears the buffer and DRAM, and resets communication parameters and default values. **~JR** performs the same function as a manual power-on reset.

The **~JN** (Head Test Fatal) instruction resets the printhead element error override, acting as a toggle for **~JO**. Printer then goes into fault status (i.e., turns head indicator on steadily) if any subsequent execution of the printing element test detects bad printing elements.

The **~JO** (Head Test Non-Fatal) instruction overrides a failure of head element status check and allows printing to continue. The override is canceled when the printer is turned off or receives a **~JR** or **~JN** instruction. The printhead test will not produce an error if the **~JO** override is active.

The **^JT** (Head Test Interval) instruction lets you change the printhead test interval from 100 to any desired interval. The printer automatically performs an internal printhead element test which occurs every 100 labels. This takes place during formatting which minimizes a delay in printing. Therefore, the test may be performed while the printer is in PAUSE.

Calibration and Media Feed Instructions

The following instructions, presented in alphabetical order, are used to perform various media and ribbon calibrations and also set the media feed mode for the printer.

The **~JC** (Set Media Sensor Calibration) is used to force a label length measurement and recalibrate the media and ribbon sensors.

NOTE: In continuous mode, only the media and ribbon sensors will be recalibrated.

The **~JG** (Graphing Sensor Calibration) is used to force a label length measurement, recalibrate the media and ribbon sensors and print a graph (media sensor profile) of the sensor values.

The **~JL** (Set Label Length) is used to set the label length. Depending on size of label, printer will feed one or more blank labels.

The **^MF** (Media Feed) instruction dictates what happens to the media at “power up.”

Cancel/Clear Instructions

The following instructions control the contents of the Zebra input buffer:

The **~JA** (Cancel All) instruction cancels all format instructions in the buffer. It also cancels any batches that may be printing.

The printer will stop printing after the current label (if one is printing) is finished printing. All internal buffers will be cleared of data. The "DATA" LED will turn off.

Printer Control Instructions

The following instructions control various printer operations.

The **~PH** or **^PH** (Slew to Home Position) instruction causes the printer to feed one blank label.

The **~PH** instruction feeds one label after the format currently being printing is done or when the printer is placed in pause.

The **^PH** instruction feeds one blank label after the format it is in prints.

The **~PP** (Programmable Pause) instruction stops printing after the current label is printed (if one is printing) and places the printer in the Pause mode.

The **^PP** (Programmable Pause) is not immediate. Therefore, several labels may be printed before a pause is performed. This instruction will pause the printer after the format it is in prints.

The operation is identical to pressing the PAUSE button on the front panel of the printer. The printer will remain paused until the PAUSE button is pressed or a **~PS** instruction is sent to the printer.

The **~PS** (Print Start) instruction causes a printer in the Pause mode to resume printing. The operation is identical to pressing the PAUSE button on the front panel of the printer when the printer is already in the Pause mode.

The **^PF** (Slew Given Number of Dot Rows) instruction causes the printer to slew labels (move labels at a high speed without printing) a specified number of dot rows, at the bottom of the label. This allows faster printing when the bottom portion of a label is blank.

The **^PQ** (Print Quantity) instruction gives control over several printing operations. It controls the number of labels to print, the number of labels printed before printer pauses, and the number of replications of each serial number.

The **^PR** (Print Rate) instruction determines the media speed during printing and the slew speed (feeding a blank label).

The printer will operate with the selected speeds until the setting is resent in a subsequent format or the printer is turned off.

The print speed is application specific. ***Since print quality is affected by media and ribbon, printing speeds and printer operating modes, it is very important to run tests for your applications.***

Limitations of Higher Print Speeds

- Use thermal transfer mode **only.**
- Horizontal bar codes with a minimum X dimension of 5 mil may be printed at print speeds of 2" (51mm) per second.
- Rotated bar codes are limited to a minimum *x* dimension of 10mil (modulus 2) at higher print speeds. At x dimension of 5 mil (modulus 1), they may be printed at 2" per second.
- Font A at a magnification of 1 is not recommended; all other fonts are acceptable.

Set Dots/Millimeter

Use the **^JM** (Set Dots/Millimeter) instruction to change the number of dots per millimeter. Depending on the print head, normal dots per millimeter on a Zebra Printer is 12-dots/mm (304-dots/inch), 8-dots/mm (203-dots/inch) or 6-dots/mm (153-dots/inch). In some applications, this high density is not required. For these applications, a lower density of 4-dots/mm (102-dots/inch) or 3-dots/mm (77-dots/inch) can be selected. For more information, see the **^JM** command on page 263.

If used, this instruction must be entered before the first **^FS** instruction.

Changing Delimiters and Instruction Prefixes

For some applications, you may need to change the ZPL II delimiter (default **“,**”) the format instruction prefix (default: “^”), and/or the control instruction prefix (default: “~”). You can change these characters to any ASCII characters you choose, using the appropriate instructions.

You might do this if you are using a hand-held terminal that does not have a comma to enter the ZPL II instructions, if you are working with a mainframe that has trouble processing the caret, or if you find some other character(s) easier to use.

Communication Diagnostics Instructions

Zebra printers support communication diagnostics through both hardware and software control. You can use these diagnostics to troubleshoot programs.

The **~JD** (Enable Communications Diagnostics) instruction initiates a diagnostic mode that produces an ASCII printout (using current label length and full width of printer) of all characters received by the printer. This printout includes the ASCII Characters, the HEX value and any communication errors.

The **~JE** (Disable Diagnostics) instruction cancels the diagnostic mode and returns the printer to normal label printing.

Host Status Instructions

Host Identification

The **~HI** (Host Identification) instruction is designed to be sent from the Host to the Zebra printer to find out the type of Zebra printer. Upon receipt, the Zebra printer will respond to the Host with a character string that gives information about the printer such as the version of firmware, dots per inch, memeory and printer options.

Print Configuration Label

The **~WC** (Print Configuration Label) instruction is used to generate a Printer Configuration Label.

NOTE: This instruction only works when the printer is idle.

Start Print

The **^SP** (Start Print) instruction allows a label to start printing at a specified point before the entire label has been completely formatted. On extremely complex labels, this instruction can increase the overall throughput of the print.

The instruction works as follows. You specify the dot row at which the **^SP** instruction is to take affect. This then creates a label 'segment.' Once the **^SP** instruction is processed, all information in that segment will be printed. During the printing process, all of the instructions after the **^SP** will continue to be received and processed by the printer.

If the segment after the **^SP** instruction (or the remainder of the label) is ready for printing, media motion does not stop. If the next segment is not ready, the printer will stop "mid-label" and wait for the next segment to be completed. Precise positioning of the **^SP** instruction is somewhat of a trial-and-error process as it depends primarily on print speed and label complexity.

The **^SP** instruction can be effectively used to determine the worst case print quality. You can determine if using the **^SP** instruction is appropriate for the particular application by using the following procedure. If you send the label format up to the first **^SP** instruction and then wait for printing to stop before sending the next segment, the printed label will be a sample of the worst case print quality. It will also drop any field that is out of order.

Networking

Assigning Network IDs/Chaining Multiple Printers

LCD Front Panel
If your printer is equiped with an LCD Front Panel, then you have the option of setting the network ID through the front panel.

NOTE: The default network ID for all printers is "000".

RS-232C
If your printer is equipped with only one RS-232C interface port, it must be used as the *last printer* in a daisy-chained Selective Calling Network of other Zebra printers. If your printer has two RS-232C ports, it can be used anywhere in the network chain.

If your printer is not equipped with an LCD Front Panel, use the following steps to assign network IDs and chain multiple printers within an RS-232C network:

1. Send a **~NR** command - to make sure all printers are in transparent mode. (See **~NR** on page 299)

2. Send a **~NC**000 command - this connects to the first printer in the chain that has an ID of 000. (See **~NC** on page 297)

3. Send a **^NI**XXX command - this is where XXX is the new ID for the printer. (See **^NI** on page 298) Issue a **^JU**S command to save current settings. (See **^JU** on page 270)

4. Send a **~NT** command - this allows you to prepare to initialize the next printer in the chain. (See **~NT** on page 299)

5. Repeat steps 2 through 4 until all printers are initialized.

RS-485 *(use these steps if there is no LCD Front Panel)*
If you want to set up an RS-485 network, you will need to initialize with a one printer network configuration for each printer using the following steps:

1. Send a **^NI**XXX command - this is where XXX is the new ID for the printer. (See **^NI** on page 298)

2. Issue a **^JU**S command to save current settings. (See **^JU** on page 270)

Connecting Printers into the Network (if they already have network IDs)

Use the **~NC** (Network Connect) command to connect a particular printer into the network by calling up the printer's Network ID Number. You can then send data to the printer. You can then use the **~NT** command to disconnect (set transparent) the printer if desired when data transmission has finished.

Graphic Instructions

In addition to text and bar codes, three types of graphics can be printed on a Zebra printer:

- Boxes and lines.
- ZPL II label formats saved as graphic images.
- Graphic images in Hexadecimal format.

ZPL II has a format instruction that will create boxes and lines as part of any label format. These label formats can also be stored as graphic images and data can be merged with them at print time. Additionally, ZPL II will permit the printing of graphic images from other sources that have been created in (or converted to) hexadecimal (HEX) format. Such graphic images can come from a variety of sources, including CAD programs, draw and paint programs, and scanned images.

Boxes and Lines

The **^GB** (Graphic Box) instruction is used to draw boxes and/or lines as part of a label format. Boxes and lines can be use to highlight important information, divide labels into distinct areas, or just dress up the way the label looks.

Working with Hex Graphic Images

ZPL II can be used to save graphic images in HEX format in DRAM, FLASH, PCMCIA, or battery backed up SRAM, depending on the type of memory installed in your printer. The image might be created using a CAD program, a draw or paint program, or a scanner. These images can then be printed on the label. Graphic images may be created using a program which creates files in the .PCX format. These files must then be converted to ZPL II graphic format .GRF (pure hexadecimal data without headers or other extraneous information) for use as part of a label format. You can use the ***ZTools™ for Windows*** program (available from Zebra) to convert the .PCX graphic format into the pure hexadecimal .GRF graphic format. Hexadecimal data may also be directly input as part of a ZPL II program. Manually preparing a string of HEX code is possible but usually impractical.

Alternative Data Compression Scheme for ~DG and ~DB Instructions

There is an alternative data compression scheme recognized by the Zebra printer. This scheme further reduces the actual number of data bytes and the amount of time required to download graphic images and bitmapped fonts with the **~DG** and **~DB** instructions.

The following represent the repeat counts 1,2,3,4,5,....,19 on a subsequent Hexadecimal value.

NOTE: Values start with G since 0 thru 9 and A thru F are already used for HEX values.)

G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Example: Sending a M6 to the printer is identical to sending the following Hexadecimal data:

```
6666666
```

The “M” has the value of 7. Therefore “M6" sends seven (7) hexadecimal 6’s.

g	h	i	j	k	l	m	n	o	p	q
20	40	60	80	100	120	140	160	180	200	220

r	s	t	u	v	w	x	y	z
240	260	280	300	320	340	360	380	400

The numbers above represent the repeat counts 20, 40, 60, 80,....400 on a subsequent Hexadecimal value.

Example: Sending a hB to the printer is identical to sending the following HEX data:

```
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
```

The “h” has the value of 40. Therefore “hB” sends forty (40) hexadecimal B’s.

Repeat Values

Several repeat values can be used together to achieve any value desired. “vMB” or “MvB” will send 327 hexadecimal B’s to the printer.

a comma (**,**) fills the line, to the right, with zeros (**0**) until the specified line byte is filled.

an exclamation mark (**!**) fills the line, to the right, with ones (**1**) until the specified line byte is filled.

a colon (**:**) denotes repetition of the previous line.

Recalling a Hexadecimal Graphic Image

The **^XG** (Recall Graphic) instruction is used to recall one or more graphic images for printing. This instruction is used in a label format to merge pictures such as company logos and piece parts, with text data to form a complete label.

An image may be recalled and resized as many times per format as needed. Other images and data may be added to the format.

Image Move

The **^IM** (Image Move) instruction performs a direct move of an image from storage area into the bitmap. The instruction is identical to the Recall Graphic instruction except that there are no sizing parameters.

Working with Label Formats as Graphics

The **^IS** (Image Save) and **^IL** (Image Load) instructions are used to save a ZPL label format (including text and/or bar codes) in the printer’s DRAM, FLASH, PCMCIA, or battery backed up SRAM, as a special graphic image. This lets you increase the throughput of a series of similar but not identical labels.

Instead of formatting each individual label completely, store the constant fields as an image (i.e create a template). Then, in subsequent label formats, instructions are issued to recall that graphic image format and merge it with variable data.

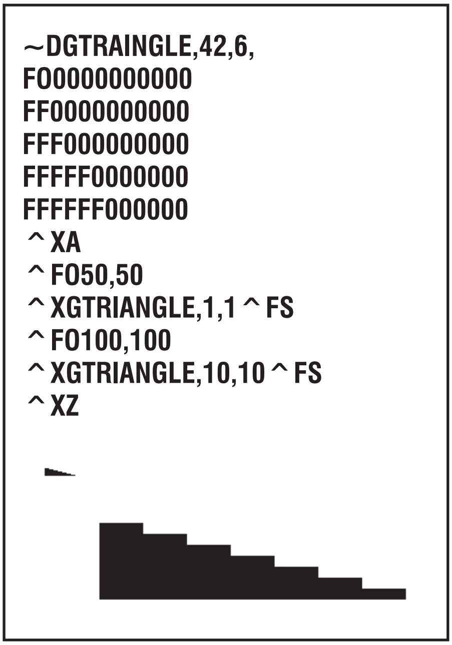
Reducing Download Time of Graphic Images

There is a method of reducing the actual number of data bytes sent to the printer when using the **~DG** instruction. This is shown in Figures 4.1 and 4.2 along with the graphic.

In Figure 4.2, if the HEX string ends in an even number of zeros (**0**'s), a single comma (**,**) can be substituted for ALL of the zeros. If the HEX string ends in an odd number of zeros, one zero and a single comma is required. The exclamation mark (**!**) and the colon (**:**) described under 'Repeat Values' on the previous page can also be used.

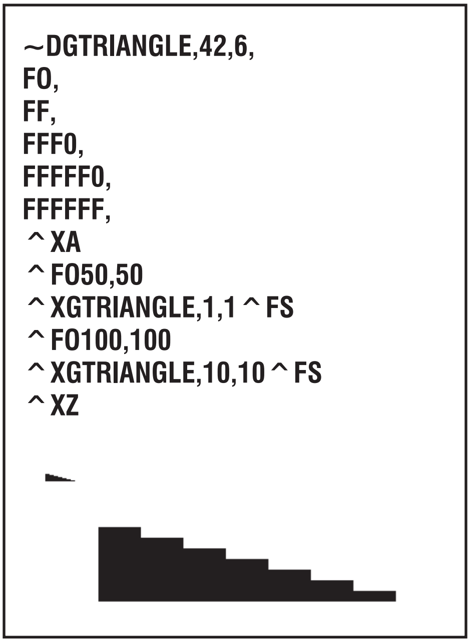
NOTE: The text rows in your editor may not be the same as the dot rows used by ZPL II. The editor may word wrap or truncate the dot rows. ZPL II ignores the end of a text line (ie. carriage returns and line feed characters).

NOTE: In Figures 4.1 and 4.2, carriage returns have been inserted at the end of every dot row for visual clarity.



```
~DGTRAINGLE,42,6,
F00000000000
FF0000000000
FFF000000000
FFFFF0000000
FFFFFF000000
^XA
^FO50,50
^XGTRIANGLE,1,1^FS
^FO100,100
^XGTRIANGLE,10,10^FS
^XZ
```

Figure 4.1 Complete Graphic Coding



```
~DGTRIANGLE,42,6,
F0,
FF,
FFF0,
FFFFF0,
FFFFFF,
^XA
^FO50,50
^XGTRIANGLE,1,1^FS
^FO100,100
^XGTRIANGLE,10,10^FS
^XZ
```

Figure 4.2 Condensed Graphic

Transferring Objects Between Storage Devices

The **^TO** (Transfer Object) instruction is used to copy an object or group of objects from one storage device to another. It is quite similar to the copy function used in PC's.

Source and destination devices must be supplied and must be different and valid for the action specified. Invalid parameters will cause the instruction to be ignored.

There are no defaults associated with this instruction. However, the asterisk (*) may be used as a wild card for Object names and extensions. For instance, ZEBRA.* or *.GRF would be acceptable forms for use with **^TO** instruction.

The Asterisk (*) can be used to transfer multiple object files (except *.FNT) from the DRAM to the Memory Card. For example, you have several object files that contain logos. These files are named LOGO1.GRF, LOGO2.GRF, and LOGO3.GRF.

For example...

You want to transfer all of these files to the Memory Card using the name NEW instead of LOGO. By placing an Asterisk (*) after both LOGO and NEW in the transfer instruction, you can copy all of these files with one instruction. The format for this would be as follows.

```
^ XA
^ TOR:LOGO*.GRF,B:NEW*.GRF
^ XZ
```

NOTE: If, during a multiple transfer, a file is to big to be stored on the Memory Card, it will be skipped. All remaining files will be checked to see if they can be stored. Those that can be stored, will be stored.

Deleting Graphics from Memory

The **^ID** (Item Delete) instruction deletes objects, images, fonts, formats etc. from storage areas selectively or in groups. This instruction can be used within a printing format to delete objects just prior to saving new ones or can be in a stand-alone type format simply to delete objects.

The object name and extension support the use of the asterisk (*) as a wildcard. This allows for easy deletion of selected groups of objects.

The following are various examples of using the **^ID** instruction.

To delete just stored formats from DRAM:

```
^ XA ^ IDR:*.ZPL ^ XZ
```

To delete formats and images named SAMPLE from DRAM regardless of the extension:

```
^ XA ^ IDR:SAMPLE.* ^ XZ
```

To delete the image SAMPLE1.GRF prior to storing SAMPLE2.GRF:

```
^ XA
^ FO25,25 ^ AD,18,10 ^ FDDelete ^ FS
^ FO25,45 ^ AD,18,10 ^ FDthen Save ^ FS
^ IDR:SAMPLE1.GRF ^ FS
^ ISR:SAMPLE2.GRF ^ FS
^ XZ
```

To delete everything from DRAM:

```
^ XA ^ IDR:*.* ^ XZ
```

Deleting all Graphic Images from DRAM

The **~EG** or **^EG** (Erase Downloaded Graphics) instruction is used to delete all graphic images (label format images and hexadecimal images) from DRAM.

Defining and Using the AUTOEXEC.ZPL Function

An AUTOEXEC.ZPL file function is supported by the printer. It functions in much the same way as the autoexec.bat file in MS-DOS. It can be used for setting up various parameters at the time the printer is powered up (i.e. **^COY, ^LL, ^CWf**, etc.). It can also be recalled at any time after power up.

This file must initially be in the extra EPROM, FLASH or PCMCIA memory. When the printer is powered on, it looks to the extra memory site for the stored format called AUTOEXEC.ZPL. If found, the contents of the file are automatically executed as a stored format.

Memory, Flash Cards, Font Cards

Zebra printers come with a variety of memory options. These include DRAM, EPROM, PCMCIA, FLASH, SOCKET FLASH and BATTERY BACKED-UP RAM. Depending on which printer model you have, on most Zebra printers you can print out a Printer Configuration Label which will show the letter designation(s) assigned to your printer memory. Some printer models do not support this feature, however, so the following chart should help you in determining how the memory IDs are assigned (memory IDs default to these values when the printer is reset to factory defaults):

EPROM	E:
PCMCIA	B:
FLASH	E:
DRAM	R:
BATTERY BACKED-UP RAM	B: or E:
SOCKET FLASH	B:

NOTE: Not all memory options are available on all printers

There are a few ZPL II commands that directly affect the types of memory available to Zebra printers. They are **~JB**, **^JB** and **~HM**.

The **~JB** (Reset Battery Dead) instruction is used for the following two conditions.

1. This instruction ***must*** be sent to the printer if the battery supplying power to the Battery Powered Font Card fails and is replaced. (A bad battery would show a “battery dead” condition on the Printer Configuration Label.)

NOTE: If the battery is replaced and this instruction is not sent to the printer, the Battery Powered Font Card will not function.

2. To intentionally clear (reinitialize) the Battery Powered Font Card.

The **^JB** (Initialize Flash Memory) instruction is used to initialize the two types of Flash Memory available in the Zebra printers.

NOTE: This command is only available in certain Zebra printers and based on the firmware installed in the printer. Please consult the Command Quick Reference Chart (Appendix A) for a complete listing of firmware that supports ^JB.

Sending the **~HM** (Host Memory Status) instruction to the printer immediately returns a memory status message to the host. Use this instruction whenever you need to know the status of the memory.

When the Host Memory Status Command, **~HM**, is sent to the Zebra printer, a line of data containing three numbers is sent back to the Host. The information contained in that line is described here.

Memory Status Line

```
1024,0780,0780
```

The first value is the ***total amount of RAM*** (Random Access Memory) installed in the printer. This number is in Kilobytes.

The second value is the ***maximum amount of RAM*** (Random Access Memory) available to the user. This number is in Kilobytes.

The third value is the ***amount of RAM*** (Random Access Memory) ***currently available*** to the user. This number is in Kilobytes.

Shortcuts and Alternate Schemes for Writing ZPL II Scripts

ZPL II programming scripts can be written in a variety of ways. There are, however, more efficient ways to write a ZPL II script depending on the application and the commands used. The following are certain ways to write the same ZPL II script, each yeilding the same result.

Example 1:
The Code 39 bar code (**^B3**) example shown on page 104 shows the ZPL II script written as:

```
^XA^FO100,75^BY3
^B3N,N,100,Y,N
^FD123ABC^XZ
```

Since it is only one field, however, the entire command can be written as a one line entry:

```
^XA^FO100,75^BY3^B3N,N,100,Y,N^FD123ABC^XZ
```

Finally, this script can be further simplified by writing it on one line, using the comma (**,**) delimeter to reduce the default parameters in the **^B3** command and eliminating the default parameters at the end of the **^B3** command:

```
^XA^FO100,75^BY3^B3,,100^FD123ABC^XZ
```

Example 2:
You may prefer to write your ZPL II scripts in any way that makes sense to you. Some programmers prefer to write out each format instruction and field on a line by line basis like this:

```
^ XA
^ PR2 ^ FS
^ LL935 ^ FS
^ LH30,30 ^ FS
^ FO20,10 ^ AF ^ FDZEBRA ^ FS
^ FO20,60 ^ B3,,40 ^ FDAA001 ^ FS
^ FO20,180 ^ AF ^ SNSERIAL NUMBER 00000000111,1,Y ^ FS
^ PQ10 ^ FS
^ XZ
```

Although this script will print with no problems, it contains unnecessary **^FS** (Field Separator) commands which have been placed after the format commands. Some programmers feel it is required to place a **^FS** command at the end of ***each line***, but the **^FS** command is only needed to separate specific fields. Therefore, the script would transmit more quickly written like this:

```
^ XA
^ PR2
^ LL935
^ LH30,30
^ FO20,10 ^ AF ^ FDZEBRA ^ FS
^ FO20,60 ^ B3,,40 ^ FDAA001 ^ FS
^ FO20,180 ^ AF ^ SNSERIAL NUMBER 00000000111,1,Y ^ FS
^ PQ10
^ XZ
```

Other programmers prefer to keep the format instructions on one line as an organizational preference, like this:

```
^ XA ^ PR2 ^ LL935 ^ LH30,30
^ FO20,10 ^ AF ^ FDZEBRA ^ FS
^ FO20,60 ^ B3,,40 ^ FDAA001 ^ FS
^ FO20,180 ^ AF ^ SNSERIAL NUMBER 00000000111,1,Y ^ FS
^ PQ10 ^ XZ
```

The label will print out the same so you should develop a scripting pattern that suits your own organizational style but one which is efficient and is concerned with keeping transmission times to a minimum.

Font Shortcuts

There are times when you might include a specific font into your script and use it repeatedly within different fields. The following is an example of one way to write this script:

```
^ XA
^ FO120,108 ^ A0N,89 ^ FDA Guide to ^ FS
^ FO120,207 ^ A0N,89 ^ FDZPL II ^ FS
^ FO120,306 ^ A0N,89 ^ FDProgramming ^ FS
^ FO120,405 ^ A0N,89 ^ FDLanguage ^ FS
^ XZ
```

Notice that the **^FS** command is used on the second to last line to close the field. Actually, it is unnecessary because the **^XZ** will accomplish the same thing, so we can remove it from our script. Also, since the font and font size are not changing within the fields, this script can be simplified for quicker transmission by removing the unnecessary font entries and listing the font information once using the **^CF** command (see **^CF** command on page 180):

```
^ XA
^ CF0,89
^ FO120,108 ^ FDA Guide to ^ FS
^ FO120,207 ^ FDZPL II ^ FS
^ FO120,306 ^ FDProgramming ^ FS
^ FO120,405 ^ FDLanguage
^ XZ
```

This script can be made even more efficient by including the **^FB** command to identify the left origin of the text which occurs at the same place each time(see **^FB** command on page 214):

```
^ XA
^ CF0,89
^ FO120,108
^ FB300,4
^ FDA Guide to\&ZPL II\&Programming\&Language
^ XZ
```

NOTE: The entries "\&" within the text indicate a carriage return/line feed as allowed by the ^FB command. For more information, see the ^FB comand on page 214.

If you wanted to change the font type or size within the script, however, you would need to include the specific font parameters within the field where the change occurs. In this case, you would not want to use the **^FB** command because the change in font size (in our example below) will affect the y-axis (up and down) position of the text. You can still use the **^CF** command, but you will need to include the specific font information on the line where the change in the field occurs:

```
^XA
^CF0,89
^FO120,108^FDA Guide to^FS
^FO120,207^FDZPL II^FS
^FO120,306^A0N,110^FDProgramming^FS
^FO120,426^FDLanguage
^XZ
```

ZPL II Command Reference

Introduction

The ZPL II Command Reference, a comprehensive guide to ZPL II commands, lists all commands in alphabetical order. This listing includes the commands originally introduced with ZPL II as well as newly introduced parameters for those commands. Some entirely new ZPL II commands have been added due to the introduction of new printer firmware and also for specific applications. Please refer to the Command Quick Reference Chart (Appendix A) for a complete listing of the ZLP II commands detailing in which version of firmware the command was introduced.

Using the ZPL II Command Reference

For a novice or experienced user, the best way to learn the details of ZPL II is to familiarize yourself with a the concepts in Chapters 1-5 and then you can learn more about a specific command by using the Command Reference.The command descriptions in this reference assume you have already read Chapters 1-5. The graphics and examples that accompany the commands should give you a good idea of the command in a typical application. If no example is given, the command's use is simple enough to not require an example.

★★IMPORTANT★★

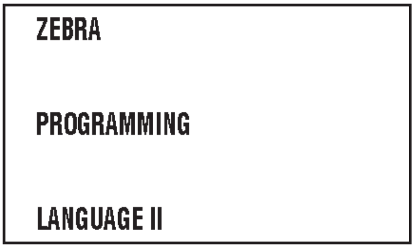
Some instructions include the following abbreviation: {I.V.P. = } This signifies the Initial Value at Power-up *regardless* of the value when the printer was turned off.

^A Scalable/Bitmapped Font

The **^A** (Scalable/Bitmapped Font) instruction is used with the built-in fonts or TrueType® fonts. Scalable fonts (also known as smooth vector fonts) expand the character size horizontally, vertically or in both dimensions on a dot by dot basis. Bitmapped fonts are made up of pixel elements and are slightly taller than their width. Bitmapped fonts are always at the maximum size of the characters cell.

The built-in scalable font *(***AØ** = CG Triumvirate Bold Condensed®) defaults to no rotation, a character height of 15 dots and a character width of 12 dots. The printer will attempt to print a scalable font based upon the rotation, height in dots and width in dots parameters used with the **^A** instruction.

```
^XA
^FO50,50^A0,32,25^FDZEBRA^FS
^FO50,150^A0,32,25^FDPROGRAMMING^FS
^FO50,250^A0,32,25^FDLANGUAGE II^FS
^XZ
```



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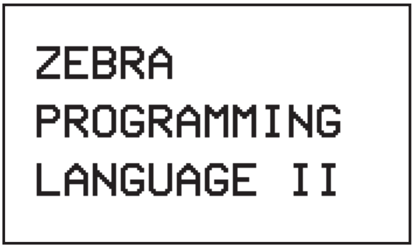
PROGRAMMING

LANGUAGE II

Example of Scalable Font Instruction

```
^XA
^FO50,50^ADN,36,20^FDZEBRA^FS
^FO50,100^ADN,36,20^FDPROGRAMMING^FS
^FO50,150^ADN,36,20^FDLANGUAGE II^FS
^XZ
```



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LANGUAGE II

Example of Bitmapped Font Instruction

The format for the **^A** instruction is

^Af,o,h,w

where

^A = **Scalable/Bitmapped Font**

f = **Desired Font**

Default value: Ø (CG Triumvirate Bold Condensed®)
Other values: A thru Z, and 1-9.
(Any font in the printer including downloaded fonts, EPROM stored fonts and fonts A-Z and 1-9 can be selected via **^CW**.)
Instruction ignored if value is incorrect or not specified.

o = **Font Orientation**

Default value: **^FW** default or last **^FW** value**.**
Other values:
N = Normal
R = Rotated, 90 degrees clockwise;
I = Inverted, 180 degrees
B = Read from Bottom up, 270 degrees.

h = **Character Height in Dots**

Scalable:
Default value: 15 dots or last **^CF** value.
Acceptable values: 10 - 1500 dots
Bitmapped:
Default value: Standard matrix height for specified bitmapped font
Other values: Multiples of height from 2 to 10 times the standard height in increments of 1.

w = **Character Width in Dots**

Scalable:
Default value: 12 dots or last **^CF** value, also shown as “0”.
Acceptable values: 10 - 1500 dots
Bitmapped:
Default value: Standard matrix width for specified bitmapped font, also shown as “0”.
Other values: Multiples of width from 2 to 10 times the standard width in increments of 1.

^A@ Use Font Name to Call Font

The **^A@** (Use Font Name to Call Font) instruction uses the complete name of a font, rather than a character designation, to call the font.

Example:

```
^XA^A@N,25,25,B:Cyrillic.FNT^FO100,20^FS
^FDThis is a test.^FS
^A@N,50,50^FO200,40^FS
^FDThis string uses the B:Cyrillic.FNT^FS^XZ
```

The first command line will search the Font Card/Battery Backed RAM (B:) looking for the “Cyrillic.FNT” font name. When the font is found, the instruction will continue to specify the character size, set the field origin, and print the Field Data “This is a test.” on a label.

Once the **^A@** instruction is defined as “Cyrillic.FNT”, it will represent that font until a new font name is included with another **^A@** instruction.

In the second command line of this example, the character size is increased, a new field origin is set, and the Field Data “This string uses the B:Cyrilllic.FNT.” prints in the same font.

The format for the **^A@** instruction is:

^A@o,h,w,n

Where

^A@ = **Use Font Name to Call Font**
*(Where @ triggers the search for font name listed by parameter **n**)*

o = **Font Orientation**

Default value: Last **^FW** value or N if none**.**
*Other values**:***
N = Normal
R = Rotated, 90 degrees clockwise;
I = Inverted, 180 degrees
B = Read from Bottom up, 270 degrees

h = **Character Height in Dots**

Default value: Magnification specified by Width, if any or uses last **^CF** value, or base height if none.
Scalable: Value is height in dots of the entire character block. Magnification factors are unnecessary, since characters are scaled.
Bitmapped: Value is rounded to nearest integer multiple of the font's base height, then divided by the font's base height, to give a magnification nearest limit.

w = **Character Width in Dots**

Default value: Magnification specified by Height, if any or uses last **^CF** value, or base width if none.
Scalable: Value is width in dots of the entire character block. Magnification factors are unnecessary, since characters are scaled.
Bitmapped: Value is rounded to nearest integer multiple of the font's base width, then divided by the font's base width, to give a magnification nearest limit.

n = **Font Name** *(follows the normal ZPL naming convention)*

If no letter designates the device location, the default device = RAM or R:. The font named will carry over on all subsequent **^A@** designations without a font name.

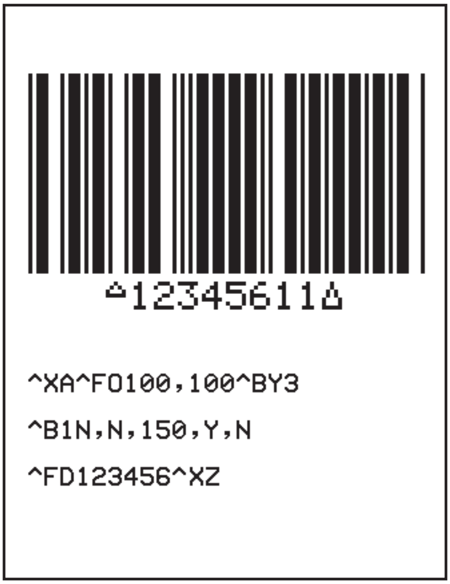
^B1 Code 11 Bar Code

The **^B1** (Code 11) bar code instruction is also known as USD-8 code.

In a Code 11 bar code, each character is composed of three bars and two spaces, and the character set includes 10 digits plus a dash.

Print Ratios Supported: 2.0 to 3.0.

^FD (*Field Data) Limitations: 100+ characters. Actual amount of data depends on* ***^BY*** *ratio and width (length if rotated) of label.*



```
^XA^FO100,100^BY3
^B1N,N,150,Y,N
^FD123456^XZ
```

Code 11 Bar Code

Characters

0	1
2	3
4	5
6	7
8	9

Internal Start/Stop Characters

Δ

NOTE*: When used as a Stop Character*
Δ is used with 1 check digit
Δ is used with 2 check digits

Code 11 Characters

The format for the **^B1** instruction is:

^B1o,e,h,f,g

where

^B1 = **Code 11 Bar Code**

o = **Orientation**

Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

e = **Check Digit**

Default value: N(No) = 2 digits
Other value: Y(Yes) = 1 digit

h = **Bar Code Height**

Default value: Value set by **^BY.**
Other values: 1 dot to 9999 dots.

f = **Print Interpretation Line**

Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

^B2 Interleaved 2 of 5 Bar Code

The **^B2** (Interleaved 2 of 5) bar code instruction is a high density, self-checking, continuous, numeric symbology.

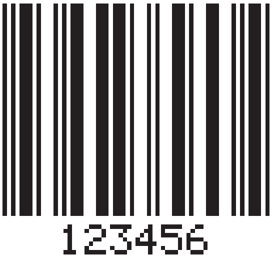
Each data character for the Interleaved 2 of 5 bar code is composed of five elements: five bars or five spaces. Of the five elements, two are wide and three are narrow. The bar code is formed by interleaving characters formed with all spaces into characters formed with all bars. For more information, refer to an Interleaved 2 of 5 bar code specification.

Print Ratios Supported: 2.0 to 3.0.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*

By definition, the total number of digits in an Interleaved code MUST be even. The printer automatically adds a leading zero if an odd number of digits is received.

The Interleaved 2 of 5 bar code uses the Mod 10 check digit scheme for error checking. (See Appendix C)



```
^XA^FO100,100^BY3
^B2N,150,Y,N,N
^FD123456^XZ
```

Interleaved 2 of 5 Bar Code

Characters

0 1

2 3

4 5

6 7

8 9

Start **Stop (internal)**

Interleaved 2 of 5 Characters

The format for the **^B2** instruction is:

^B2o,h,f,g,e

where

^B2 = **Interleaved 2 of 5 Bar Code**

o = **Orientation**

Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**

Default value: Value set by **^BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**

Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

e = **Calculate and Print Mod 10 Check Digit**

Default value: N = No
Other value: Y = Yes

^B3 Code 39 Bar Code

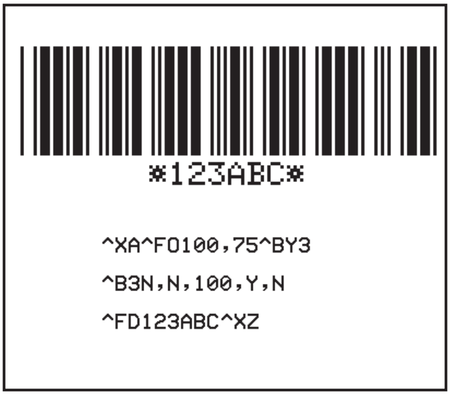
The **^B3** (Code 39) bar code instruction is the standard for many industries, including adoption by the U.S. Department of Defense (DOD) and is one of three symbologies identified in the American National Standards Institute (ANSI) standard MH10.8M-1983. This code is also known as USD-3 code and 3 of 9 code.

Each character in Code 39 bar code is composed of nine elements; five bars, four spaces, and intercharacter gap. Three of the nine elements are wide; six elements are narrow.

Print Ratios Supported: 2.0:1 to 3.0:1.

*^**FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on ^**BY** ratio and width (length if rotated) of label..*

Code 39 is also capable of encoding the full 128 ASCII Character Set. See Tables (A) and (B) on pages 106 and 147 respectively.



```
^XA^FO100,75^BY3
^B3N,N,100,Y,N
^FD123ABC^XZ
```

Code 39 Bar Code

Characters

1	A	K	U	-
2	B	L	V	.
3	C	M	W	$
4	D	N	X	/
5	E	O	Y	+
6	F	P	Z	%
7	G	Q		
8	H	R		
9	I	S		
0	J	T	SPACE	

Code 39 Characters

The format for the **^B3** instruction is:

^B3o,e,h,f,g

where

^B3 = **Code 39 Bar Code**

o = **Orientation**
Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

e = **Mod-43 Check Digit**
Default value: N = No
Other value: Y = Yes

h = **Bar Code Height**
Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**
Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**
Default value: N = No
Other value: Y = Yes

For the Code 39 bar code, the Start and Stop Character (an asterisk) is automatically generated.

NOTE: Information on the MOD-43 check digit can be found in Appendix D.

Full ASCII Mode for Code 39

Code 39 can generate the full 128 ASCII character set using paired characters as shown in tables (A) and (B) below.

ASCII	Code 39
SOH	$A
STX	$B
ETX	$C
EOT	$D
ENQ	$E
ACK	$F
BEL	$G
BS	$H
HT	$I
LF	$J
VT	$K
FF	$L
CR	$M
SO	$N
SI	$O
DLE	$P
DC1	$Q
DC2	$R
DC3	$S
DC4	$T
NAK	$U
SYN	$V
ETB	$W
CAN	$X
EM	$Y
SUB	$Z
ESC	%A
FS	%B
FS	%C
RS	%D
US	%E

ASCII	Code 39
SP	Space
!	/A
“	/B
#	/C
$	/D
%	/E
&	/F
‘	/G
(	/H
)	/I
*	/J
++	/K
‘	/L
-	-
.	.
/	/O
0	O
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
:	/Z
;	%F
<	%G
=	%H
>	%I
?	%J

(A) Code 39 Full ASCII MODE

ASCII	Code 39
@	%V
A	A
B	B
C	C
D	D
E	E
F	F
G	G
H	H
I	I
J	J
K	K
L	L
M	M
N	N
O	O
P	P
Q	Q
R	R
S	S
T	T
U	U
V	V
W	W
X	X
Y	Y
Z	Z
[	%K
\	%L
]	%M
	%N
_	%O

ASCII	Code 39
‘	%W
a	+A
b	+B
c	+C
d	+D
e	+E
f	+F
g	+G
h	+H
i	+I
j	+J
k	+K
l	+L
m	+M
n	+M
o	+O
p	+P
q	+Q
r	+R
s	+S
t	+T
u	+U
v	+V
w	+W
x	+X
y	+Y
z	+Z
{	%P
|	%Q
}	%R
~	%S
DEL	%T, %X

(B) Code 39 Full ASCII MODE

^B4 Code 49 Bar Code

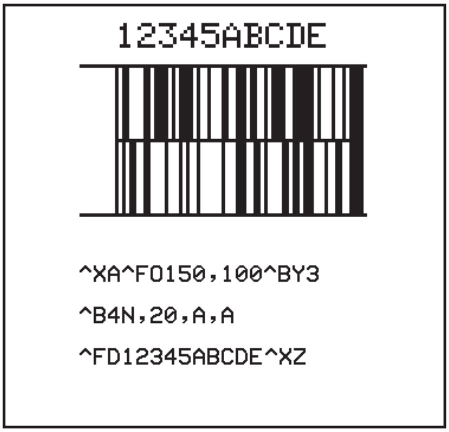
The **^B4** (Code 49) bar code is a multi-row, continuous variable length symbology capable of encoding the full 128 ASCII character set. It is ideally suited to applications where large amounts of data are required in a small space.

The code consists of 2 to 8 rows. A row consists of a leading quiet zone, 4 symbol characters encoding 8 code characters, a stop pattern, and a trailing quiet zone. Rows are separated by a 1-module high separator bar. Each symbol character encodes two characters from a set of 49 code characters (See the Code 49 table on page 110 for information on using the Code 49 character set). Rows can be scanned in any order.

Refer to the *Uniform Symbology Specification USS-49* for further information.

Print Ratio is Fixed

The illustration below shows an example of the Code 49 bar code and the instructions used to print it. The Code 49 table on page 110 shows all of the characters associated with this code.



```
^XA^FO150,100^BY3
^B4N,20,A,A
^FD12345ABCDE^XZ
```

Code 49 Bar Code

The format for the **^B4** instruction is:

^B4o,h,f,m

where

^B4 = **Code 49 Bar Code**

o = **Orientation**
Default value: Current **^FW** value
(**^FW** defaults to N = Normal at power-up)
Other values:
R = Rotated (90 Degrees Clockwise)
I = Inverted (180 Degrees)
B = Bottom (270 Degrees - Read from bottom up)

h = **Height Multiplier of Individual Rows**
Defined: This number, multiplied by the module, equals the height of the individual rows in dots.
Default value: Value set by ^**BY**
Other values: 1 to height of label.

NOTE: 1 is not a recommended value.

f = **Print Interpretation Line**
Default value: N = No line printed.
Other values:
A = Print interpretation line above code.
B = Print interpretation line below code.

NOTE: When the code is greater than 2 rows, expect interpretation line to extend well beyond right edge of the code.

m = **Starting Mode**
Default value: A = Automatic Mode. Printer determines starting mode by analyzing field data.
Other values:
0 = Regular Alphanumeric Mode
1 = Multiple Read Alphanumeric
2 = Regular Numeric Mode
3 = Group Alphanumeric Mode
4 = Regular Alphanumeric Shift 1
5 = Regular Alphanumeric Shift 2

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

Code 49 Shift 1 & 2 Character Substitutions

Code 49 Field Data Character Set

The **^FD** data sent to the printer when using Starting Modes 0 thru 5 is based on the Code 49 Internal Character Set. This is shown in the first column of the Code 49 table on page .110 The characters **:** **;** **<** **=** **>** and **?** are special Code 49 control characters.

Valid field data must be supplied when using modes 0 thru 5. Shifted characters are sent as a two-character sequence of a “shift character” followed by a “character in the unshifted character set.” For example, to print a lower case ‘a,’ send a “Shift 2" followed by an ”A" (>A). If interpretation line printing is selected, a lower case ‘a’ would print in the interpretation line.

NOTE: Code 49 uses UPPERCASE Alpha characters only.

If an invalid sequence is detected, the Code 49 formatter will stop interpreting field data and print a symbol with the data up to the invalid sequence. The following are examples of invalid sequences.

- Terminating numeric mode with any characters other than 0 thru 9 or a Numeric Space.
- Starting in Mode 4 (Regular Alphanumeric Shift 1) and the first field data character is not in the Shift 1 set.
- Starting in Mode 5 (Regular Alphanumeric Shift 2) and the first field data character is not in the Shift 2 set.
- Sending Shift 1 followed by a character not in the Shift 1 set.
- Sending Shift 2 followed by a character not in the Shift 2 set.
- Sending two Shift 1 or Shift 2 controls characters.

Advantages of Using the Code 49 Automatic Mode

Using the Automatic (Default) Mode completely eliminates the need for selecting the starting mode or manually performing character shifts. The Automatic Mode analyzes the incoming ASCII string, determines the proper mode, performs all character shifts and compacts the data for maximum density.

NOTE: Numeric mode will only be selected or shifted when 5 or more continuous digits are found. Numeric packaging provides no space advantage for numeric strings of less than 8 characters.

^B7 PDF417 Bar Code

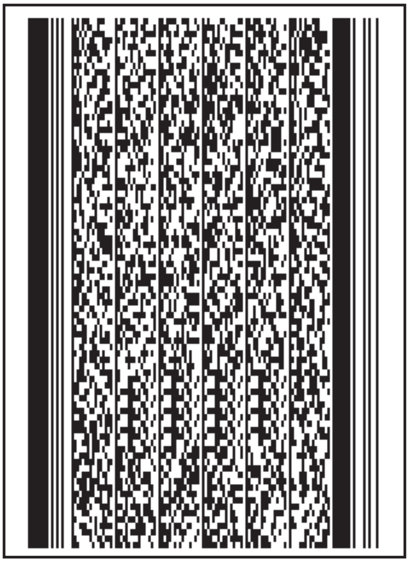
The **^B7** (PDF417) bar code instruction is a two-dimensional multi-row, continuous, stacked symbology. This bar code is capable of encoding over 1000 bytes of data per label. It is ideally suited to applications where large amounts of information are required at the time the bar code is read.

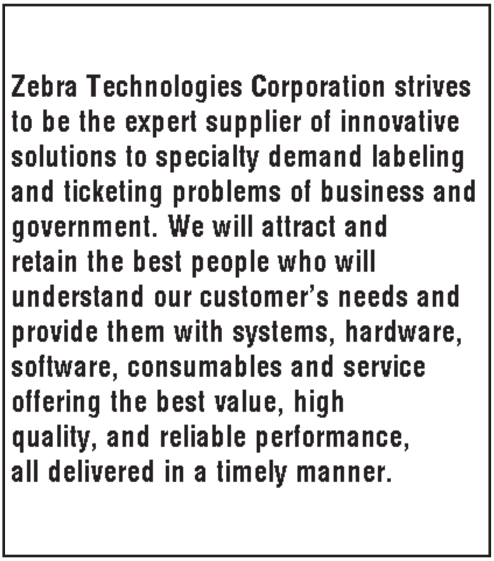
The code consists of 3 to 90 stacked rows. Each row consists of start/stop patterns and symbol characters called "codewords." A "codeword" consists of 4 bars and 4 spaces. The minimum number of "codewords" per row is 3.

Print Ratio is Fixed.

The illustration below shows an example of the PDF417 bar code. The instructions to create the bar code are shown below. The text used in the **^FD**...**^FS** statement is shown at the right of the bar code.

```
^ XA ^ BY2,3
^ FO10,10 ^ B7N,5,5,,83,N
^ FD(Text shown at right of bar code) ^ FS
^ XZ
```





Zebra Technologies Corporation strives
to be the expert supplier of innovative
solutions to specialty demand labeling
and ticketing problems of business and
government. We will attract and
retain the best people who will
understand our customer's needs and
provide them with systems, hardware,
software, consumables and service
offering the best value, high
quality, and reliable performance,
all delivered in a timely manner.

The format for the **^B7** instruction is:

^B7o,h,s,c,r,t

where

^B7 = **PDF417 Bar Code**

o = **Orientation**

Default value: Current **^FW** value
(**^FW** defaults to N = Normal at power-up)
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height for Individual Rows**

(This number, multiplied by the module, equals the height of the individual rows in dots.)
Default value: Value set by ^**BY**
Other values: 1 dot to height of label.

NOTE: 1 is not a recommended value.

s = **Security Level**

Determines the number of error detection and correction code words to be generated for the symbol. Default level provides only error detection (no correction). Increasing the security level adds increasing levels of error correction. (Increases symbol size.)
Default value: 0 = Error detection only
Other values: 1 to 8.
Error detection plus correction.

c = **Number of Data Columns to Encode**

User can specify number of codeword columns giving control over the width of the symbol.
Default value: 1:2 row/column aspect ratio.
Other values: 1 to 30

r = **Number of Rows to Encode**

User can specify number of symbol rows giving control over the height of the symbol.
Default value: 1:2 row/column aspect ratio.
Other values: 3 to 90
Example: With no row or column values entered, 72 codewords would be encoded into a symbol of 6 columns and 12 rows. (Depending on codewords, aspect ratio will not always be exact.)

t = **Truncate Right Row Indicators and Stop Pattern**

Default value: N = No truncation
Print right row indicators and stop pattern.
Other value: Y = Yes perform truncation.

NOTES:

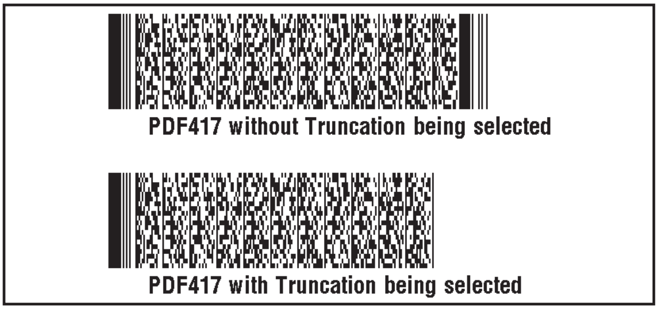
1. ***If both columns and rows are specified, their product must be less than 928.***

2. ***No symbol printed if columns x rows > 928.***

3. ***No symbol printed if total codewords > columns x rows.***

4. ***Serialization is not allowed with this bar code.***

5. ***The truncation feature can be used in situations where label damage is not likely. The right row indicators and stop pattern will be reduced to a single module bar width. The difference between a non-truncated and a truncated bar code is shown below.***



PDF417 without Truncation being selected

PDF417 with Truncation being selected

Special considerations for the ^BY instruction when using PDF417.

The parameters for the **^BYw,r,h** instruction when used with a **^B7** PDF417 code are as follows;

w = Module width. (Default = 2) Limited to 10.
r = Ratio (Default = 3) Fixed. Has no effect on PDF417.
h = Height of bars. Overall symbol height.
PDF417 uses this as the overall symbol height only when the row height is not specified in the **^B7** 'h' parameter.

Special considerations for the ^FD character set when using PDF417.

The character set sent to the printer includes the full ASCII set except for those characters with special meaning to the printer.

CR/LF have become valid characters for all **^FD** statements. The following scheme will be used.

" \& "	= carriage return/line feed
" **(*)**"	= soft hyphen (word break with a dash)
" \\\\ "	= \\ (See Item 1 below)
(*)	= Any alpha/numeric character.

Item 1: **^CI13** must be selected in order to print a \\.

Item 2: If a soft hyphen is placed near the end of a line, the hyphen will be printed. If it is not placed near the end of the line, it will be ignored. (Ignored in **^B7** barcode.)

^B8 EAN-8 Bar Code

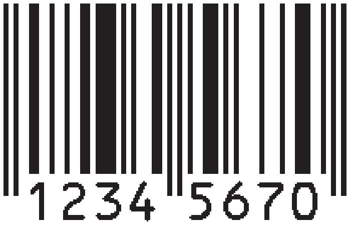
The **^B8** (EAN-8) bar code instruction is the shortened version of the EAN-13 bar code. See EAN-13 (page 138) for more information about EAN bar codes. EAN is an acronym for European Article Numbering.

Each character in EAN-8 Bar Code is composed of four elements; two bars, two spaces.

Print Ratios Supported: Fixed Ratio.

***^FD** (Field Data) Limitations: Exactly 7 characters. ZPL II automatically pads or truncates on the left with 0's to achieve required number of characters.*

NOTE: JAN-8 (Japanese Article Numbering) system is a special application of EAN-8. In this case, the first two "non-zero" digits sent to the printer will always be 49.



```
^XA^FO100,100^BY3
^B8N,100,Y,N
^FD1234567^XZ
```

EAN-8 Bar Code

Characters	
0	1
2	3
4	5
6	7
8	9

EAN-8 Characters

The format for the **^B8** instruction is:

^B8o,h,f,g

where

^B8 = **EAN-8 Bar Code**

o = **Orientation**

Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**

Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**

Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

^B9 UPC-E Bar Code

The **^B9** (UPC-E) bar code instruction is a variation of the UPC symbology used for number system 0. UPC is an acronym for Universal Product Code. It is a shortened version of the UPC-A bar code in which zeros are suppressed, resulting in codes that require less printing space. It is used for labeling small items.

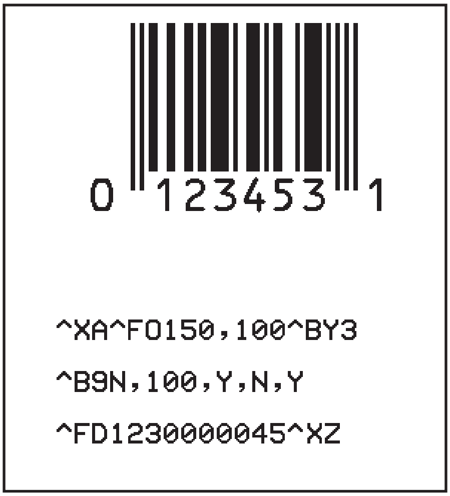
NOTE: When using the zero suppressed versions of UPC, the user MUST enter the full ten character sequence. ZPL II will then calculate and print the shortened version.

Each character in a UPC-E bar code is composed of four elements; two bars, two spaces.

Print Ratios Supported: Fixed Ratio.

***^FD** (Field Data) Limitations: Exactly 10 characters. Requires a 5-digit manufacturers code and a 5-digit product code.*

For more information, refer to a UPC-E Bar Code Specification.



```
^XA^FO150,100^BY3
^B9N,100,Y,N,Y
^FD1230000045^XZ
```

UPC-E Bar Code

Characters	
0	1
2	3
4	5
6	7
8	9

UPC-E Characters

The format for the **^B9** instruction is:

^B9o,h,f,g,e

where

^B9 = **UPC-E Bar Code**

o = **Orientation**
Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**
Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**
Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**
Default value: N = No
Other value: Y = Yes

e = **Print Check Digit**
Default value: Y = Yes,
Other value: N = No

The Four Rules for Proper Product Numbers

1. If the last 3 digits in the manufacturer’s number are 000, 100 or 200, valid Product Code numbers are 00000 - 00999.
2. If the last 3 digits in the manufacturers number are 300, 400 , 500, 600, 700, 800 or 900, valid Product Code numbers are 00000 - 00099.
3. If the last 2 digits in the manufacturers number are 10, 20, 30, 40 , 50, 60, 70, 80 or 90, valid Product Code numbers are 00000 - 00009.
4. If the manufacturer’s number does not end in zero (0), valid Product Code numbers are 00005 - 00009

^BA Code 93 Bar Code

The **^BA** (Code 93) bar code instruction is a variable length, continuous symbology. It is used in many of the same applications as the Code 39 bar code. It uses the full 128 character ASCII Code. ZPL II, however, does not support ASCII control codes or escape sequences, so it uses the substitute characters shown below. This code is also known as USS-93.

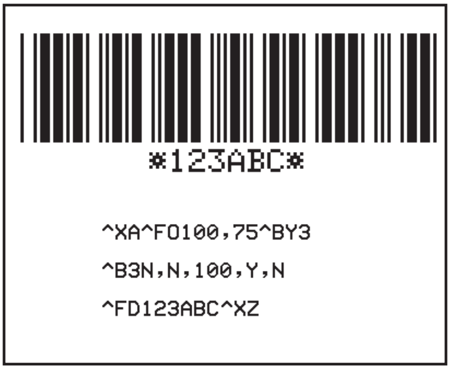
Control Code	**ZPL II Substitute**
Ctrl $	&
Ctrl %	‘
Ctrl /	(
Ctrl +	)

Each character in Code 93 Bar Code is composed of six elements; three bars, three spaces. Although invoked differently, the human-readable interpretation line will print as though the control code had been used.

NOTE: Control codes are used in pairs. Refer to a Code 93 specification for further details.

Print Ratios Supported: Fixed Ratio.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*



```
^XA^FO100,75^BY3
^B3N,N,100,Y,N
^FD123ABC^XZ
```

Code 93 Bar Code

Characters

1	2	3	4	5	6	7	8	9	0
	A	B	C	D	E	F	G	H	I
	J	K	L	M	N	O	P	Q	R
	S	T	U	V	W	X	Y	Z	
-	.	$	/	+	%	&	’	(	)
			SPACE						

Denotes a internal Start/Stop character that must precede and follow every bar code message

Code 93 Characters

The format for the **^BA** instruction is:

^BAo,h,f,g,e

where

^BA = **Code 93 Bar Code**

o = **Orientation**
Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**
Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**
Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**
Default value: N = No
Other value: Y = Yes

e = **Print Check Digit**
Default value: N = No
Other value: Y = Yes

Code 93 is also capable of encoding the full 128 ASCII Character Set. See Tables (A) and (B) on pages 122 and 123 respectively.

Full ASCII Mode for Code 93

Code 93 can generate the full 128 ASCII character set using paired characters as shown in tables (A) and (B) below.

ASCII	Code 93
NUL	‘U
SOH	&A
STX	&B
ETX	&C
EOT	&D
ENQ	&E
ACK	&F
BEL	&G
BS	&H
HT	&I
LF	&J
VT	&K
FF	&L
CR	&M
SO	&N
SI	&O
DLE	&P
DC1	&Q
DC2	&R
DC3	&S
DC4	&T
NAK	&U
SYN	&V
ETB	&W
CAN	&X
EM	&Y
SUB	&Z
ESC	‘A
FS	‘B
FS	‘C
RS	‘D
US	‘E

ASCII	Code 93
SP	Space
!	(A
“	(B
#	(C
$	$
%	%
&	(F
‘	(G
(	(H
)	(I
*	(J
++	++
‘	(L
-	-
.	.
/	/
0	O
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
:	(Z
;	‘F
<	‘G
=	‘H
>	‘I
?	‘J

(A) Code 93 Full ASCII MODE

ASCII	Code 93
@	‘V
A	A
B	B
C	C
D	D
E	E
F	F
G	G
H	H
I	I
J	J
K	K
L	L
M	M
N	N
O	O
P	P
Q	Q
R	R
S	S
T	T
U	U
V	V
W	W
X	X
Y	Y
Z	Z
[	‘K
\	‘L
]	‘M
	‘N
_	‘O

ASCII	Code 93
‘	‘W
a	)A
b	)B
c	)C
d	)D
e	)E
f	)F
g	)G
h	)H
i	)I
j	)J
k	)K
l	)L
m	)M
n	)M
o	)O
p	)P
q	)Q
r	)R
s	)S
t	)T
u	)U
v	)V
w	)W
x	)X
y	)Y
z	)Z
{	‘P
|	‘Q
}	‘R
~	‘S
DEL	‘T

(B) Code 93 Full ASCII MODE

^BB CODABLOCK Bar Code

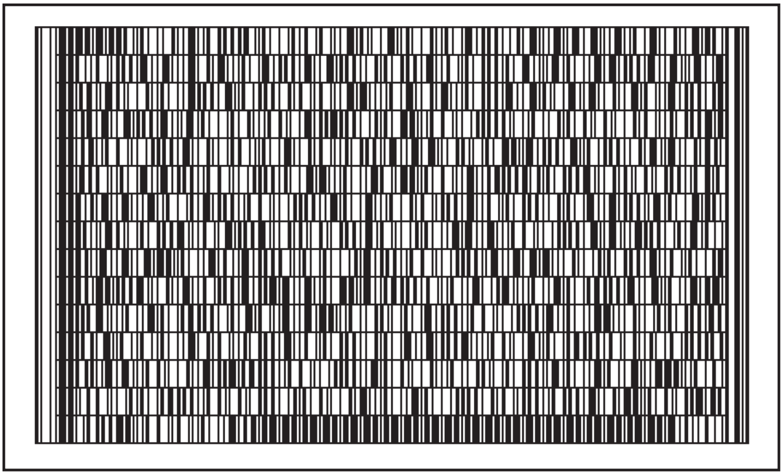
The **^BB** (CODABLOCK) bar code is a two-dimensional multi-row, stacked symbology. It is ideally suited to applications where large amounts of information are required.

Depending on the mode selected, the code consists of 1 to 44 stacked rows. Each row begins and ends with a start/stop pattern.

Print Ratios: CODABLOCK A is variable, CODABLOCK E and CODABLOCK F are fixed.

An example of the instructions used to print the CODABLOCK bar code appears below:

```
^ XA ^ LH10,10 ^ FS
^ BY2,3 ^ FO50,50 ^ BBN,30,,30,44,E
^ FD Zebra Technologies Corporation strives to be the expert supplier
of innovative solutions to specialty demand labeling and ticketing
problems of business and government. We will attract and retain the
best people who will understand our customer's needs and provide
them with systems, hardware, software, consumables, and service
offering the best value, high quality, and reliable performance, all
delivered in a timely manner. ^ FS
^ XZ
```



CODABLOCK

The format for the **^BB** instruction is:

^BBo,h,s,c,r,m

where

^BB = **CODABLOCK Bar Code**

o = **Field Position**
Default value: N = Normal
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height for Individual Rows**
(This number, multiplied by the module, equals the height of the individual rows in dots)
Default value: 8 dots
Other values: 2 dots to 200 dots

s = **Security Level**
(Determines if symbol check sums will be generated and added to the symbol.)

NOTE: Can only be turned off if parameter "m" is set to CODABLOCK A.

NOTE: Check sums are never generated for single-row symbols.

Default value: Y (Yes)
Other value: N (No)

c = **Number of Characters per Row (data columns) Used to Encode a CODABLOCK Symbol**
This gives the user control over the width of the symbol.
Range: CODABLOCK A, E, and F: 2 to 62

Continued on next page

r = **Number of Rows to Encode**
(User can specify the number of symbol rows giving control over the height of the symbol.
Range: CODABLOCK A: 1 to 22
CODABLOCK E and F: 2 to 44.

- If values for Number of Characters per Row and for Number of Rows to Encode are not specified, a single row will be produced.
- If a value for Number of Rows to Encode is not specified, and Number of Characters per Row exceed the maximum range, a single row equal to the field data length will be produced.
- If a value for Number of Characters per Row is not specified, the number of characters per row is derived by dividing the field data by the value for the rows to encode.
- If both parameters are specified, the amount of field data must be less than the product of the specified parameters. If the field data exceeds the value of the product, either no symbol or an error code (depending on how the **^CV** parameter is set) will be printed.
- If the data field contains primarily numeric data, fewer than the specified rows may be printed. If the field data contains several shift and code switch characters, more than the specified number of rows may be printed.

m = **Mode**
Default value: F
Other values: A and E
CODABLOCK A uses the Code 39 character set.
CODABLOCK F uses the Code 128 character set.
CODABLOCK E uses the Code 128 character set and automatically adds FNC1

Special Considerations for the ^BY Instruction when using CODABLOCK

The parameters for the **^BYw,r,h** instruction, when used with a **^BB** code, are as follows:

w = Module width. (Default = 2) Max. is 10. (CODABLOCK A only)

r = Ratio (Default = 3) Fixed. Has no effect on CODABLOCK E or F.

h = Height of bars. CODABLOCK uses this as the overall symbol height only when the row height is not specified in the **^BB "h"** parameter.

Special Considerations for the ^FD Character Set when using CODABLOCK

The character set sent to the printer depends on the mode selected with the **"m"** parameter.

CODABLOCK A: Uses the same character set as Code 39. If any other character is used in the **^FD** statement, either no bar code is printed or an error message is printed, depending on how the **^CV** parameter is set.

CODABLOCK E: The automatic mode includes the full ASCII set except for those characters with special meaning to the printer. Function codes or the Code 128 subset A <nul> character can be inserted through the use of the **^FH** instruction.

<Fnc1>	= 80 hex	<fnc4>	= 83 hex
<fnc2>	= 81 hex	<nul>	= 84 hex
<fnc3>	= 82 hex		

For any other character above 84 hex, either no bar code is printed or an error message is printed, depending on how the **^CV** parameter is set.

CODABLOCK F: Uses the full ASCII set except for those characters with special meaning to the printer. Function codes or the Code 128 subset A <nul> character can be inserted through the use of the **^FH** instruction.

<Fnc1>	= 80 hex	<fnc4>	= 83 hex
<fnc2>	= 81 hex	<nul>	= 84 hex
<fnc3>	= 82 hex		

For all characters above 84 hex, either no bar code is printed or an error message is printed, depending on how the **^CV** parameter is set.

^BC Code 128 Bar Code (Subsets A, B, and C)

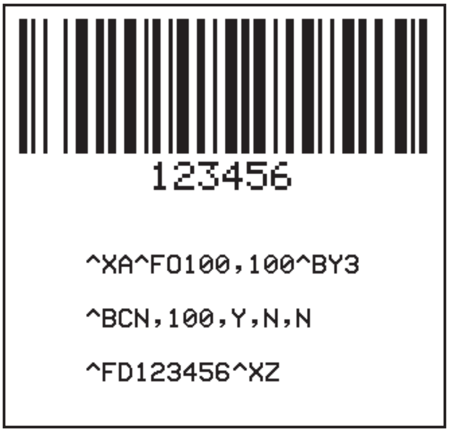
The **^BC** (Code 128) bar code instruction is a high density, variable length, continuous alphanumeric symbology. It was designed for complex encoded product identification. This is also known as a USD-6 bar code.

Code 128 has three subsets of characters. There are 106 printing (encoded) characters in each set. Therefore, each character can have up to three different meanings, depending on the character subset being used.

Each Code 128 character consists of six elements. Three bars and three spaces.

Print Ratios Supported: Fixed Ratio.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*



123456

```
^XA^FO100,100^BY3
^BCN,100,Y,N,N
^FD123456^XZ
```

Code 128 Bar Code

The format for the **^BC** instruction is:

^BCo,h,f,g,e,m

where

^BC = **Code 128 Bar Code**

o = **Orientation**

Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**

Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**

Default value: Y = Yes
Other value: N = No

NOTE: Intrepretation line can be printed in any available font by placing the instruction for the font directly before the bar code instruction.

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

NOTE: Default changes to Yes in UCC Case Mode

e = **UCC Check Digit**

Default value: N = No
Other value: Y = Yes

m = **Mode**

Default value: N = No mode selected
Other value: U = UCC Case Mode
(**^FD** or **^SN** statement must contain 19 numeric digits (it can also contain valid alpha characters). Subset C using FNC1 values is automatically selected.

Effective for Version 16.3.0

Other value: A = Automatic Mode

The Automatic Mode analyzes the data sent and automatically determines the best packing method. Full ASCII Character Set can be used in the **^FD** statement. Printer will determine when to shift subsets. A string of four or more numeric digits will cause automatic shift to subset C.

Value	Code A	Code B	Code C
0	SP	SP	00
1	!	!	01
2	”	”	02
3	#	#	03
4	$	$	04
5	%	%	05
6	&	&	06
7	‘	‘	07
8	(	(	08
9	)	)	09
10	*	*	10
11	++	++	11
12	,	,	12
13	-	-	13
14	.	.	14
15	/	/	15
16	0	0	16
17	1	1	17
18	2	2	18
19	3	3	19
20	4	4	20
21	5	5	21
22	6	6	22
23	7	7	23
24	8	8	24
25	9	9	25
26	:	:	26
27	;	;	27
28	<	<	28
29	=	=	29
30	>	>	30
31	?	?	31
32	@	@	32
33	A	A	33
34	B	B	34
35	C	C	35
36	D	D	36
37	E	E	37
38	F	F	38
39	G	G	39
40	H	H	40
41	I	I	41
42	J	J	42
43	K	K	43
44	L	L	44
45	M	M	45
46	N	N	46
47	O	O	47
48	P	P	48
49	Q	Q	49
50	R	R	50
51	S	S	51
52	T	T	52

Value	Code A	Code B	Code C
53	U	U	53
54	V	V	54
55	W	W	55
56	X	X	56
57	Y	Y	57
58	Z	Z	58
59	[	[	59
60	\	\	60
61	]	]	61
62			62
63		_	63
64	NŪL	.	64
65	SOH	a	65
66	STX	b	66
67	ETX	c	67
68	EOT	d	68
69	ENQ	e	69
70	ACK	f	70
71	BEL	g	71
72	BS	h	72
73	HT	i	73
74	LF	j	74
75	VT	k	75
76	FF	l	76
77	CR	m	77
78	SO	n	78
79	SI	o	79
80	DLE	p	80
81	DC1	q	81
82	DC2	r	82
83	DC3	s	83
84	DC4	t	84
85	NAK	u	85
86	SYN	v	86
87	ETB	w	87
88	CAN	x	88
89	EM	y	89
90	SUB	z	90
91	ESC	{	91
92	FS	|	92
93	GS	}	93
94	RS	~	94
95	US	DEL	95
96	FNC3	FNC3	96
97	FNC2	FNC2	97
98	SHIFT	SHIFT	98
99	Code C	Code C	99
100	Code B	FNC4	Code B
101	FNC4	Code A	Code A
102	FNC1	FNC1	FNC1
103		*START (Code A)*	
104		*START (Code B)*	
105		*START (Code C)*	

Code 128 Character Sets

Special Conditions if UCC Case Mode is Selected

1. Excess digits (above 19) in **^FD** or **^SN** will be eliminated.

2. Below 19 digits in **^FD** or **^SN** adds zeros to right to bring count to 19. *(This produces an invalid interpretation line.)*

Code 128 Subsets

The three Code 128 character subsets are referred to as Subset A, Subset B, and Subset C. A subset may be selected in one of two ways.

1. A special Invocation Code can be included in the field data (**^FD**) string associated with that bar code.

2. Place the desired Start Code at the beginning of the field data. If no Start Code is entered, Subset B will be used.

To change subsets within a bar code, place the appropriate Invocation Code at the appropriate points within the field data string. The new subset will stay in effect until changed with appropriate Invocation Code. (For example, in Subset C, a **“>7"** in the field data changes the Subset to A.) The table below shows the Code 128 Invocation Codes and Start Characters for the three subsets.

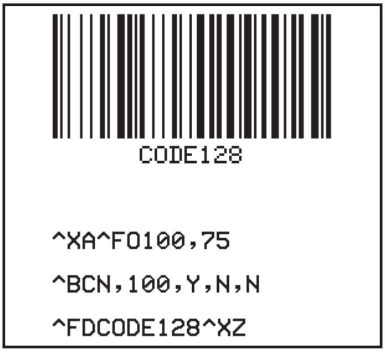
Invocation Code	Decimal Value	Subset A Character	Subset B Character	Subset C Character
><	62			
>0	30	>	>	
>=	94		~	
>1	95	USQ	DEL	
>2	96	FNC 3	FNC 3	
>3	97	FNC 2	FNC 2	
>4	98	SHIFT	SHIFT	
>5	99	CODE C	CODE C	
>6	100	CODE B	FNC 4	CODE B
>7	101	FNC 4	CODE A	CODE A
>8	102	FNC 1	FNC 1	FNC 1
Start Characters				
>9	103	Start Code A	(Numeric Pairs give Alpha/Numerics)	
>:	104	Start Code B	(Normal Alpha/Numeric)	
>;	105	Start Code C	(All Numeric ØØ - 99)	

Code 128 Invocation Characters

Example of Code 128 - Subset B

Since Code 128 subset ‘B’ is the most commonly used subset, ZPL II defaults to subset ‘B’ if no start character is specified in the data string. This is demonstrated in following two samples.

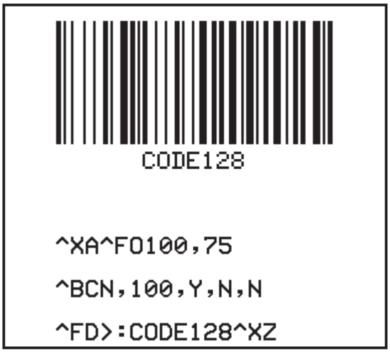
The bar codes in the following two samples are identical.



```
CODE128

^XA^FO100,75
^BCN,100,Y,N,N
^FDCODE128^XZ
```

Fig. A: Subset B - No Start Character



```
CODE128

^XA^FO100,75
^BCN,100,Y,N,N
^FD>:CODE128^XZ
```

Fig. B: Subset B - With Start Character

The first two instructions (**^XA^FO100,75**) start the label format and sets the field origin (from the upper-left corner) at which the bar code field begins to 100 dots across the x axis and 75 dots down the y axis.

The third instruction (**^BCN,100,Y,N,N**) calls for a Code 128 style bar code to be printed with no rotation and a height of 100 dots.

Instruction four (**^FDCODE128** in Fig.A) and (**^FD>:CODE128** in Fig. B) specify the content of the bar code.

Instructions five (**^XZ**) indicates the end of the print field and the end of the label format.

The interpretation line will print below the code with the UCC check digit turned off.

NOTE: The ^FD instruction for Fig. A does not specify any subset so the ‘B’ subset is used. In Fig. B , the ^FD instruction specifically calls subset ‘B.’ Although ZPL II defaults to Code B, it is very good practice to include the “invocation characters” in the instruction.

Code 128 - subset B is programmed directly as ASCII text, except for values greater than 94 decimal and a few special characters:

^ > ~

These characters must be programmed by using the invocation codes shown in the table on page 131.

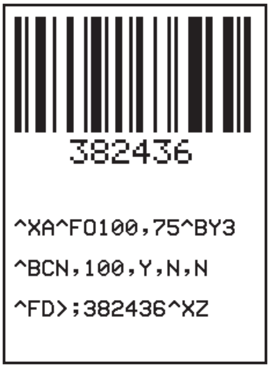
Example of Code 128 - Subsets A and C

Code 128 subsets A and C are programmed as pairs of digits, 00-99, in the field data string. (Refer to the Code 128 characters chart on page .130)

In subset A, each pair of digits results in a single character being encoded in the barcode; in subset C, they are printed as entered. Fig E below is an example of Subset A. (The ">9" is the Start Code for Subset A.)

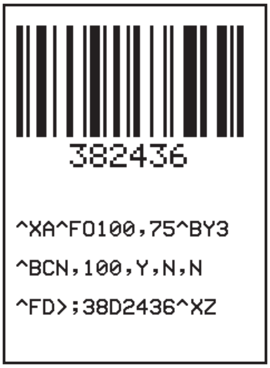
NOTE: Non-integers programmed as the first character of a digit pair (D2) are ignored. However, non-integers programmed as the second character of a digit pair (2D) invalidate the entire digit pair, and the pair is ignored. An extra, unpaired digit in the field data string just before a code shift is also ignored.

Fig. C and Fig. D below are examples of subset C. Notice that the bar codes in the figures are identical. In the program code for Fig. D, the "D" is ignored and the 2 is paired with the 4.



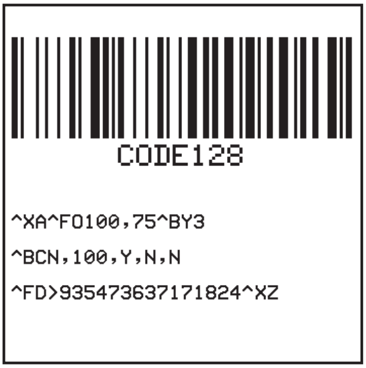
```
^XA^FO100,75^BY3
^BCN,100,Y,N,N
^FD>;382436^XZ
```

Fig. C: Subset C
Normal Data



```
^XA^FO100,75^BY3
^BCN,100,Y,N,N
^FD>;38D2436^XZ
```

Fig D: Subset C
Ignored Alpha
Character



```
^XA^FO100,75^BY3
^BCN,100,Y,N,N
^FD>935473637171824^XZ
```

Fig. E: Subset A

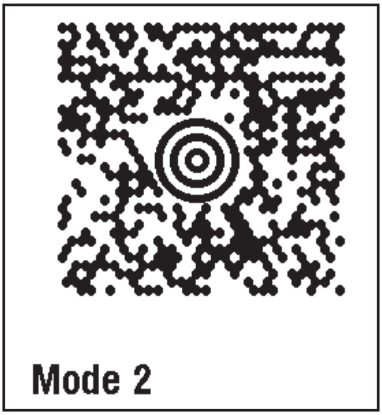
^BD UPS MaxiCode Bar Code

The **^BD** (UPS MaxiCode) instruction creates a two-dimensional, optically read (not scanned) code. This symbology was developed by UPS (United Parcel Service).

The code is generated from the information in the **^FD** statement which is described below. Notice that there are no additional parameters for this code. Also, this code does not generate an interpretation line. The **^BY** instruction has no affect on MaxiCode, however the **^CV** instruction does work.

Example:

```
^ XA
^ FO50,50
^ CVY
^ BD ^ FH ^ FD001840152382802[)>_1E01_1D961Z00004951_1DUPSN_1D
06X610_1D
159_1D1234567_1D1/1_1D_1DY_1D
634 ALPHA DR_1DPITTSBURGH_1DPA_1E_04 ^ FS
^ FO30,300 ^ A0,30,30 ^ FDMode2 ^ FS
^ XZ
```



MaxiCode

The format for the **^BD** instruction is:

^BDm,n,t

where

^BD = **MaxiCode Bar Code**

m = **Mode**

Default value:
2 Structured Carrier Message - Numeric Postal Code (US)
Other values:
3 Structured Carrier Message - Alphanumeric Postal Code (Non-US)
4 Standard Symbol, SEC
5 N/A
6 Reader Program, SEC

NOTE: Mode 0 and mode 1 are obsolete. Mode 0, if used, will default to mode 2; mode1 defaults to mode 4.

Effective for Versions 14.8.0, 18.8.0, 21.8.0, 23.8.1, 23.8.2, 25.8.1, 25.8.2, 22.8.5
Mode 5 = Full EEC

n = **Symbol Number**

Default value: 1
Other values: 1 to 8 symbols may be added in a structured document

t = **Total Number of Symbols**

Default value: 1
Other values: 1 to 8, representing the total number of symbols in this sequence

Special considerations for the ^FD instruction when using MaxiCode

The **^FD** statement is divided into two parts: a High Priority Message (hpm) and a Low Proirity Message (lpm). There are two types of High Priority Messages. One is for a US Style Postal Code, the other is for a Non-US Style Postal Code. The syntax for either of these High Priority Messages must be exactly as shown or an error message will be generated. The format is shown on the next page.

The format for the **^FD** instruction is:

^FD<hpm><lpm>

where

^FD = **Field Data**

<hpm> = **High Priority Message**
(only applicable in Modes 2 and 3)
Valid characters are 0123456789, except where noted.

US Style Postal Code (Mode 2)
<hpm> is aaabbbcccccdddd
where

aaa = three-digit class of service
bbb = three-digit country code
ccccc = five-digit zip code
dddd = four-digit zip code extension

NOTE: If there is no ZIP code extension, four zeros (0000) must be entered.

Non-US Style Postal Code (Mode 3)
<hpm> is aaabbbcccccc
where

aaa = three-digit class of service
bbb = three-digit country code
cccccc = six-character zip code (0-9 or A-Z)

<lpm> = **Low Priority Message**
(only applicable in Modes 2 and 3

Message Header	[)>Rs
Transportation Data Format Header	01Gs96
Tracking Number*	<tracking number>
SCAC*	Gs<SCAC>
UPS Shipper Number	Gs<shipper number>
Julian Day of Pickup	Gs<day of pickup>
Shipment ID Number	Gs<shipment ID number>
Package n/x	Gs<n/x>
Package Weight	Gs<weight>

Address Validation	Gs<validation>
Ship to Street Address	Gs<street address>
Ship to City	Gs<city>
Ship to State	Gs<state>
Rs	Rs
End of Message	Eot

* Mandatory Data for UPS

NOTE: Gs is used to separate fields in a message (0x1D)
Rs is used to separate format types (0x1E)
Eot is the end of transmission character (0x04)

SPECIAL NOTES:

- ***The formatting of <hpm> and <lpm> only apply when using modes 2 and 3. Mode 4, for example, will take whatever data is defined in the ^FD command and place it in the symbol.***
- ***UPS requires that certain data be present in a defined manner. When formatting MaxiCode data for UPS, always use upper-case characters. When filling in the "fields" in the <lpm> for UPS, follow the data size and types as specified in Guide to Bar Coding with UPS.***
- ***If you do not choose a mode, the default mode will be mode 2. So, if you use non-US postal codes you will probably get an error message (invalid character or message too short). When using non-US codes, use mode 3.***
- ***ZPL doesn't automatically change your mode based on the zip code format.***
- ***When using special characters, such as Gs, Rs, or Eot, use the ^FH instruction to tell ZPL to use the hex value following the '_' underscore character.***

^BE EAN-13 Bar Code

The **^BE** (EAN-13) bar code instruction is similar to the UPC-A bar code. It is widely used throughout Europe and Japan in the retail marketplace.

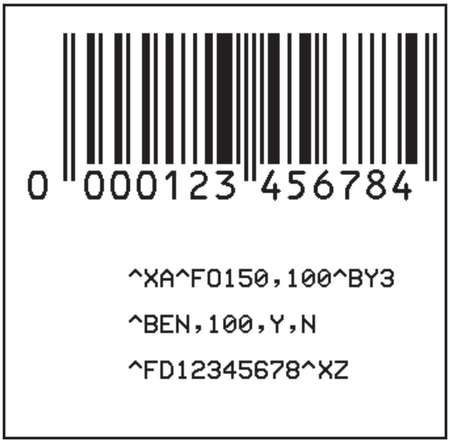
The EAN-13 bar code has 12 data characters, one more data character than the UPC-A code. An EAN-13 symbol contains the same number of bars as the UPC-A but encodes a 13th digit into a parity pattern of the left-hand six digits. This 13th digit, in combination with the 12th digit, represents a country code.

Print Ratios Supported: Fixed Ratio.

***^FD** (Field Data) Limitations: Exactly 12 characters. ZPL II automatically truncates or pads on the left with 0's to achieve required number of characters.*

The EAN-13 bar code uses the Mod 10 check digit scheme for error checking. (See Appendix C).

NOTE: JAN-13 (Japanese Article Numbering system) is a special application of EAN-13. The first two data values entered must be "49."



```
^XA^FO150,100^BY3
^BEN,100,Y,N
^FD12345678^XZ
```

EAN-13 Bar Code

Characters	
0	1
2	3
4	5
6	7
8	9

UPC/EAN Characters

The format for the **^BE** instruction is:

^BEo,h,f,g

where

^BE = **EAN-13 Bar Code**

o = **Orientation**

Default value: N=Normal or current **^FW**
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**

Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**

Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

^BF Micro-PDF417 Bar Code

The **^BF** (Micro-PDF417) is a two-dimensional multi-row, continuous, stacked symbology identical to PDF417 except that it replaces the 17-module-wide start/stop patterns and left/right row indicators with a unique set of 10-module-wide Row Address Patterns designed to reduce overall symbol width and to allow linear scanning at row heights as low as 2X.

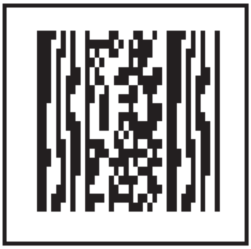
Micro PDF417 is designed for applications with a need for improved area efficiency but without the requirement for PDF417's maximum data capacity. It may only be printed in specific combinations of rows and columns up to a maximum of four data columns by 44 rows.

*^**FD** (Field Data) and ^**FH** (Field Hex) limitations:*
250 7-bit text characters, 150 8-bit Hex characters, or 366 4-bit Numeric characters.

If additional information is required, refer to the
International Symbology Specification - MicroPDF417
published by AIM International, Inc.

Example: ZPL and label output

```
^ XA ^ BY6 ^ BFN,8,3
^ FDABCDEFGHIJKLMNOPQRSTUV ^ XZ
```



Micro-PDF417
Bar Code

The format for the **^BF** instruction is:

^BFo,h,m

where

^BF = **Micro-PDF Bar Code**

o = **Orientation**
Default value: N or last **^FW** value.
Other values:
N = Normal
R = Rotated, 90 degrees clockwise;
I = Inverted, 180 degrees
B = Read from Bottom up, 270 degrees

m = **Mode**
Default value: 0 (from table)
Selections: 0 - 33 (from table shown below)

h = **Bar Code Height**
Default value: Value set by **^BY** or 10 dots if none
Other values: 1 dot to 9999 dots. Out of range is set to nearest limit.

Mode (m)	Data Columns	Data Rows	Mode (m)	Data Columns	Data Rows	Mode (m)	Data Columns	Data Rows
0	1	11	12	2	26	23	4	6
1	1	14	13	3	6	24	4	8
2	1	17	14	3	8	25	4	10
3	1	20	15	3	10	26	4	12
4	1	24	16	3	12	27	4	15
5	1	28	17	3	15	28	4	20
6	2	8	18	3	20	29	4	26
7	2	11	19	3	26	30	4	32
8	2	14	20	3	32	31	4	38
9	2	17	21	3	38	32	4	44
10	2	20	22	3	44	33	4	4
11	2	23						

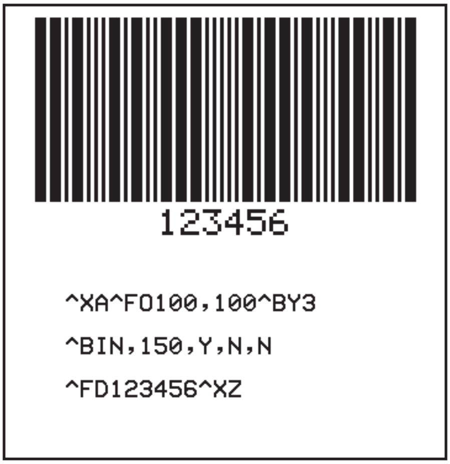
^BI Industrial 2 of 5 Bar Code

^BI (Industrial 2 of 5) bar code instruction is a discrete, self-checking continuous numeric symbology. Industrial 2 of 5 Bar Code has been in use the longest of the 2 of 5 family of bar codes. Of that family, the Standard 2 of 5 and Interleaved 2 of 5 bar codes are also available in ZPL II.

In Industrial 2 of 5, all of the information is contained in the bars. Two bar widths are employed in this code, the wide bar being three times the width of the narrow bar.

Print Ratios Supported: 2.0 to 3.0.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*



```
^XA^FO100,100^BY3
^BIN,150,Y,N,N
^FD123456^XZ
```

Industrial 2 of 5 Bar Code

Characters

0	1
2	3
4	5
6	7
8	9

Start (internal)

Stop (internal)

Industrial 2 of 5 Characters

The format for the **^BI** instruction is:

^BIo,h,f,g

where

^BI = **Industrial 2 of 5 Bar Code**

o = **Orientation**
Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**
Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**
Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**
Default value: N = No
Other value: Y = Yes

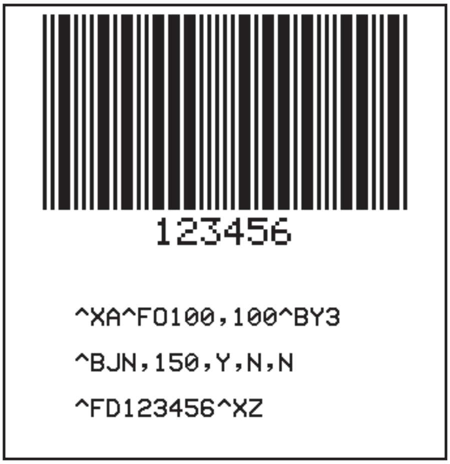
^BJ Standard 2 of 5 Bar Code

The **^BJ** (Standard 2 of 5) bar code instruction is a discrete, self-checking continuous numeric symbology.

In Standard 2 of 5, all of the information is contained in the bars. Two bar widths are employed in this code, the wide bar being three times the width of the narrow bar.

Print Ratios Supported: 2.0 to 3.0.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*



```
^XA^FO100,100^BY3
^BJN,150,Y,N,N
^FD123456^XZ
```

Standard 2 of 5 Bar Code

Characters

0 1

2 3

4 5

6 7

8 9

Start (automatic)

Stop (automatic)

Standard 2 of 5 Characters

The format for the **^BJ** instruction is:

^BJo,h,f,g

where

^BJ = **Standard 2 of 5 Bar Code**

o = **Orientation**

Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**

Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**

Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

^BK ANSI Codabar Bar Code

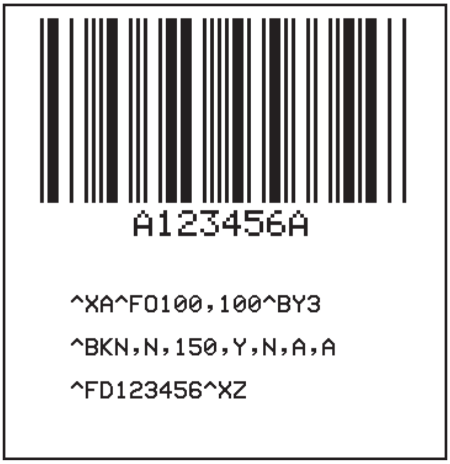
The **^BK** (ANSI Codabar) bar code instruction is currently used in a variety of information processing applications such as libraries, the medical industry, and overnight package delivery companies. This bar code is also known as USD-4 code, NW-7 and 2 of 7 code. It was originally developed for retail price-labeling use.

Each character in this code is composed of seven elements: four bars and three spaces. Codabar bar codes use two character sets:

- numeric characters
- control, start/stop characters

Print Ratios Supported: 2.0:1 to 3.0:1.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*



```
^XA^FO100,100^BY3
^BKN,N,150,Y,N,A,A
^FD123456^XZ
```

ANSI Codabar Bar Code

Characters

0	1
2	3
4	5
6	7
8	9

Start (automatic)

-	$
:	/
.	+

Stop (automatic)

A	T
B	N
C	*
D	E

ANSI Codabar Characters

The format for the **^BK** instruction is:

^BKo,e,h,f,g,k,l

where

^BK = **ANSI Codabar Bar Code**

o = **Orientation**

Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

e = **Check Digit (not implemented)**

Default value: N = No
Other value: Y = Yes

h = **Bar Code Height**

Default value: Value set by ^**BY**.
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**

Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

k = **Start Character**

Default value: A
Other values: B,C,D,*,N,E or T

l = **Stop Character**

Default value: A
Other values: B,C,D,*,N,E or T

The ***k*** and ***l*** parameters designate which Start and Stop characters will be used.

^BL LOGMARS Bar Code

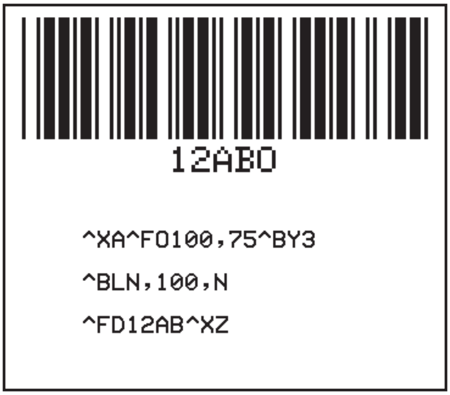
The **^BL** (LOGMARS) bar code instruction is a special application of Code 39 used by the Department of Defense (DOD). LOGMARS is an acronym for Logistics Applications of Automated Marking and Reading Symbols.

Print Ratios Supported: 2.0:1 to 3.0:1.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*

For more information, refer to a LOGMARS bar code specification.

NOTE: The LOGMARS bar code produces a "mandatory" check digit using MOD-43 calculations. For further information, refer to Appendix D.



```
^XA^FO100,75^BY3
^BLN,100,N
^FD12AB^XZ
```

LOGMARS Bar Code

Characters

1	2	3	4	5	6	7	8	9	0
A	B	C	D	E	F	G	H	I	
J	K	L	M	N	O	P	Q	R	
S	T	U	V	W	X	Y	Z		
-	.	*	$	/	+	%	SPACE		

LOGMARS Characters

The format for the **^BL** instruction is:

^BLo,h,g

where

^BL = **LOGMARS Bar Code**

o = **Orientation**
Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**
Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

g = **Print Interpretation Line Above Code**
Default value: N = No
Other value: Y = Yes

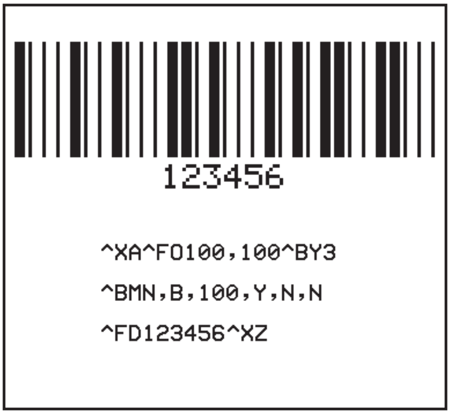
^BM MSI Bar Code

The **^BM** (MSI) bar code is a pulse-width modulated, continuous non-self checking symbology. It is a variant of the Plessey bar code.

Each character in the MSI bar code is composed of eight elements: four bars and four adjacent spaces .

Print Ratios Supported: 2.0:1 to 3.0:1.

***^FD** (Field Data) Limitations: 1 - 14 digits when parameter ‘e’ is B, C or D, 1 - 13 digits when parameter ‘e’ is A, plus quiet zone.*



```
^XA^FO100,100^BY3
^BMN,B,100,Y,N,N
^FD123456^XZ
```

MSI Bar Code

Characters
0
1
2
3
4
5
6
7
8
9

MSI Characters

The format for the **^BM** instruction is:

^BMo,e,h,f,g,h

where:

^BM = **MSI Bar Code**

o = **Orientation**

Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

e = **Check Digit Selection**

Default value: B = 1 Mod 10
Other values:
A = No Check Digits
C = 2 Mod 10
D = 1 Mod 10 and 1 Mod 11

h = **Bar Code Height**

Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**

Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

h = **Print Check Digit in Interpretation Line**

Default value: N = No
Other value: Y = Yes

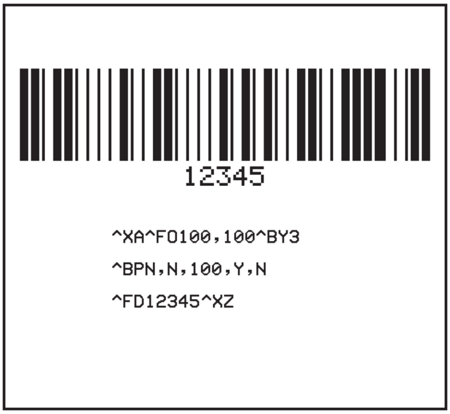
^BP Plessey Bar Code

The **^BP** (Plessey) bar code is a pulse-width modulated, continuous non-self checking symbology.

Each character in the Plessey bar code is composed of eight elements: four bars and four adjacent spaces.

Print Ratios Supported: 2.0:1 to 3.0:1.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*



```
^XA^FO100,100^BY3
^BPN,N,100,Y,N
^FD12345^XZ
```

Plessey Bar Code

Characters	
0	8
1	9
2	A
3	B
4	C
5	D
6	E
7	F

Plessey Characters

The format for the **^BP** instruction is:

^BPo,e,h,f,g

where:

^BP = **Plessey Bar Code**

o = **Orientation**
Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

e = **Print Check Digit (CRC8 2-digits)**
Default value: N = No
Other value: Y = Yes

h = **Bar Code Height**
Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**
Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**
Default value: N = No
Other value: Y = Yes

^BQ QR Code Bar Code

The **^BQ** (QR Code) is a matrix symbology consisting of an array of nominally square modules arranged in an overall square pattern. A unique pattern at three of the symbols four corners assists in determining the bar code size, position, and inclination.

A wide range of symbol sizes is possible along with four levels of error correction. User-specified Module dimensions provide a wide variety of symbol production techniques.

QR Code model 1 is the original specification while QR Code model 2 is an enhanced form of the symbology. Model 2 provides additional features and can be automatically differentiated from model 1.

This bar code is printed using field data specified in a subsequent ^FD stream.

Encodable character sets include numeric data, alphanumeric data, 8-bit byte data, and Kanji characters.

Example: ZPL and label output

```
^ XA
^ FO20,20 ^ BQN,2,10 ^ FDMM,AAC-42 ^ FS
^ XZ
```

QR Code

The format for the **^BQ** instruction is:

^BQa,b,c

where

^BQ = **QR Code Bar Code**

a = **Field Position**
Default value: Normal.
Other values:
No rotation is available. The **^FW** command has no effect on rotation.

b = **Model**
Default value: 2 (Enhanced) ***Recommended***
Other values: 1 (Original)

c = **Magnification Factor**
Default value: 1 on 150 dpi printers
2 on 200 dpi printers
3 on 300 dpi printers
Other values: 4 through 10

The following pages provide specific information about the formatting of the ^BQ instruction and the **^FD** statements which contain the information to be bar coded.

If additional information is required, refer to the
International Symbology Specification - QR Code
published by AIM International, Inc.

Special considerations for the ^FD command when using QR Code

The QR switches are formatted into the ^FD field data as follows:

There are two types of Data Input Modes, **Automatic** and **Manual**.
If you specify "**A**" you do not need to specify the character mode.
If you specify "**M**" you will need to specify the character mode.

^FD field data-Normal mode

Automatic Switches

^FD
<Error correction level> **A,**
<Data character string>
^FS

Manual Switches

^FD
<Error correction level> **M,**
<character mode> <data character string>
^FS

^FD field data - Mixed Mode (requires more switches)

Automatic Switches

^FD
<Mixed mode identifier ("D")> <Code No.> <No. of divisions>
<Parity data>,
<Error correction level> **A**,
<Data character string>,
<Data character string>,
<   :   >,
<Data character string n**>
^FS

Manual Switches

^FD
<Mixed mode identifier**>** **<**Code No.> <No. of divisions>
<Parity data>,
<Error correction level> **M,**
<Character mode 1> <Data character string 1>,

<Character mode 2> <Data character string 2>,
< : > < : >,
<Character mode n> <Data character string n**>
^FS

**n = Up to 200 in Mixed mode

QR Code switches which can be used in the ^FD field data string:

Mixed Mode Switches
<Mixed mode identifier>
<No. of divisions>
<Parity data>

Regular Switches
<Error correction level>
<Input mode>
<Character mode>

Data String
<Data character string>

Switch Definitions *many of these switches do not need to be present (see examples on the following pages)

Mixed Mode <D>
Allows the mixing of different types of character modes in one code

Code No. <01 16>
Value = subtracted from the Nth number of the divided code (Must be 2 Digits)

No. of divisions <02 16>
No. of divisions (Must be 2 Digits)

Parity data <1 byte>
Value obtained by calculating at the input data (the original input data before divided byte by byte through the EX-OR operation)

Error correction level <H, Q, M, L>

H	Ultra High Reliability Level
Q	High Reliability Level
M	Standard Level (Default)
L	High density Level

Data input <A, M>

A Automatic input (Default)
Data character string JIS8 unit, Shift JIS. When the input mode is automatic input, the binary codes of 0x80 to 0x9F and 0xE0 to 0xFF cannot be set.

M Manual input

Character mode <N, A, B, K>

N Numeric (0 - 9)

A Alphanumeric (Default) (0 - 9) (A - Z) (SP,$,%,*,+,-,.,/,:)

Bxxxx 8-bit Byte mode
Handles the 8-bit Latin/Kana character set in accordance with JIS X 0201 (character values 0x00 to 0xFF).
xxxx -- No. of data characters is represented by 2 bytes of BCD code

K Kanji - Only handles Kanji characters in accordance with the Shift JIS system based on JIS X 0208. This means that all parameters after the Character mode "K" should be 16-bit characters. If there are any 8-bit characters (such as ASCII code), an error will occur.

Data character string <Data>

Example: QR Code

```
^XA
^FO20,20^BQ,2,10^FDQA,0123456789ABCD 2D code^FS
^XZ
```

<Error correction level>	**Q**	*High reliability level*
<Input mode>	**A**	*Automatic setting*
	,	
<Data character string>		**0123456789ABCD 2D code**

Example: QR Code with automatic mask & automatic data

```
^XA
^FO20,20^BQ,2,10^FDQ,0123456789ABCD 2D code^FS
^XZ
```

<Error correction level>	**Q**	*High reliability level*
<Input mode>		*Automatic (default if not specified)*
	,	
<Data character string>		**0123456789ABCD 2D code**

Example: QR Code

```
^XA
^FO20,20^BQ,2,10^FDHM,N123456789012345^FS
^XZ
```

<Error correction level>	**H**	*Ultra high reliability level*
<Input mode>	**M**	*Manual input*
	,	
<Character mode>	**N**	*Numeric Data*
<Data character string>		**123456789012345**

Example: QR Code

```
^ XA
^ FO20,20 ^ BQ,2,10 ^ FDMM,AAC-42 ^ FS
^ XZ
```

<Error correction level>	**M**	*Standard reliability level*
<Input mode>	**M**	*Manual input*
	,	
<Character mode>	**A**	*Alphanumeric Data*
<Data character string>		**AC-42**

Example: QR Code

```
^ XA
^ FO20,20 ^ BQ,2,10 ^ FDLM,N0123456789012345,AABC,B0006qrcode ^ FS
^ XZ
```

<Error correction level>	**L**	*High density level*
<Input mode>	**M**	*Manual input*
	,	
<Character mode>	**N**	*Numeric Data*
<Data character string>		**0123456789012345**
	,	
<Character mode>	**A**	*Alphanumeric Data*
<Data character string>		**ABC**
	,	
<Character mode>	**B**	*8-bit Byte Data*
	0006	Number of bytes
<Data character string>		**qrcode**

Example: QR Code

```
^XA
^FO20,20^BQ,2,10^FDD03048F,LM,N0123456789,A12AABB,B0006qrcode^FS
^XZ
```

<Mixed mode identifier>	**D**	*Mixed*
<Code No.>	**M**	*Code number*
<No. of divisions>	**D**	*divisions*
<Parity data>	**M**	*0x8F*
	,	
<Error correction level>	**L**	*High density level*
<Input mode>	**M**	*Manual input*
	,	
<Character mode>	**N**	*Numeric Data*
<Data character string>		**0123456789**
	,	
<Character mode>	**A**	*Alphanumeric Data*
<Data character string>		**12AaBb**
	,	
<Character mode>	**B**	*8-bit Byte Data*
	0006	Number of bytes
<Data character string>		**qrcode**

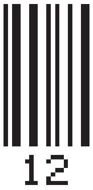
^BS UPC/EAN Extensions

The **^BS** (UPC/EAN extensions) instruction is the 2- and 5-digit add-on used primarily by publishers to create bar codes for ISBN's (International Standard Book Numbers, issued by R.R. Bowker). These extensions are handled as separate bar codes.

Although compatible with the UPC symbol, these extensions cannot be mistaken for a UPC symbol or for part of the UPC symbol by scanners designed to read only standard UPC symbols. This is because the UPC/EAN extension has only one guard pattern (on the left, encoded 1011) and its characters are separated by delineator characters.

Print Ratios Supported: Fixed Ratio.

***^FD** (Field Data) Limitations: Exactly 2 or 5 characters. ZPL II automatically truncates or pads on the left with 0's to achieve required number of characters.*



```
^XA^FO150,100^BY3
^BSN,100,Y,N
^FD12^XZ
```

UPC/EAN Two-digit Extensions

Characters

0	1
2	3
4	5
6	7
8	9

UPC/EAN Two-digit Characters

The format for the **^BS** instruction is:

^BSo,h,f,g

where

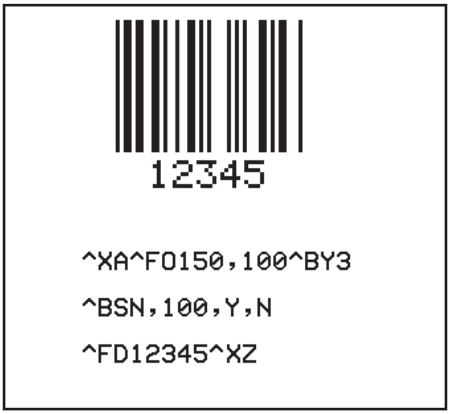
^BS = **UPC/EAN Extension**

o = **Orientation**
Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**
Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**
Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**
Default value: Y = Yes
Other value: N = No



```
^XA^FO150,100^BY3
^BSN,100,Y,N
^FD12345^XZ
```

UPC/EAN Five-digit Extensions

Characters	
0	1
2	3
4	5
6	7
8	9

UPC/EAN Two and Five-digit Characters

Care should be taken in positioning the UPC/EAN extension with respect to the UPC-A (or UPC-E) code to insure the resultant composite code is within the UPC specification.

For UPC codes, with a module width of 2 (default), the Field Origin offsets for the extension are as follows:

UPC-A

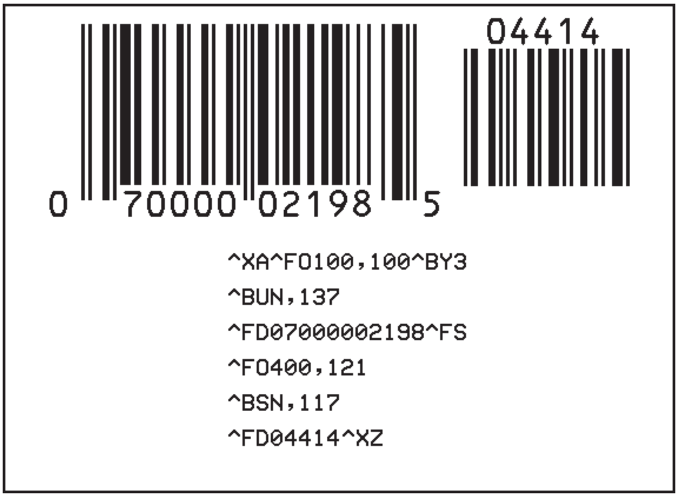
	Supplement Origin	**Adjustment**
	X - Offset	**Y - Offset**
Normal	209 Dots	21 Dots
Rotated	0	209 Dots

UPC-E

	Supplement Origin	**Adjustment**
	X - Offset	**Y - Offset**
Normal	122 Dots	21 Dots
Rotated	0	122 Dots

Additionally, the bar code height for the extension should be 27 dots (0.135 inches) shorter than that of the Primary code. A Primary UPC code height of 183 dots (0.900 inches) would require a extension height of 155 dots (0.765).

The figure below shows an example of how to create a normal UPC-A code for the value 7000002198 with an extension equal to 04414.



```
^XA^FO100,100^BY3
^BUN,137
^FD07000002198^FS
^FO400,121
^BSN,117
^FD04414^XZ
```

UPC-A Bar Code with an Extension

^BU UPC-A Bar Code

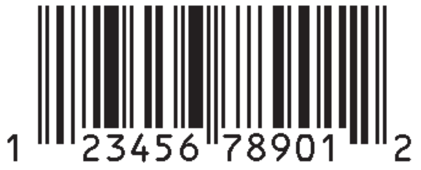
The **^BU** (UPC-A) bar code instruction is a fixed length, numeric, continuous symbology. It is primarily used in the retail industry for labeling packages. The UPC-A bar code has 11 data characters. An 8 dot/mm printhead can produce UPC/EAN symbologies at a magnification factor of 77%.

For more information, refer to a UPC-A Bar Code Specification.

Print Ratios Supported: Fixed Ratio.

***^FD** (Field Data) Limitations: Exactly 11 characters. ZPL II automatically truncates or pads on the left with 0's to achieve required number of characters.*

The UPC-A bar code uses the Mod 10 check digit scheme for error checking. (See Appendix C).



```
^XA^FO150,100^BY3
^BUN,100,Y,N,Y
^FD12345678901^XZ
```

UPC-A Bar Code

Characters	
0	1
2	3
4	5
6	7
8	9

UPC-A Characters

The format for the **^BU** instruction is:

^BUo,h,f,g,e

where

^BU = **UPC-A Bar Code**

o = **Orientation**
Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**
Default value: Value set by ^**BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**
Default value: Y = Yes
Other value: N = No

g = **Print Interpretation Line Above Code**
Default value: N = No
Other value: Y = Yes

e = **Print Check Digit**
Default value: Y = Yes,
Other value: N = No

The font style of the interpretation line depends on the modulus (width of narrow bar) selected in **^BY**:

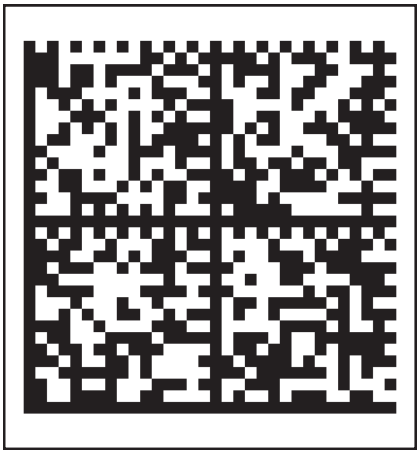
On a 6dot/mm printer: A modulus of 2 dots and greater will print with an OCR-B interpretation line; a modulus of 1 dot will print font A.
On an 8dot/mm printer: A modulus of 3 dots and greater will print with an OCR-B interpretation line; a modulus of 1 or 2 dots will print font A.
On a 12dot/mm printer: A modulus of 4 dots and greater will print with an OCR-B interpretation line; a modulus of 1,2 or 3 dots will print font A.

^BX Data Matrix Bar Code

The **^BX** (Data Matrix) bar code is a two-dimensional matrix symbology which is made up of square modules arranged within a perimeter finder pattern.

Example:

```
^XA
^LL500^LH0,0
^FO100,100^BXN,10,200,,,,
^FDZEBRA TECHNOLOGIES CORP>
333 CORPORATE WOODS PKWY
VERNON HILLS, ILLINOIS   60061-3109^FS
^XZ
```



Data Matrix

The format for the **^BX** instruction is:

^BXo,h,s,c,r,f,g

where

^BX = **Data Matrix Bar Code**

o = **Orientation**

Default value: N = Normal
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Dimensions of Individual Symbol Elements (one to width of label)**

The individual elements are square, so this parameter specifies both the module and row height. If this parameter is zero or not given, the **^BY**, "**h**" bar height parameter will be used as the approximate symbol height.

s = **Quality Level**

Default value: 0
Other values: 50, 80, 100, 140, 200

"Quality" refers to the amount of data that is added to the symbol for error correction. The AIM specification refers to it as the ECC value. ECC 50, ECC 80, ECC 100, and ECC 140 use convolution encoding; ECC 200 uses Reed-Solomon encoding. For new applications, ECC 200 is recommended. ECC 000-140 should only be used in closed applications where a single party controls both the production and reading of the symbols and is responsible for overall system performance.

c = **Columns to Encode ("9" to "49")**

Odd values only for quality "0" to "140" ("10"-"144"); even values only for quality "200."

ECC Level	ID = 1	ID = 2	ID = 3	ID = 4	ID = 5	ID = 6
0	596	452	394	413	310	271
50	457	333	291	305	228	200
80	402	293	256	268	201	176
100	300	218	190	200	150	131
140	144	105	91	96	72	63

Maximum Field Sizes

r = **Rows to Encode (“9” to “49”)**

Odd values only for quality “0” to “140” (“10”-“144”); even values only for quality “200.”

The number of rows and columns in the symbol will be automatically determined. The user may wish to force the number of rows and columns to a larger value to achieve uniform symbol size. In the current implementation, quality “0” to “140” symbols will always be square, so the larger of the rows or columns supplied will be used to force a symbol to that size. If the user attempts to force the data into too small of a symbol, no symbol will be printed. If a value greater than “49” is entered, the rows or columns value will be set to zero and the size will be determined normally. If an even value is entered, it will generate an “Invalid_P” (invalid parameter). If a value less than “9” but not “0”, or if the data is too large for the forced size, no symbol will print; if ^CVY is on, INVALID - L will print.

Quality “200” symbols may be adjusted by the printer to a size that is different than the forced value.

f = **Format ID (“0” to “6”) — Not used with quality “200”**

Default value:

6 Field data is full 256 ISO 8-bit set

Other values:

1 Field data is numeric + space (0..9,’’) — No \&’’

2 Field data is upper-case alphanumeric + space (A..Z,’’) — No \&’’

3 Field data is upper-case alphanumeric + space, period, comma, dash, and slash (0..9,A..Z,".,-/") — No \&

4 Field data is upper-case alphanumeric + space (0..9,A..Z,’’) — No \&’’

5 Field data is full 128 ASCII 7-bit set

The format ID determines what form of data compression can be used. If the field data is invalid for the selected format ID, no symbol will be printed; if **^CVY** is on, INVALID-C will be printed. If the field data has

more than 596 characters, no symbol will be printed; if **^CVY** is on, INVALID-L will be printed.

This parameter has no effect if quality level “200” is selected.

g = **Escape Sequence Control Character**

Default value: ‘_’ (underscore)

Other values: Any character

This parameter is only used if quality “200” is specified. It is the escape character for embedding special control sequences within the field data. Refer to *Field Data* (***^FD****) for Data Matrix* for usage.

Effects of ^BYw,r,h Instruction on Data Matrix

w = Module NO EFFECT (see dimensions of individual symbol elements)

r = Ratio NO EFFECT

h = Height of Symbol

If the dimensions of individual symbol elements are not specified in the **^BD** instruction, the height of symbol value will be divided by the required rows/columns, rounded, limited to a minimum value of one, and used as the dimensions of individual symbol elements.

Field Data (^FD) for Data Matrix

Quality "000"-"140"

- The "\&" and "||" can be used to insert carriage return/line feed and back slash as with PDF417. Other characters in the control character range can only be inserted by using **^FH**. Field data is limited to 596 characters for quality "0" to "140." Excess field data will cause no symbol to be printed; if **^CVY** is on, INVALID-L will be printed. The field data must correspond to a user-specified format ID or no symbol will be printed; if **^CVY** is on, INVALID-C will be printed.
- The maximum field sizes for quality "0" to "140" symbols are shown in the following table:

Quality "200"

- If more than 3072 characters are supplied as field data, it is truncated to 3072 characters. This limits the maximum size of a numeric Data Matrix symbol to less than the 3116 numeric characters that the specification would allow. The maximum alphanumeric capacity is 2335 and the maximum 8-bit byte capacity is 1556.
- If **^FH** is used, field hex processing takes place before the escape sequence processing described below.
- The underscore is the default escape sequence control character for quality "200" field data. A different escape sequence control character may be selected by using parameter "g" in the **^BX** command.

Input string escape sequences may be embedded in quality "200" field data using "_" (ASCII 45, underscore) or the character entered in parameter "g":

- _X is the shift character for control characters (e.g., _@=NUL,_G=BEL,_0 is PAD)
- _1 through _3 for FNC characters 1-3 (explicit FNC4, upper shift, is not allowed)
- FNC1 and FNC3 (Reader Programming) are followed by normal data
- FNC2 (Structured Append) must be followed by 9 digits, composed of three 3-digit numbers with values between 1 and 254, that represent the symbol sequence and file identifier (for example, symbol 3 of 7 with file ID 1001 is represented by 2214001001)
- 5NNN is Code Page NNN where NNN is a 3-digit Code Page value (e.g., Code Page 9 is represented by _5009)
- _dNNN creates ASCII decimal value NNN for a code word (must be 3 digits)
- _ in data is encoded by __ (two underscores)

^BY Bar Code Field Default Instruction

The **^BY** instruction is used to change the values for the Narrow Element Module (Narrow Bar or Space) Width, the Wide Bar to Narrow Bar Width Ratio and the Bar Height. It can be used as often as necessary within a label format.

Ratio Selected (r)	Module Width in Dots (w)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2.0	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1
2.1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2:1	2.1:1
2.2	2:1	2:1	2:1	2:1	2.2:1	2.16:1	2.1:1	2.12:1	2.1:1	2.2:1
2.3	2:1	2:1	2.3:1	2.25:1	2.2:1	2.16:1	2.28:1	2.25:1	2.2:1	2.3:1
2.4	2:1	2:1	2.3:1	2.25:1	2.4:1	2.3:1	2.28:1	2.37:1	2.3:1	2.4:1
2.5	2:1	2.5:1	2.3:1	2.5:1	2.4:1	2.5:1	2.4:1	2.5:1	2.4:1	2.5:1
2.6	2:1	2.5:1	2.3:1	2.5:1	2.6:1	2.5:1	2.57:1	2.5:1	2.5:1	2.6:1
2.7	2:1	2.5:1	2.6:1	2.5:1	2.6:1	2.6:1	2.57:1	2.65:1	2.6:1	2.7:1
2.8	2:1	2.5:1	2.6:1	2.75:1	2.8:1	2.6:1	2.7:1	2.75:1	2.7:1	2.8:1
2.9	2:1	2.5:1	2.6:1	2.75:1	2.8:1	2.8:1	2.85:1	2.87:1	2.8:1	2.9:1
3.0	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1

Bar Code Print Ratios

The format for the **^BY** instruction is:

^BYw,r,h

where

^BY = **Change Bar Code Default Parameters**

w = **Module (Narrow Bar) Width**
Initial power -up value: 2 dots
Acceptable values: 1-10 dots

r = **Wide Bar to Narrow Bar Width Ratio**
Initial power-up ratio: 3.0
Acceptable ratios: From 2.0 to 3.0 in .1 increments.
(No affect on Fixed Ratio bar codes.)

h = **Height of Bars**
Initial Power-up value: 10 dots,
Acceptable values: 1 dot to height of label

For parameter ***r***, the actual ratio generated is a function of the number of dots in parameter ***w,*** narrow bar (module). *See Table - Bar Code Print Ratios on previous page.*

For example, select module width ***w*** at 9 and the ratio ***r*** at 2.4. The width of the narrow bar is 9 dots wide and the wide bar is 9 x 2.4 or 21.6 dots. However, since the printer rounds out to the nearest dot, the wide bar is actually printed at 22 dots.

This produces a bar code with a ratio of 2.44 (22 divided by 9). This ratio is as close to 2.4 as possible since only full dots are printed.

Module width and height (parameters ***w*** and ***h***) may be changed at anytime with the **^BY** instruction regardless of the symbology selected.

NOTE 1: Once a ^BY instruction is entered into a label format, it stays in effect until the another ^BY instruction is encountered.

NOTE 2: Parameter b in the ^BY instruction is overridden by the "h" parameter in any bar code that comes after the ^BY instruction.

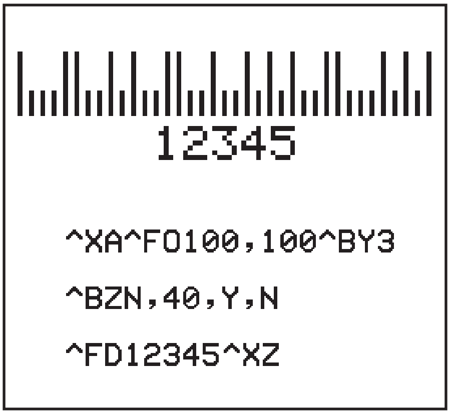
^BZ POSTNET Bar Code

The **^BZ** (POSTNET) bar code is used to automate the handling of mail. POSTNET uses a series of 5 bars, 2 tall and 3 short, to represent the digits 0 through 9.

Print Ratios Supported: Fixed Ratio.

***^FD** (Field Data) Limitations: 100+ characters. Actual amount of data depends on **^BY** ratio and width (length if rotated) of label.*

NOTE: If ^CV (Code Validation) is active, The length of the data field must be 5, 9 or 11 digits. A space or '-' is allowed if it is the sixth digit



```
^XA^FO100,100^BY3
^BZN,40,Y,N
^FD12345^XZ
```

POSTNET Bar Code

Characters

0	1
2	3
4	5
6	7
8	9

POSTNET Characters

The format for the **^BZ** instruction is:

^BZo,h,f,g

where:

^BZ = **POSTNET Bar Code**

o = **Orientation**

Default value: Current **^FW** setting
Other values:
N = Normal
R = Rotated, 90 degrees clockwise
I = Inverted, 180 degrees
B = Read from Bottom Up, 270 degrees

h = **Bar Code Height**

Default value: Value set by **^BY**
Other values: 1 dot to 9999 dots

f = **Print Interpretation Line**

Default value: N = No
Other value: Y = Yes

g = **Print Interpretation Line Above Code**

Default value: N = No
Other value: Y = Yes

^CC Change Caret

~CC

The **^CC**, **~CC** (Change Caret) instruction is used to change the format instruction prefix. The default prefix is the caret **(^)**.

The format for the **^CC, ~CC** instruction is:

^CCx, ~CCx

where

^CC, ~CC = **Change Caret**

x = **Any ASCII Character**
Default value: Parameter is required. If none is used, the next character received is the new prefix character.

NOTE 1: ^ and ~ are interchangeable only on the CC command.

NOTE 2: Do not set any of the values to the same value as another prefix.

^CD Change Delimiter

~CD

The **^CD, ~CD** (Change Delimiter) instruction is used to change the ZPL II delimiter character. This character is used to separate parameter values associated with several ZPL instructions. The default delimiter character is a comma **(,)**.

The format for the **^CD, ~CD** instruction is:

^CDa, ~CDa

where

^CD, ~CD = **Change Delimiter**

a = **Any ASCII Character.**
Default value: Parameter is required. If none is used, the next character received is the new delimiter character.

^CF Change Alphanumeric Default Font

You can use the **^CF** (Change Alphanumeric Default Font) instruction to keep your programs simple. For an example of using **^CF** in a ZPL II script, see page 92.

The format for the **^CF** instruction is:

^CFf,h,w

where

^CF = **Change Alphanumeric Default Font**

f = **Specified Default Font:**
A = font A **{I.V.P.}**
Other values: B thru H, and Ø-9.
(Any font in the printer including downloaded fonts, EPROM stored fonts and fonts A-Z and 1-9 can be selected via **^CW**.)

h = **Individual Character Height in Dots**
Acceptable values: 0-9999 **{I.V.P. = 9}**

w = **Individual Character Width in Dots**
Acceptable values: 0-9999 **{I.V.P. = 5}**
I.V.P. = Last permanent value saved

Parameter ***f*** specifies the default font for every alphanumeric field. Parameter ***h*** is default height for every alpha field, parameter ***w*** is default width value for every alpha field.

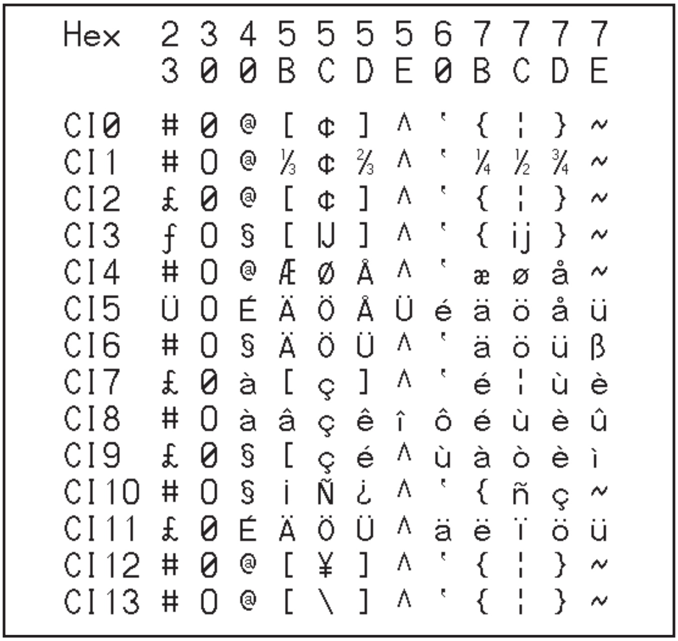
The default alphanumeric font is A. If you do not change the alphanumeric default font (**^CF** instruction)**,** do not use any alphanumeric field instruction (**^Af**) or enter an invalid font value, any data you specify will print in font A.

Defining *only* the height *or* width forces the magnification to be proportional to the parameter defined. If neither value is defined, the last **^CF** values given or the default **^CF** values for height and width are used.

^CI Change International Font

Zebra printers can print all fonts using various international character sets: USA1, USA2, UK, Holland, Denmark/Norway, Sweden/Finland, Germany, France 1, France 2, Italy, Spain and miscellaneous. ZPL II follows the ISO standards for international characters.

The **^CI** (Change International Font) instruction enables you to call up the international character set you want to use for printing. You can mix character sets on a label. The illustration below shows the international character sets available. The instruction to call an international character set is



Hex	2	3	4	5	5	5	5	6	7	7	7	7
	3	0	0	B	C	D	E	0	B	C	D	E
CI0	#	0	@	[	¢	]	^	`	{	¦	}	~
CI1	#	0	@	⅓	¢	⅔	^	`	¼	½	¾	~
CI2	£	0	@	[	¢	]	^	`	{	¦	}	~
CI3	ƒ	0	§	[	Ĳ	]	^	`	{	ĳ	}	~
CI4	#	0	@	Æ	Ø	Å	^	`	æ	ø	å	~
CI5	Ü	0	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
CI6	#	0	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
CI7	£	0	à	[	ç	]	^	`	é	¦	ù	è
CI8	#	0	à	â	ç	ê	î	ô	é	ù	è	û
CI9	£	0	§	[	ç	é	^	ù	à	ò	è	ì
CI10	#	0	§	¡	Ñ	¿	^	`	{	ñ	ç	~
CI11	£	0	É	Ä	Ö	Ü	^	ä	ë	ï	ö	ü
CI12	#	0	@	[	¥	]	^	`	{	¦	}	~
CI13	#	0	@	[	\	]	^	`	{	¦	}	~

International Character Sets

The format for the **^CI** instruction is:

^ CIa

where

^ CI = **Change International Font**

a = **Desired Character Set**

0 = USA1 **{I.V.P.}**
Other acceptable values:
1 = USA2
2 = UK
3 = Holland
4 = Denmark/Norway
5 = Sweden/Finland
6 = German
7 = France 1
8 = France 2
9 = Italy
10 = Spain
11 = Miscellaneous
12 = Japan (ASCII with Yen sign)
13 = IBM Code Page 850

Effective for Version X.7.0, 16.5.0
14 = 16-bit (Unicode) encoded scalable fonts*
15 = Shift-JIS for scalable Japanese fonts**
16 = EUC-Kanji for scalable fonts
17 = Reserved
18 = Reserved
19 = Reserved
20 = Reserved

I.V.P. = Last permanent value saved

* The encoding is controlled by the conversion table (*.DAT). The table generated by ZTools is the TrueType font's internal encoding (Unicode).

** Shift-JIS encoding converts Shift-JIS to JIS and then looks up the JIS conversion in JIS.DAT. This table must be present for Shift-JIS to function.

^CO Cache On

The **^CO** (Cache On) instruction is used to change the size of the character cache. By definition, a “character cache” (from here on referred to as cache) is a portion of the DRAM reserved for storing scalable characters. All printers have a default 22K cache that is *always* turned on. The maximum single character size that can be stored, without changing the size of the cache, is 450 dots x 450 dots.

There are two types of fonts used in Zebra printers: bitmapped and scalable. Letters, numbers, and symbols in a bitmapped font have a fixed size. For example 10 points, 12 points, 14 points, etc. On the other hand, scalable fonts are not fixed in size. Their size is user selectable.

Because their sized is fixed, bitmapped fonts can be moved quickly to the label. By contrast, scalable fonts are much slower because each character is built on an as-needed basis before it is moved to the label. By storing scaled characters in a “cache” they can be recalled at a much faster speed.

The number of characters that can be stored in the cache depends on two factors; the size of the cache (memory) and the size of the character (in points) being saved. The larger the point size, the more space in the cache it uses. The default cache stores every scalable character that is requested for use on a label(s). If the same character, with the same rotation and size is used again, it is quickly retrieved from the cache.

It is quite possible that after a while, the print cache could become full. Once this happens space for new characters is obtained by eliminating an existing character from the print cache. Existing characters are eliminated by determining how often they have been used. This is done automatically. For example, a 28 point “Q” that was used only once would be a good candidate for elimination from the cache.

Maximum size of a single print cache character is 1500 dots x 1500 dots. It would require a cache of 300K for this.

When the cache is too small for the desired style, smaller characters may appear but larger characters will not. If possible, increase the size of the cache.

NOTE: The cache can be resized as often as needed. Any characters in the cache when it is resized are lost. Memory used for the cache reduces the space available for label bitmaps, graphic, downloaded fonts, etc.

The format for the **^CO** instruction is:

^COa,b,c

where:

^CO = **Cache On**

a = **Cache On**
Default value: Y = Yes
Other value: N = No

b = **Amount of Additional ‘K of Memory’ to be Added to Cache.**
(Default value: 40K (if no number specified)

Effective for Version 16.5.0
Other value: 300 (recommended for Kanji font)

c = **Cache Type**
Effective for Version 16.5.0
Default value: 0 = Cache Buffer (normal fonts)
1 = Internal Buffer (recommended for Kanji font)

NOTE: Kanji requires an internal working buffer which is much larger than the normal cache. Since most fonts do not require this larger buffer, it is now a selectable configuration option. Printing with the Kanji font will greatly reduce the printer memory available for labels, graphics, fonts and formats.

The following is an example using the **^CO** instruction.

To resize the print cache to 62K:

^COY 40K (default memory) + 22K (existing cache) = 62K

To resize the print cache to 100K:

^COY,78 78K (memory added) + 22K (existing cache) = 100K

Print Cache Performance

For printing large characters, memory added to the cache by the **^CO** instruction is not physically added to the 22K cache already in the printer. In the second example above, the resultant 100K cache is actually two separate blocks of memory, 22K and 78K.

Since large characters need contiguous blocks of memory, a character requiring a cache of 90K would not be completely stored because neither portion of the 100K cache is big enough. Therefore, if large characters are needed, the **^CO** instruction should reflect the actual size of the cache you need.

Increasing the size of the cache will improve the performance in printing scalable fonts. However, the performance will start to go down if the size of the cache becomes large and contains too many characters. The performance gained will be lost because of the time involved in searching through the cache for all of the characters.

^CT

Change Tilde

~CT

The **^CT, ~CT** (Change Tilde) instruction is used to change the control instruction prefix. The default prefix is the tilde **(~)**.

The format for the **^CT, ~CT** instruction is**:**

^CTa, ~CTa

where

^CT, ~CT = **Change Tilde**

a = **Any ASCII Character**
*Default value:*Parameter is required. If none is used, the next character received is the new prefix character.

To use the caret instructions, you must enclose them within format bracket instructions (**^XA** and **^XZ**; see pages 332 and338 respectively). For example, to change the format instruction prefix to a slash (/) and the delimiter character to (+), you would include in a program a line like this:

```
^XA^CD+^CC/^XZ
```

^CV Code Validation

The **^CV** (Code Validation) instruction acts as a switch to turn the code validation function ON and OFF. When this instruction is turned ON, all bar code data will be checked for the following error conditions:

Character not in character set
Check digit incorrect
Data field too long (too many characters)
Data field too short (too few characters)
Parameter string contains incorrect data or missing parameter

When invalid data is detected, an error message and code will be printed in reverse image in place of the bar code. The message will read “INVALID - X” where “X” is one of the following error codes:

C = Character not in character set
E = Check digit incorrect
L = Data field too long
S = Data field too short
P = Parameter (occurs only on select bar codes)

Once turned on, the **^CV** instruction will remain active from format to format until turned off by another **^CV** instruction or the printer is turned off. The instruction IS NOT permanently saved.

NOTE: If more than one error exists, the first error detected will be the one displayed.

The format for the **^CV** instruction is:

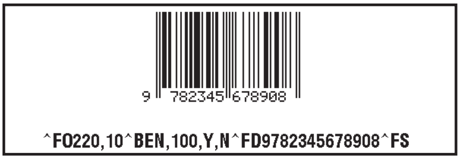
^CVa

where:

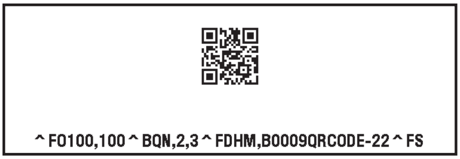
^CV = **Bar Code Validation**

a = **Code Validation**
Default value: N = No
Other values: Y = Yes

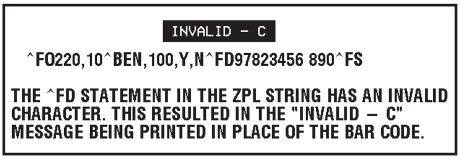
The following is an example of how the **^CV** instruction works. The top sample (both columns) is a correctly printed bar code. It is followed by an example of the error messages.



```
^FO220,10^BEN,100,Y,N^FD9782345678908^FS
```



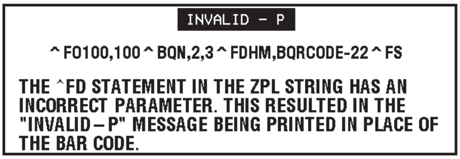
```
^FO100,100^BQN,2,3^FDHM,B0009QRCODE-22^FS
```



INVALID - C

```
^FO220,10^BEN,100,Y,N^FD97823456 890^FS
```

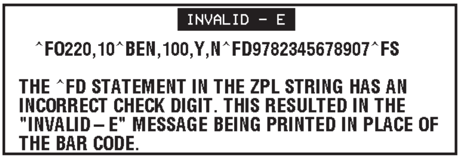
THE ^FD STATEMENT IN THE ZPL STRING HAS AN INVALID CHARACTER. THIS RESULTED IN THE "INVALID – C" MESSAGE BEING PRINTED IN PLACE OF THE BAR CODE.



INVALID - P

```
^FO100,100^BQN,2,3^FDHM,BQRCODE-22^FS
```

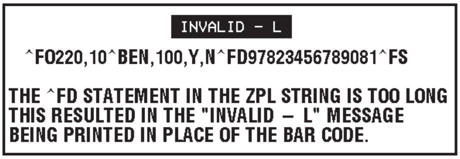
THE ^FD STATEMENT IN THE ZPL STRING HAS AN INCORRECT PARAMETER. THIS RESULTED IN THE "INVALID–P" MESSAGE BEING PRINTED IN PLACE OF THE BAR CODE.



INVALID - E

```
^FO220,10^BEN,100,Y,N^FD9782345678907^FS
```

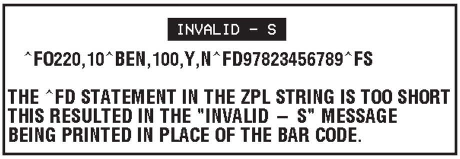
THE ^FD STATEMENT IN THE ZPL STRING HAS AN INCORRECT CHECK DIGIT. THIS RESULTED IN THE "INVALID–E" MESSAGE BEING PRINTED IN PLACE OF THE BAR CODE.



INVALID - L

```
^FO220,10^BEN,100,Y,N^FD97823456789081^FS
```

THE ^FD STATEMENT IN THE ZPL STRING IS TOO LONG THIS RESULTED IN THE "INVALID – L" MESSAGE BEING PRINTED IN PLACE OF THE BAR CODE.



INVALID - S

```
^FO220,10^BEN,100,Y,N^FD97823456789^FS
```

THE ^FD STATEMENT IN THE ZPL STRING IS TOO SHORT THIS RESULTED IN THE "INVALID – S" MESSAGE BEING PRINTED IN PLACE OF THE BAR CODE.

^CW Font Identifier

All built-in fonts have a one-character identifier i.e. A, B, C, etc. The **^CW** (Font Identifier) instruction assigns a single alphanumeric character (A to Z and 0 to 9) to a font downloaded to DRAM R:, MEMORY CARD B:, EPROM E:, or BUILT-IN Z:.

If the assigned character is the same as that of a built-in font, the downloaded font is used in place of the built-in font. The new font will be printed on the label wherever the format calls for the built-in font. If used in place of a built in font, the change is only in effect until Power Off.

If the assigned character is different, the downloaded font is used as an additional font. The assignment will remain in effect until a new instruction is issued or the printer turned off.

The format for the **^CW** instruction is:

```
^CWa,d,f
```

where:

^CW = **Font Identifier**
Use new font for ZPL II calls.

a = **The Letter of the Built-in Font to be Substituted or the New Font to be Added.**
(A ***required*** one character entry.)

d = **Source Device where Font is Stored**
(Optional. Default is R:)

f = **The Name of the Downloaded Font to be Substituted for the Built-in Font or as an Additional Font**
(Extension fixed at .FNT.)
Default: Unknown.

The following are some examples of using the **^CW** instruction.

To use MYFONT.FNT stored in DRAM, whenever a format calls for Font A:

```
^XA^CWA,R:MYFONT.FNT^XZ
```

To use MYFONT.FNT stored in DRAM, as additional font Q:

```
^XA^CWQ,R:MYFONT.FNT^XZ
```

To use NEWFONT.FNT stored in DRAM, whenever a format calls for Font F:

```
^XA^CWF,R:NEWFONT.FNT^XZ
```

~DB Download Bitmap Font

The **~DB** (Download Bitmap Font) instruction sets the printer to receive a downloaded bitmap font, defines native cell size, baseline, space size and copyright.

This instruction consists of two portions, a ZPL II instruction which defines the font and a structured data segment which defines each character of the font.

The following is an example of how to use the **~DB** instruction. It shows the first two characters of a font being downloaded to DRAM.

```
~DBR:TIMES.FNT,N,5,24,3,10,2,ZEBRA 1992,

    #0025.5.16.2.5.18.
    OOFF
    OOFF
    FFOO
    FFOO
    FFFF

    #0037.4.24.3.6.26.
    OOFFOO
    OFOOFO
    OFOOFO
    OOFFOO
```

The format for the **~DB** instruction is:

~DBd,o,x,a,h,w,base,space,#char,©,DATA

where:

~DB = **Set Printer to Accept Download Bitmap Font**

d = **Destination Device to Store Font**
{Fixed. Will always be DRAM(R:)}

o = **Name of Font, 1-8 Alphanumeric Characters**
Default: Unknown.

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .FNT}

a = **Orientation of Native Font**
(N=Normal=default, R=90, I=180, B=270)
Currently, only N is supported.

h = **Maximum Height of Cell in Dots.**

w = **Maximum Width of Cell in Dots.**

base = **Dots from Top of Cell to Character Baseline.**

space = **Width of Space or Nonexistent Characters**

#char = **Number of Characters in Font**
(This MUST match the number of characters being downloaded.)

© = **Holder of Copyright**
(Maximum length of text string is 63 characters.)

DATA = **Structured ASCII Data which Defines Each Character in the Font**

The # symbol signifies character code parameters which are separated with periods. The character code is from 1 to 4 characters to allow for large international character sets to be downloaded to the printer.

The data structure is:

#xxxx.h.w.x.y.i.data

where:

#xxxx = character code

h = bitmap height (in dot rows)

w = bitmap width (in dot rows)

x = x-offset (in dots)

y = y-offset (in dots)

i = typesetting motion displacement (width including intercharacter gap of a particular character in the font)

data = HEX bitmap description

^DD Download Direct Bitmap

The **^DD** (Download Direct Bitmap) command causes a downloaded image to print directly rather than being stored in memory.

NOTE: *Refer to the* ***~DG*** *(Download Graphic) description for more information about calculating the parameters needed for this command.*

The format for the **~DD** instruction is:

^DDa,b,DATA

where

^DD = **Download (an image) Direct into Bitmap**

a = **Total Number of Bytes in Graphic**

Default value: None - entire command is ignored when not specified.

Other values: Enter a value corresponding to the number of bytes in the graphic.

Range: 1 to 99999. Out of range is set tothe nearest limit.

b = **Total Number of Bytes per Row**

Default value: None - entire command is ignored when not specified.

Other values: Enter a value corresponding to the number of bytes in each row of the graphic.

Range: 1 - 9999

DATA = **A String of ASCII Hex Numbers (2 Digits per Byte) that Defines an Image**

CR and LF can be interspersed as needed for readability. The number of 2-digit number pairs must match the number of bytes in the graphic specified above. Any numbers sent after the specified data has been sent are ignored. A comma in the data will pad the current line with “00" (white space), thereby allowing minimization of data sent. The **~DN** instruction or any caret or tilde character prematurely aborts the download.

Default: None. Must be specified.

Range: 00 to FF

~DE Download Encoding

The standard encoding for TrueType® Windows fonts is always Unicode. Therefore, the ZPL field data must be converted from some other encoding to Unicode. The required translation table is downloaded with the **~DE** (Download Encoding) command. These tables are provided with ***ZTools™ for Windows***.

The only font conversion currently supported is JIS and Shift-JIS to Unicode.

The format for the **~DE** instruction is:

~DEn,s,DATA

Where

~DE = **Download Encoding Table for Unbounded Unicode TrueType Font**

n = **Table Name**

Default value:
NO NAME = The command is ignored
Other values:
Enter a Destination Indicator followed by the Table Name (up to 8 characters maximum)
Destination Indicators:
R: = RAM Memory
B: = Memory Card

s = **Table Size**

Default value:
NO VALUE = The command is ignored
Other values:
Enter the number of bytes of memory required to hold the Zebra Downloadable Format of the Font

DATA = **Data String**

Default value:
NO VALUE = The command is ignored
Other values:
A string of ASCII Hex values
(2 hex digits/byte)

The total number of 2-digit values must match the “Table Size” value. (An insufficient number of bytes causes the entire command to be ignored.)

Example:

```
~DER:JIS.DAT,27848,300021213001........
          (27848 2-digit hex values)
```

^DF Download Format

The **^DF** (Download Format) instruction saves the ZPL II format instructions as text strings to be later merged using **^XF** with variable data. The format to be stored may contain Field Number (**^FN**) instructions to be referenced when recalled.

While use of stored formats will reduce transmission time, no formatting time is saved since this instruction saves the ZPL II as text strings which need to be formatted at print time.

If the image name is omitted, the default name and extension "UNKNOWN.ZPL" will be used. Enter the **^DF** (Download Format) instruction immediately after the **^XA** instruction, then enter the format instructions to be saved.

NOTE: A format containing a ^DF will not print. Results are undefined for any instructions that appear prior to the ^DF in a format.

The format for the **^DF** instruction is:

^DFd,o,x

where

^DF = **Download and Store Format**

d = **Destination Device to Store Image.**
{Fixed. Will always be DRAM(R:)}

o = **Name of Image, 1-8 Alphanumeric Characters**
(Default, the name "UNKNOWN" is used.)

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .ZPL}

The following is an example of using the **^DF** instruction to download and store ZPL II text strings to DRAM. The name used to store the text strings is STOREFMT.ZPL.

```
^XA
^DFR:STOREFMT.ZPL^FS
^FO25,25^AD,36,20^FN1^FS
^FO135,25^AD,36,20^FN2^FS
^FO25,75^AB,11,7^FDBUILT BY^FS
^FO25,100^AD,18,10^FN1^FS
^XZ
```

~DG Download Graphic

The **~DG** (Download Graphic) instruction performs the following functions:

1. Puts the printer into Graphics Mode.
2. Names the graphic.
   (This name is used to recall it into a label.)
3. Defines the size of the graphic.
4. Downloads the HEX string to the printer.

NOTE 1: As far as the printer is concerned, the name used for the graphic image will end at a space, period, or extension.

NOTE 2: To avoid accidental replacement of graphics due to spaces in the names, do not use spaces in graphic names. Always use different names for different graphics.

NOTE 3: If two graphics with the same name are sent to the printer, the first graphic will be erased and replaced by the second graphic.

The format for the **~DG** instruction is:

~DGd,o,x,t,w,DATA

where

~DG = **Set Printer to Download Graphic Mode**

d = **Destination Device to Store Image**
Default value:R:(DRAM)
Other value: B:(Optional Memory)

o = **Name of Image, 1-8 Alphanumeric Characters**
(Default, the name "UNKNOWN" is used.)

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .GRF}

t = **Total Number of Bytes in Graphic**

w = **Number of Bytes Per Row**

DATA = **ASCII Hexadecimal String that Defines Image**

If the "**o**" parameter is omitted, the default name "UNKNOWN.GRF" will be used. The DATA string which defines the image is an ASCII Hexadecimal representation of the image. Each character represents a horizontal nibble of four dots.

The following is an example of using the **~DG** instruction to load a checkerboard pattern into DRAM. The name used to store the graphic is SAMPLE.GRF.

```
~DGR:SAMPLE.GRF,00080,010,

FFFFFFFFFFFFFFFFFFFF
8000FFFF0000FFFF0001
8000FFFF0000FFFF0001
8000FFFF0000FFFF0001
FFFF0000FFFF0000FFFF
FFFF0000FFFF0000FFFF
FFFF0000FFFF0000FFFF
FFFFFFFFFFFFFFFFFFFF
```

The “t” parameter (the total number of bytes in a graphic) can be determined by using the following formula:

$$\frac{x \times \mathit{(dots/mm)}}{8\ \mathit{(bits/byte)}} \times (y \times \mathit{(dots/mm)}) = \text{total bytes}$$

where *x* is the width of the graphic in millimeters, *y* is the height of the graphic in millimeters and *dots/mm* is the print density of the printer being programmed.

For example, to determine the correct *t* parameter for a graphic 8mm wide, 16mm high and a print density of 8 dots/mm, the formula works this way:

$$\left(\frac{8 \times 8}{8}\right)^{*} \times (16 \times 8) = \text{total bytes}$$

$$8 \times 128 = 1024 \text{ bytes}$$

$$t = 1024$$

NOTE: * Raise any portion of a byte to the next whole byte.

The “**w**” parameter (the width in terms of bytes per row) can be determined by using the following formula:

$$\frac{x \times \mathit{(dots/mm)}^{*}}{8} = \text{total bytes per row}$$

where *x* is the width of the graphic in millimeters and *dots/mm* is the print density of the printer being programmed.

For example, to determine the correct *w* parameter for a graphic 8mm wide and a print density of 8 dots/mm, the formula works this way:

$$\frac{8 \times 8}{8} = 8 \text{ bytes}$$

$$w = 8$$

NOTE 1: Raise any portion of a byte to the next whole byte.

NOTE 2: *‘w’* ***is the first value in the*** *‘t’* ***calculation.***

Parameter *DATA* is a string of Hexadecimal numbers sent as a representation of the graphic image. Each Hexadecimal character represents a horizontal nibble of four dots. For example, if the first four dots of the graphic image to be created should be white and the next four black, the dot by dot Binary code would be 00001111. The Hexadecimal representation of this Binary value would be 0F. The entire graphic image is coded in this way. The complete graphic image is sent as one long continuous string of Hexadecimal values.

~DN Abort Download Graphic

After decoding and printing the number of bytes in parameter “*t*” of the **^DG** command, the printer returns to normal print mode. Graphics Mode can be aborted and normal printer operation resumed by using the **~DN** (Abort Download Graphic) instruction.

The format for the **~DN** instruction is:

~DN

where

~DN = **Abort Download Graphic**

NOTE: Any ^ or ~ instruction will also end the download

~DS Download Scalable Font

The **~DS** (Download Scalable Font) instruction is used to set the printer to receive a downloadable scalable font and defines the size of the font in bytes.

The **~DS** instruction, and its associated parameters, are the result of converting a vendor supplied font for use on a Zebra printer. The conversion is done using the Zebra Tools Utility Program called ***ZFONT***. The utility program is available from Zebra Technologies.

The format for the **~DS** instruction is:

~DSd,o,x,s,DATA

where:

~DS = **Set printer to accept download soft scalable font**

d = **Destination Device to Sore Font**
Default value:R:(DRAM)
Other value: B:(Optional Memory)

o = **Name of Font, 1-8 Alphanumeric Characters**
Default: Unknown.

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .FNT}

s = **Size of Font in Bytes**
This number was generated by the ***ZFONT*** program. It should not be changed.

DATA = **ASCII Hex String which Defines the Font**
This data was generated by the ***ZFONT*** program. It should not be changed.

The following example shows the first three lines of a converted scalable font that is ready to be downloaded to the printer. If necessary the destination and object name can be changed.

```
~DSB:CGTIMES.FNT,37080,

00FF00FF00FF00FF
FF0AECB28FFF00FF
```

NOTE: Downloaded scalable fonts are not checked for integrity. If they are corrupted, they will cause unpredictable results at the printer.

~DT Download TrueType® Font

The ***ZTools™ for Windows*** program must be used to convert the TrueType® font to a Zebra-downloadable format. This program creates a downloadable file that includes a **~DT** (Download TrueType®) command. Once downloaded, the font will function just like the earlier Intellifont software.

The format for the **~DT** instruction is:

~DTf,s,DATA

where

~DT = **Download TrueType® Font**

f = **Font Name**

Default value:

NO NAME = The command is ignored

Other values:

Enter a Destination Indicator followed by the TrueType Name (up to 8 characters maximum)

Destination Indicators:

R: = RAM Memory

B: = Memory Card

s = **Font Size**

Default value:

NO VALUE = The command is ignored

Other values:

Enter the number of bytes of memory required to hold the Zebra Downloadable Format of the Font

DATA = **Data String**

Default value:

NO VALUE = The command is ignored

Other values:

A string of ASCII Hex values
(2 hex digits/byte)

The total number of 2-digit values must match the “Font Size” value. (An insufficient number of bytes causes the entire command to be ignored.)

Example:

```
~DTR:FONT,52010,00AF01B0C65E.......
          (52010 2-digit hex values)
```

~DU Download Unbounded (TrueType® Font)

Some international fonts have more than 256 printable characters. These fonts are supported as “Large TrueType® Fonts” and are downloaded to the printer with the **~DU** (Download Unbounded) command.

The Field Block (**^FB**) command cannot support the large TrueType® fonts.

The format for the ~**DU** instruction is:

~DUf,s,DATA

where

~DU = **Download Unbounded Unicode TrueType Font**

f = **Font Name**

Default value:

NO NAME = The command is ignored

Other values:

Enter a Destination Indicator followed by the TrueType Name (up to 8 characters maximum)

Destination Indicators:

R: = RAM Memory

B: = Memory Card

s = **Font Size**

Default value:

NO VALUE = The command is ignored

Other values:

Enter the number of bytes of memory required to hold the Zebra Downloadable Format of the Font

DATA = **Data String**

Default value:

NO VALUE = The command is ignored

Other values:

A string of ASCII Hex values (2 hex digits/byte)

The total number of 2-digit values must match the “Font Size” value. (An insufficient number of bytes causes the entire command to be ignored.)

Example:

```
~DUR:KANJI,86753,60CA017B0CE7........
          (86753 2-digit hex values)
```

^EF Initialize/Erase Stored Formats

~EF

The **^EF** or **~EF** (Erase Format) instruction erases all stored formats. If you use the erase format instruction, you erase all stored formats. (Stored formats can be selectively erased using the **^ID** instruction.)

The format of the **^EF** or **~EF** instruction is:

^ EF or ~EF

where

^ EF, ~EF = **Erase Format**

^EG Erase Download Graphics

~EG

The **^EG** or **~EG** (Erase Downloaded Graphics) instruction is used to delete all graphic images (label format images and hexadecimal images) from DRAM.

The format for the **~EG** or **^EG** instruction is:

~EG or ^ EG

where

~EG, ^ EG = **Erase Downloaded Graphics**

^FA Field Allocate

Use the **^FA** (Field Allocate) instruction to allocate space for the field to be saved.

The format for the **^FA** instruction is:

^FAn

where

^FA = **Field Allocate**

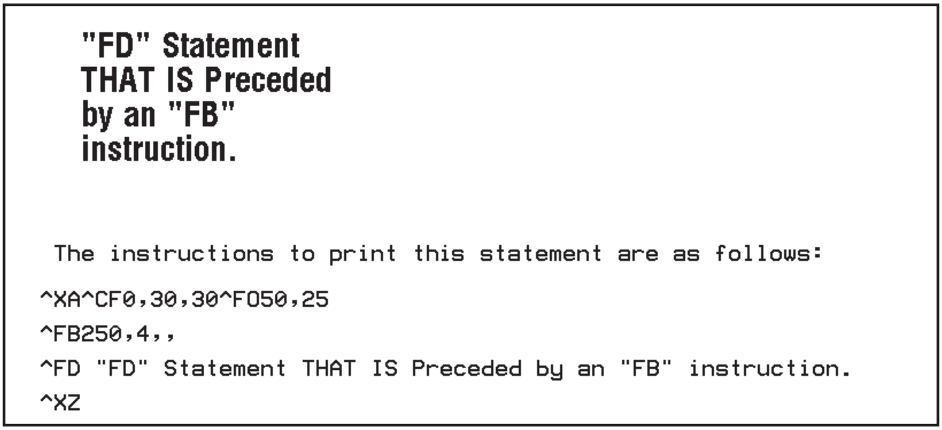
n = **Number of Character Spaces to be Saved**
Default value: None
Instruction is ignored if no value is specified.
Minimum = 1, Maximum = 256

Effective for Versions 14.4.0, 15.4.0, 20.4.0, 23.6.0, 25.6.0
Maximum = 3072

^FB Field Block

The **^FB** (Field Block) instruction allows you to print text into a defined “block type ” format. This instruction formats an **^FD** text string into a block of text using the origin, font and rotation specified for the text string. This instruction also contains an automatic word wrap function.

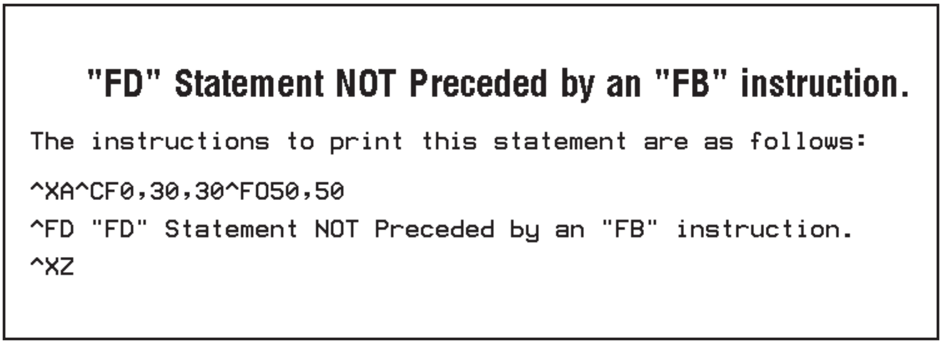
The following is an example of how the **^FB** instruction affects the field data.



"FD" Statement
THAT IS Preceded
by an "FB"
instruction.

The instructions to print this statement are as follows:

```
^XA^CF0,30,30^FO50,25
^FB250,4,,
^FD "FD" Statement THAT IS Preceded by an "FB" instruction.
^XZ
```



"FD" Statement NOT Preceded by an "FB" instruction.

The instructions to print this statement are as follows:

```
^XA^CF0,30,30^FO50,50
^FD "FD" Statement NOT Preceded by an "FB" instruction.
^XZ
```

The format for the **^FB** instruction is:

^ FBa,b,c,d,e

where

^ FB = **Define Field Block**

a = **Width of Text Block Line in Dots**

Valid data: Minimum = one character width.
Maximum = label width.

Default value: = 0

Acceptable values: 0 - 9999

NOTE: If value is less than font width or not specified, text block will not print.

b = **Maximum Number of Lines in Text Block**

Default value: 1 line

Acceptable values: 1 - 9999.

NOTE: Text exceeding the maximum number of lines will overwrite the last line. Changing the font size will automatically increase or decrease the size of the block.

c = **Add or Delete Space Between Lines in Dots**

Default value: = 0

Acceptable values: -9999 to +9999

NOTE: Numbers are considered to be positive unless preceded by a minus sign. Positive values add space; negative values delete space.

d = **Justification of Text in Block**

Default value: = L (Left)

Acceptable values: L (Left), C (Center),
J (Margin to Margin) and R (Right)

NOTE: Last line is "left justified" if "J" is used.

e = **Secondary Left Margin. How far, in dots, second and all remaining lines in text block will be indented.**

Acceptable values: 0 - 9999

Notes Concerning the ^FB Instruction

- The following scheme can be used to facilitate special functions.

" \& "	=	carriage return/line feed
" \(*)"	=	soft hyphen (word break with a dash)
" \\ "	=	\ (See Item 1 below)

  Item 1: ^CI13 must be selected in order to print a \.

  Item 2: If a soft hyphen is placed near the end of a line, the hyphen will be printed. If it is not placed near the end of the line, it will be ignored.

  (*) = Any alphanumeric character.

- If a word is too long to print on one line by itself (and no soft hyphen is specified), a hyphen will automatically be placed in the word at the right edge of the block. The remainder of the word will be on the next line. *(The position of the hyphen depends on word length not a syllable boundary. Placing a soft hyphen with a word controls where the hyphenation will occur.)*

- Maximum data string length is 3K including control characters and carriage return/line feeds.

- Normal carriage return/line feeds and 'word spaces' at line breaks are discarded.

- When using **^FT** (Field Typeset) **- ^FT** uses the baseline origin of the last possible line of text. Increasing the font size will cause the text block to increase in size from bottom to top. (Could cause label to print past top of label.)

- When using **^FO** (Field Origin) - Increasing the font size will cause the text block to increase in size from top to bottom.

- If an **^SN** is used instead of an **^FD**, the field will not print.

- An **^FS** terminates an **^FB** statement. Each block requires its own **^FB** instruction.

^FD Field Data

The **^FD** (Field Data) instruction defines the data string for the field. The field data can be any printable character *except* those used as instruction prefixes (i.e. ^ and ~).

The format for the **^FD** instruction is:

^ FDa

where

^ FD	=	**Enter Field Data**
a	=	**Data to be Printed**

NOTE 1: The field data string is limited to 3072 characters.

NOTE 2: The ^ and ~ characters can be printed by changing the prefix characters - see the CC and CT instructions (Note: The new prefix characters cannot be printed.)

NOTE 3: Characters with codes above 127, or the ^ and ~ characters can be printed using the ^FH and ^FD instructions.

Effective for Versions 14.4.0, 15.2.1, 20.4.0, 23.6.0, 25.6.0
In the past, CR/LF (Carriage Return/Line Feed) were ignored in **^FD** statements. However, with the support for the **^B7** (PDF417 Bar Code) and the **^FB** (Field Block) instruction, CR/LF have become valid characters for all **^FD** statements.

- The following scheme can be used to facilitate special functions.

“ \& ”	= carriage return/line feed
“ \(*)”	= soft hyphen (word break with a dash)
“ \\ ”	= \ (See Item 1 below)

Item 1: ^CI13 must be selected in order to print a \.

Item 2: If a soft hyphen is placed near the end of a line, the hyphen will be printed. If it is not placed near the end of the line, it will be ignored.

^FH Field HEX

The **^FH** (Field HEX) instruction allows you to enter the hexadecimal value for any character directly into the **^FD** statement. The **^FH** instruction *must* precede each **^FD** instruction in which it will be used.

Within the **^FD** statement, the HEX indicator must precede each Hexadecimal value. The default HEX indicator is the underscore "_". The 'a' parameter can be added when a different HEX indicator is needed.

This instruction can be used with any of the instructions that have field data (i.e. **^FD, ^FV** (Field Variable)**,** and **^SN** (Serialized Data)).

Valid HEX characters are:

0 1 2 3 4 5 6 7 8 9 A B C D E F a b c d e f

The format for the **^FH** instruction is:

^ FHa

where

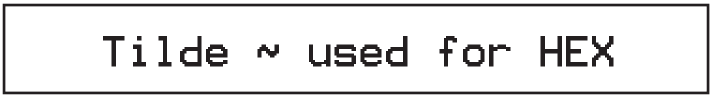
^ FH = **Field HEX Instruction**

a = **HEX Indicator**
{I.V.P. = _ (underscore)}
Other Acceptable values: Any character except current Format and Control prefix.

Example:

```
^ FO100,100 ^ AD ^ FH ^ FDTilde _7e used for HEX ^ FS
^ FO100,100 ^ AD ^ FH\ ^ FDTilde \7E used for HEX ^ FS
```

Either of the above two lines will produce the following results.



Tilde ~ used for HEX

^FN Field Number Instruction

The **^FN** (Field Number) instruction is used to number the data fields. This instruction is used in both Store Format and Recall Format operations.

In a stored format, the ^**FN** instruction is used where you would normally use the **^FD** (Field Data) instruction. In recalling the stored format, use **^FN** in conjunction with the **^FD** (Field Data) instruction.

The format for the **^FN** instruction is**:**

^ FN#

where

^ FN = **Field Number**

= **Number to be Assigned to the Field**
Default value: 0
Other Values: Minimum=1, Maximum=9999

NOTE 1: The same ^FN# value can be stored with several different fields.

NOTE 2: If a label format contains a field with an ^FN# and an ^FD, the data in that field will be printed for any other field containing the same ^FN# value.

^FO Field Origin

The **^FO** (Field Origin) instruction sets a field origin, relative to the label home position designated by the **^LH** command. **^FO** sets the upper-left corner of the field area by defining points along the x-axis and y-axis independent of the rotation.

The format for the **^FO** instruction is:

^ FOx,y

where

^ FO = **Set Field Origin**

x = **Number of Dots along X-axis**
Default value: = 0
Acceptable values: 0 - 9999

y = **Number of Dots along Y-axis**
Default value: = 0
Acceptable values: 0 - 9999

NOTE: If a the value for 'x' or 'y' is too big, it could position the field origin completely off the label.

^FP Field Parameter

The **^FP** (Field Parameter) command has been added to ZPL II to support the Kanji character set. This command rotates the font field without rotating the characters within the field.

The format for the **^FP** instruction is:

^FPd,g

where

^FP = **Field Parameter**

d = **Direction:**
H = Horizontal Printing
V = Vertical Printing

Effective for Versions 14.8.0, 18.8.0, 21.8.0, 23.8.1, 23.8.2, 25.8.1, 25.8.2, 22.8.5
R = Reverse Printing (right to left)

g = **Additional Intercharacter Gap;**
Size represented in dots
Range: = 0 - 9999

NOTE: With reverse printing, the origin specified by the ^FT command is the lower left corner of the right-most text character.

Example:

```
^XA^FPV,10^AG^FDtest^XZ

^XA^FPR,10^AG^FDtest^XZ
```

^FR Field Reverse Print

The **^FR** (Field Reverse Print) instruction allows a field to appear as white over black or black over white. When printing a field, if the dot to print is black, it is made white; if the dot is white, it is made black.

The format for the **^FR** instruction is:

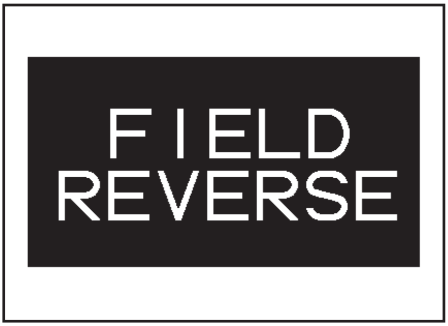
^ FR

where

^ FR = **Field Reverse Print**

The following is an example of how to use the **^FR** instruction.

```
^XA
^FO100,60
^GB380,203,203^FS
^FO180,110
^CFG^FR^FDFIELD^FS
^FO130,170
^FR^FDREVERSE^FS
^XZ
```



NOTE 1: Dot patterns for a particular field are placed into the bit map in the same order the fields are specified in the format instructions. Therefore, care should be taken when using more than one ^FR instruction in a label format.

NOTE 2: The effects of an ^FR instruction will not be seen unless it is preceded by another field (i.e. text followed by a ^FR^GB) as shown in the above example.

^FS Field Separator

The **^FS** (Field Separator) instruction denotes the end of the field definition. The field separator instruction can be issued as a single ASCII control code **SI** (Control-O, HEX 0F).

The format for the **^FS** instruction is**:**

^ FS

where

^ FS = **Field Separator**

^FT Field Typeset

The **^FT** (Field Typeset) instruction also sets the field position, relative to the home position of the label designated by the **^LH** command. The typesetting origin of the field is fixed with respect to the contents of the field and does not change with rotation.

The format for the **^FT** instruction is:

^ FTx,y

where

^ FT = **Set Field Typeset**

x = **Number of Dots along X-axis**
Default value: = Position after last formatted text field.
Acceptable values: 0 - 9999

y = **Number of Dots along Y-axis**
Default value: = Position after last formatted text field.
Acceptable values: 0 - 9999

TEXT - Origin is the start of the character string, at the baseline of the font. Normally the baseline is the bottom of most characters except for those with decenders such as ‘g’, ‘y’, etc.

NOTE: When a coordinate is missing, the position following the last formatted field is assumed. This “remembering” simplifies field positioning with respect to other fields. Once the first field is positioned, other fields will follow automatically.

BAR CODES - The origin is the base of the bar code, even when an interpretation is present below the bar code, or if the bar code has guard bars.

GRAPHIC BOXES - Origin is at the bottom left corner of the box.

IMAGES - Origin is at the bottom left corner of the rectangular image area.

NOTE: There are several instances where using the ^FT instruction without specified “a” and “b” parameters is not recommended.

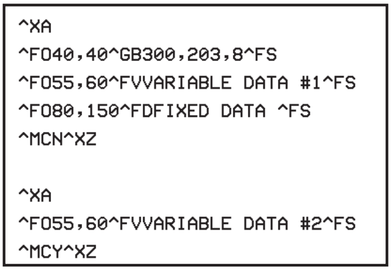
1. **To position the first field in a label format.**
2. **At any time with the ^FN (Field Number) instruction.**
3. **Following a ^SN (Serialization Data) instruction.**

^FV Field Variable Data

The **^FV** (Field Variable Data) instruction replaces the **^FD** (Field Data) instruction in a label format when the field is variable.

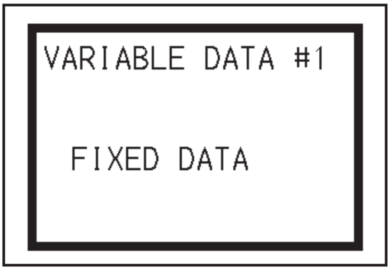
The following is an example of how to use the **^MC** and **^FV** instruction.

NOTE: ^FV fields are always cleared after the label is printed. ^FD fields are not cleared.



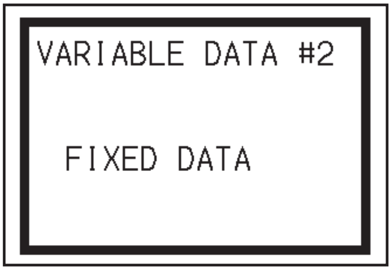
```
^XA
^FO40,40^GB300,203,8^FS
^FO55,60^FVVARIABLE DATA #1^FS
^FO80,150^FDFIXED DATA ^FS
^MCN^XZ

^XA
^FO55,60^FVVARIABLE DATA #2^FS
^MCY^XZ
```



VARIABLE DATA #1

FIXED DATA



VARIABLE DATA #2

FIXED DATA

The format for the **^FV** instruction is:

^FVa

where

^FV = **Field Variable Data**

a = **Variable Field Data to be Printed (0 to 255 character string)**
Instruction ignored if no data entered.

Effective for Versions 14.4.0, 15.4.0, 20.4.0, 23.6.0, 25.6.0
Maximum Character String = 3072

^FW Field Orientation

The **^FW** (Field Orientation) instruction sets the default orientation for all instruction fields that have an orientation (rotation) parameter. Fields can be rotated 0, 90, 180, 270 degrees clockwise by using this instruction.

The **^FW** instruction only affects fields that follow it. Once you have issued a **^FW** instruction, the setting is retained until you turn off the printer or send a new **^FW** instruction to the printer.

The format for the **^FW** instruction is:

^ FWr

where

^ FW = **Set Field Orientation**

r = **Rotate Field**
N = Normal **{I.V.P. = N}**
R = Rotated 90 degrees;
I = Inverted (180 degrees);
B = Bottom Up (270 degrees read from bottom up).

NOTE 1: If the ^FW instruction is entered with the 'r' parameter missing, the instruction is ignored.

NOTE 2: ^FW only affects the orientation in instructions where the rotation parameter has not been specifically set. If an instruction has a specific rotation parameter, that is the one that is used.

^FX Comment

The **^FX** (Comment) instruction is useful when you want to add a “non-printing” informational comment or statement within a label format. Any data after the **^FX** instruction up to the next caret or tilde instruction will not have any effect on the label format.

The format for the **^FX** instruction is:

^ FXc

where

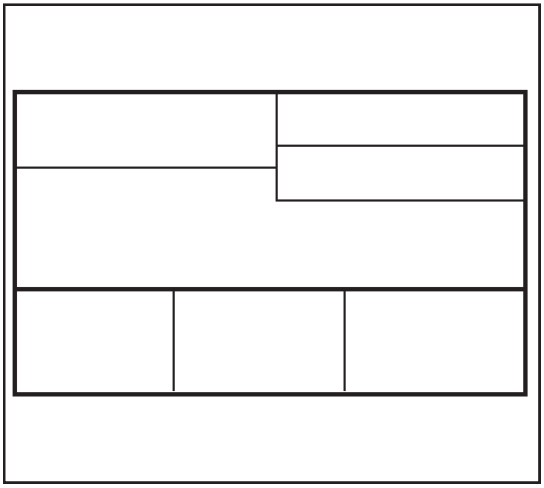
^ FX = **Comment**

c = **A “Non-printing” Instructional Comment or Statement.**

The following is an example of how to use the **^FX** instruction.

NOTE: It is a good practice to always follow the data with a ^FS instruction.

```
^XA
^LH100,100
^FXSHIPPING LABEL^FS
^FO10,10^GB470,280,4^FS
^FO10,190^GB470,4,4^FS
^FO10,80^GB240,2,2^FS
^FO250,10^GB2,100,2^FS
^FO250,110^GB226,2,2^FS
^FO250,60^GB226,2,2^FS
^FO156,190^GB2,95,2^FS
^FO312,190^GB2,95,2^FS
^XZ
```



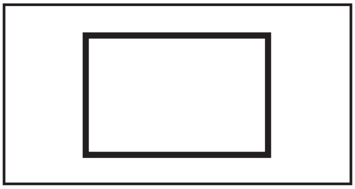
^GB Graphic Box

The **^GB** (Graphic Box) instruction is used to draw boxes and/or lines as part of a label format. Boxes and lines can be use to highlight important information, divide labels into distinct areas, or just dress up the way the label looks. The same format instruction is used for drawing either boxes or lines.

Example for Drawing a Box

The following are the instructions to draw a box 1 inch high, 1.5 inches wide and a line thickness of 10 dots.

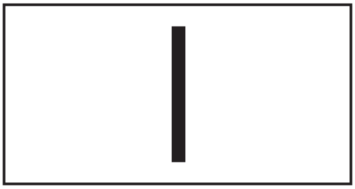
```
^XA
^FO150,100
^GB305,203,10
^XZ
```



Example for Drawing a Vertical Line

The following are the instructions to draw a vertical line 1 inch high with a line thickness of 20 dots.

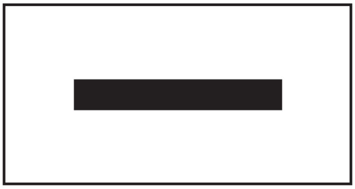
```
^XA
^FO150,100
^GB0,203,20
^XZ
```



Example for Drawing a Horizontal Line

The following are the instructions to draw a horizontal line 1 inch long with a line thickness of 30 dots.

```
^XA
^FO150,100
^GB203,0,30
^XZ
```



The format for the **^GB** instruction is:

^GBw,h,t,c

where

^GB = **Graphic Box**

w = **Width of Box (in dots**
Default value: Value used for thickness or 1 dot
Minimum value: 1 dot
Maximum value: 9999 dots

h = **Height of Box (in dots**
Default value: Value used for thickness or 1 dot
Minimum value: 1 dot
Maximum value: 9999 dots

t = **Thickness of Line (in dots)**
Default value: 1 dot
Minimum value: 1 dot
Maximum value: 9999 dots

c = **Line Color**
Default value: B = Black
Other value: W = White

For the ***w*** and ***h*** parameters, keep in mind that printers will have a default of 6, 8, or 12 dots/millimeter. This comes out to 153, 203 or 300 dots per inch. To determine the values for ***w*** and ***h***, figure out the dimensions in millimeters and multiply by 6, 8 or 12.

^GF Graphic Field

The **^GF** (Graphic Field) command allows you to download graphic field data directly into the bitmap. This command follows the conventions for any other field meaning a field orientation is included with this command. The graphic field data can be placed at any location within the bitmap space.

Example (ZPL and label output):

```
^ FO100,100 ^ GFA,8000,8000,80,ASCII data...
```

This command will download 8000 total bytes of data and place the graphic data at location 100,100 of the bitmap. The data sent to the printer is in ASCII form.

```
^ FO100,100 ^ GFB,8000,8000,80,Binary data...
```

This command will download 8000 total bytes of data and place the graphic data at location 100,100 of the bitmap. The data sent to the printer is in binary form.

```
^ FO100,100 ^ GFC,1980,8000,80,Compressed Binary data...
```

This command will download 1980 total bytes of compressed data and place the graphic data at location 100,100 of the bitmap. The actual graphic will be total size of 8000 bytes. The data sent to the printer is in binary form.

The format for the **^GF** instruction is:

^GFa,b,c,d,DATA

where

^GF = **Graphic Field**

a = **Compression Type**

Default: ASCII

Value:

A = ASCII Hex

This follows the conventional download format used for all other download commands.

B = Binary

The data sent to the printer after the '**c**' parameter is strictly binary.

C = Compressed Binary

The data sent after parameter '**c**' is in a compressed binary format. The data is compressed on the host side using a compression algorithm supplied by Zebra. The data is then decompressed and placed directly in the bitmap.

b = **Binary Byte Count**

Default: None - entire command is ignored when not specified

Value: Total number of bytes to be transmitted for the binary or compressed binary option for parameter **a**. This is the total number of bytes to be transmitted for the total image or the total number of bytes that follow parameter **d**.

For ASCII download the parameter should match parameter **c**.

Range: 1 to 99999. Out of range is set to nearest limit.

On the Z130/90/220/105, this number is fixed to 5 digits.

c = **Graphic Field Count**

Default: None - entire command is ignored when not specified

continued on next page

Value: Total number of bytes comprising graphic format (i.e., width x height), which are sent as parameter **d.** Count divided by bytes per row gives the number of lines in the image. This number represents the size of the image, not necessarily the size of the data stream (see **d**.).

Range: 1 to 99999. Out of range is set to nearest limit. On the Z130/90/220/105, this number is fixed to 5 digits.

d = **Bytes per Row**

Default: None - entire command is ignored when not specified

Value: Number of bytes in the download data that comprise one row of the image.

Range: 1 to 99999. Out of range is set to nearest limit. On the Z130/90/220/105, this number is fixed to 3 digits.

DATA = **Data**

Default: None - must be specified

ASCII Hex Data:

A string of ASCII hex numbers, 2 digits per image byte. CR and LF can be interspersed as needed, for readability. The number of 2 digit number pairs must match the above count. Any numbers sent after count is satisfied are ignored. A comma in the data will pad the current line with “00" (white space), thereby allowing minimization of data sent. **~DN** or any caret or tilde character prematurely aborts the download.

Range: 00 to FF

Binary Data:

Strictly binary data is sent from the host. All control prefixes will be ignored until the total number of bytes needed for the graphic format is sent.

Compressed Binary Data

Compressed binary data is sent from the host. The printer will decompress the data to format the graphic prior to placing it within the bitmap space.

^GS Graphic Symbol

The **^GS** (Graphic Symbol) instruction enables you to generate the registered trademark, copyright symbol and other symbols.

The format for the **^GS** instruction is:

^GSo,h,w

where

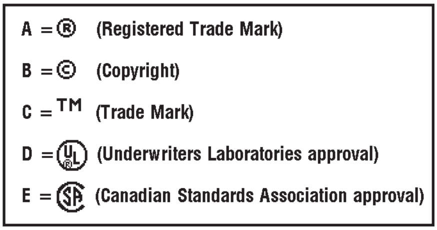
^GS = **Graphic Symbol**

o = **Font Orientation**
Default value: N = normal or last **^FW** value.
Other values:
R = Rotate 90 degrees clockwise
I = Inverted 180 degrees
B = Bottom up, 270 degrees

h = **Character Height in Dots Proportional to Width**
Default value: Last **^CF** value.

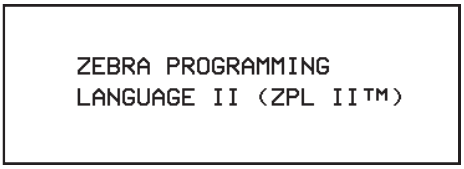
w = **Character Width in Dots Proportional to Height**
Default value: Last **^CF** value.

Use the **^GS** instruction, then use **^FD** and the appropriate character (A thru E) within the field data statement to generate the character you want:



A = ® (Registered Trade Mark)
B = © (Copyright)
C = ™ (Trade Mark)
D = (Underwriters Laboratories approval)
E = (Canadian Standards Association approval)

```
^XA^CFD
^FO 50,50^FDZEBRA PROGRAMMING^FS
^FO 50,75^FDLANGUAGE II (ZPL II)^FS
^FO 280,75^GS^FDC
^XZ
```



ZEBRA PROGRAMMING
LANGUAGE II (ZPL II™)

~HB Battery Status

When the Battery Status command, **~HB**, is sent to the Zebra printer, a data string is sent back to the Host. The string starts with an <STX> Control Code and is terminated by an <ETX><CR><LF> Control Code sequence.

Data String

<STX>bb.bb,hh.hh,bt<ETX><CR><LF>

bb.bb = current battery voltage reading to nearest ¼ volt

hh.hh = last head voltage reading under load to nearest ¼ volt

bt = battery temperature

^HG Host Graphic

The **^HG** (Host Graphic) instruction is used to send (upload) the graphic to the host. This graphic image can be stored by the host for future use. It can be downloaded back to the original printer or to any other Zebra printer.

The format for the **^HG** instruction is:

^HGn

where

^HG	=	**Host Graphic**
n	=	**Name of Graphic**

~HI Host Identification

The **~HI** (Host Identification) instruction is designed to be sent from the Host to the Zebra printer to find out the type of Zebra printer. Upon receipt, the Zebra printer will respond to the Host with the following information:

XXXXXX,V1.0.0,12,512KB,X

XXXXXX	=	**Model of Zebra Printer**
V1.0.0	=	**Version of Software**
12	=	**Dots/mm** (6, 8 or 12 dots/mm printheads)
512KB	=	**Memory** 512KB or 1024KB (1 MB) ***Effective for Version 16.3.0*** 512KB (1/2 megabyte, or MB) 1024KB (1 MB) 2048KB (2 MB) 4096KB (4 MB) 8192KB (8 MB)
X	=	**Recognizable Options** (i.e. Cutter, Communication Options, etc.)

~HM Host Memory Status

Sending the **~HM** (Host Memory Status) instruction to the printer immediately returns a memory status message to the host. Use this instruction whenever you need to know the status of the memory.

When the Host Memory Status Command, **~HM**, is sent to the Zebra printer, a line of data containing three numbers is sent back to the Host. The information contained in that line is described here.

Memory Status Line

1024,0780,0780

The first value is the ***total amount of RAM*** (Random Access Memory) installed in the printer. This number is in Kilobytes. In our example, the Zebra printer has 1024K RAM installed.

The second value is the ***maximum amount of RAM*** (Random Access Memory) available to the user. This number is in Kilobytes. In our example, the Zebra printer has a Maximum of 780K RAM available.

The third value is the ***amount of RAM*** (Random Access Memory) ***currently available*** to the user. This number is in Kilobytes. In our example, there is 780K of RAM in the Zebra printer currently available to the user.

NOTE 1: Memory taken up by bitmaps **is not** ***excluded from the memory currently available value. (Due to ^MCN.)***

NOTE 2: Downloading a graphic image or saving a bitmap only affects the 3rd value. The 1st and 2nd values will not change after the printer is turned on.

~HS Host Status Return

When the Printer Status Command, **~HS**, is sent to the Zebra printer, three data strings are sent back to the Host. Each string starts with an <STX> Control Code and is terminated by an <ETX><CR><LF> Control Code sequence. In this way, to avoid confusion, each String will be displayed/printed on a separate line by the Host.

String 1

<STX>aaa,b,c,dddd,eee,f,g,h,iii,j,k,l<ETX><CR><LF>

aaa	=	Communication (Interface) Settings **(*)**
b	=	“Paper Out” Flag (1=Paper Out)
c	=	“Pause” Flag (1=Pause Active)
dddd	=	Label Length (Value in Number of Dots)
eee	=	Number of Formats in Receive Buffer
f	=	“Buffer Full” Flag (1=Receive Buffer Full)
g	=	“Communications Diagnostic Mode” Flag (1= Diagnostic Mode Active)
h	=	“Partial Format” Flag (1=Partial Format in Progress)
iii	=	UNUSED (Always 000)
j	=	“Corrupt RAM” Flag (1=Configuration Data Lost))
k	=	Temperature Range (1 = Under Temperature)
l	=	Temperature Range (1 = Over Temperature)

(*) This parameter specifies the Printer’s baud rate, # of data bits, # of stop bits, parity setting and type of handshaking. This value is a 3-digit decimal representation of an eight-bit binary number. To evaluate this parameter, first convert the decimal number to a binary number. Then, the 9-digit binary number is read as follows:

aaa = $a^8\ a^7\ a^6\ a^5\ a^4\ a^3\ a^2\ a^1\ a^0$

a^8 = High Speed Baud Rate

0 = 110 thru 19200 baud

1 = 28800 baud and above

a^7 = Handshake

0 = Xon/Xoff

1 = DTR

a^6 = Parity Odd/Even

0 = Odd

1 = Even

a^5 = Disable/Enable

0 = Disable

1 = Enable

a^4= Stop Bits

0 = 2 Bits

1 = 1 Bit

a^3= Data Bits

0 = 7 Bits

1 = 8 Bits

a^8 $a^2\ a^1\ a^0$ = Baud

0 000 = 110

0 001 = 300

0 010 = 600

0 011 = 1200

0 100 = 2400

0 101 = 4800

0 110 = 9600

0 111 = 19200

1 000 = 28800

1 001 = 38400 (available only on certain printer models)

1 010 = 57600

String 2

<STX>mmm,n,o,p,q,r,s,t,uuuuuuuu,v,www<ETX><CR><LF>

mmm = Function Settings**(*)**

n = 0 (Unused)

o = “Head Up” Flag (1 = Head in UP Position)

p = “Ribbon Out” Flag (1= Ribbon Out)

q = “Thermal Transfer Mode” Flag (1 = Thermal Transfer Mode Selected)

r = Print Mode
0 = Rewind
1=Peel Off
2=Tear Off
3=Reserved

s = Print Width Mode
6= 4.41"

t = “Label Waiting” Flag
(1=Label Waiting in Peel-Off Mode)

uuuuuuuu = Labels remaining in Batch

v = “Format While Printing” Flag (Always 1)

www = Number of Graphic Images stored in Memory

(*) This parameter specifies the Printer’s media type, sensor profile status, and communication diagnostics status. As in String 1, this is a 3-digit decimal representation of an eight-bit binary number. First, convert the decimal number to a binary number. Then, the 8-digit binary number is read as follows:

mmm = m7 m6 m5 m4 m3 m2 m1 m0

m7 = Media Type
0 = Die-Cut
1 = Continuous

m6= Sensor Profile
0 = Off

m5= Communications Diagnostics

0 = Off
1 = On

m4 m3 m2 m1 = Unused

0 = Always

m0 = Print Mode

0 = Direct Thermal
1 = Thermal Transfer

String 3

```
<STX>xxxx,y<ETX><CR><LF>
```

xxxx	=	0000 (Reserved for future use)
y	=	0 (Reserved for future use)

^HV Host Verification

The **^HV** (Host Verification) instruction is used to return data from specified fields, along with an optional ASCII header, to the host. It can be used with any field that has been assigned a number with the **^FN** instruction (see page 219)

The format for the **^HV** instruction is:

^HV#,c,ASCII

where

^HV = **Host Verification**

= **Specified Field Number**
Default value: 0
Acceptable values: 0 - 9999.

c = **Number of Characters to be Returned**
Default value: 8 characters
Acceptable values: 0 - 256.

Effective for Version 14.4.0
Acceptable values: 0 - 3072 characters

ASCII = **Header (in uppercase ASCII characters**
Default Value: None
Acceptable values: 0 - 256 characters

Effective for Versions 14.4.0, 15.4.0, 20.4.0, 23.6.0, 25.6.0
Acceptable values: 0 - 3072 characters

^HW Host Directory List

The **^HW** (Host Directory List) is used to transmit a Directory Listing of objects in a specific memory area (storage device) back to the Host computer (the device providing input to the printer). This instruction will return a formatted ASCII string of object names to the HOST via the primary serial port.

Each parameter on a line is of fixed length, and the total length of a line is also fixed. Each line listing an object begins with the asterisk (*) followed by a blank space. There are then 8 spaces for the Objectname, a period and three spaces for the extension. The extension is followed by 2 blank spaces, then 6 spaces for the object size, 2 blank spaces and 3 spaces for option flags (reserved for future use). The format looks like this.

```
<STX><CR><LF>
- DIR R:                xx<CR><LF>
* Objectname.ext(2sp.)(6 obj. sz. )(2sp.)(3 option flags)<CR><LF>
* Objectname.ext(2sp.)(6 obj. sz. )(2sp.)(3 option flags)<CR><LF>
 <CR><LF>
- xxxxxxx bytes free <CR><LF>
<ETX>
```

NOTE: <STX> = Start of Text, <CR><LF> = Carriage Return/Line Feed, <ETX> = End of Text

The instruction may be used in a stand-alone type file to be issued to the printer at any time. The printer will return the directory listing as soon as possible based on other tasks it may be performing when the instruction is received.

NOTE: Remember, this instruction is processed in the order it is received by the printer, unlike the ~HS which is processed immediately.

The format for the **^HW** instruction is:

^HWd,o,x

where

^HW = **Return Directory Listing to Host**

d = **Source Device of Object Listings**
{Optional. Default is DRAM}

o = **Name of Object**
{Optional. Default is "". A "?" can also be used.}*

x = **Extension**
{Optional. Default is "". A "?" can also be used.}*

Effective for Version 22.8.5
Specific changes include the following new descriptive parameter names.

E: ONBOARD FLASH
B: MEMORY CARD
R: RAM

The following is an example of using the **^HW** instruction.

To send a listing of all objects in DRAM to the Host:

```
^XA^HWR:*.*^XZ
```

^ID Image Delete

The **^ID** (Image Delete) instruction deletes objects, images, fonts, formats etc. from storage areas selectively or in groups. This instruction can be used within a printing format to delete objects just prior to saving new ones or can be in a stand-alone type format simply to delete objects.

The image name and extension support the use of the asterisk (*) as a wildcard. This allows for easy deletion of selected groups of objects.

The format for the **^ID** instruction is:

^IDd,o,x

where

^ID = **Delete Image (object)**

d = **Source Device Where Object is Stored**
{R:, B:}

o = **Name of Stored Image,**
1-8 Alphanumeric Characters.
(Default, the name "UNKNOWN" is used.)

x = **Extension, 3 Alphanumeric Characters**
{Default is .GRF}

To delete just stored formats from DRAM:

```
^XA^IDR:*.ZPL^XZ
```

To delete formats and images named SAMPLE from DRAM regardless of the extension:

```
^XA^IDR:SAMPLE.*^XZ
```

To delete the image SAMPLE1.GRF prior to storing SAMPLE2.GRF:

```
^XA
^FO25,25^AD,18,10^FDDelete^FS
^FO25,45^AD,18,10^FDthen Save^FS
^IDR:SAMPLE1.GRF^FS
^ISR:SAMPLE2.GRF^FS
^XZ
```

The ***.*** in the following example will only delete formats and images that have the extension .GRF.

```
^XA^IDR:*.*^XZ
```

Normally the *.* means to delete everything, however in this instruction it means delete all formats and images that have a .GRF extension. To delete other formats and images, the specific extension *must be included* as part of the instruction.

^IL Image Load

The **^IL** (Image Load) instruction is used at the beginning of a label format to load a stored image of a format and merge it with additional data. The image is always positioned at **^FO**0,0.

Using this technique to overlay the image of constant information with the variable data greatly increases the throughput of the label format.

The format for the **^IL** instruction is:

^ILd,o,x

where

^IL = **Load Graphic Image to Bitmap**

d = **Source Device where Image is Stored**
{Optional. Default is Search Priority.}

o = **Name of Stored Image**
1-8 alphanumeric Characters
(Default, the name "UNKNOWN" is used.)

x = **Extension, 3 alphanumeric characters**
{Fixed. Will always be .GRF}

The following example would recall the stored image SAMPLE2.GRF from DRAM and overlay it with the additional data.

```
^XA
^ILR:SAMPLE2.GRF^FS
^CFD,36,20
^FO15,210^FD900123^FS
^FO218,210^FDLINE 12^FS
^FO15,360^AD^FDZEBRA THERMAL^FS
^FO15,400^AD^FDTRANSFER PRINTER^FS
^FO15,540^FD54321^FS
^FO220,530^FDZ58643^FS
^FO15,670^A0,27,18^FDTesting Stored Graphic^FS
^FO15,700^A0,27,18^FDLabel Formats!!
^XZ
```

^IM Image Move

The **^IM** (Image Move) instruction performs a direct move of an image from storage area into the bitmap. The instruction is identical to the Recall Graphic instruction except that there are no sizing parameters.

The format for the **^IM** instruction is:

^IMd,o,x

where

^IM = **Move Image to Bitmap.**

d = **Source Device Where Image is Stored**
{Optional. Default is Search Priority.}

o = **Name of Stored Image**
1-8 Alphanumeric Characters
(Default, the name "UNKNOWN" is used.)

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .GRF}

NOTE 1: By using the ^FO instruction, the graphic image can be positioned anywhere on the label.

NOTE 2: The difference between ^IM and the ^XG instruction is that the Image Move instruction does not have magnification, and therefore may require less formatting time. However, to take advantage of this, the image must be at a 8, 16 or 32 "bit boundary".

The following example moves the image SAMPLE.GRF from DRAM and prints it in 5 locations in its original size.

```
^XA
^FO100,100^IMR:SAMPLE.GRF^FS
^FO100,200^IMR:SAMPLE.GRF^FS
^FO100,300  ^IMR:SAMPLE.GRF^FS
^FO100,400^IMR:SAMPLE.GRF^FS
^FO100,500^IMR:SAMPLE.GRF  ^FS
^XZ
```

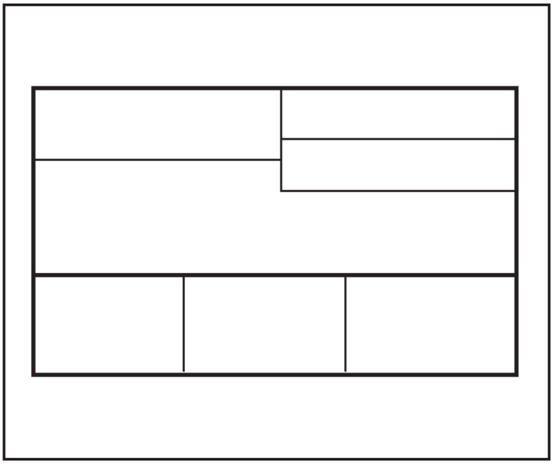
^IS Image Save

The **^IS** (Image Save) instruction is used within a ZPL II label format to save that format as a graphic image. This instruction is used within a label format, typically at the end. It instructs the printer to save that label format as a graphic image rather than a ZPL II script file. The image can later be recalled with virtually no formatting time and overlaid with variable data to form a complete label.

Using this technique to overlay the image of constant information with the variable data greatly increases the throughput of the label format. If the Objectname is omitted, the default name "UNKNOWN.GRF" will be used.

The following is an example of a label format that might be saved as a graphic image.

```
^XA
^LH100,100
^FXSHIPPING LABEL^FS
^FO10,10^GB470,280,4^FS
^FO10,190^GB470,4,4^FS
^FO10,80^GB240,2,2^FS
^FO250,10^GB2,100,2^FS
^FO250,110^GB226,2,2^FS
^FO250,60^GB226,2,2^FS
^FO156,190^GB2,95,2^FS
^FO312,190^GB2,95,2^FS
^XZ
```



The format for the **^IS** instruction is:

^ISd,o,x,p

where

^IS = **Save Format as a Graphic Image.**

d = **Destination Device to Store Image**
Default value:R:(DRAM)
Other value: B:(Optional Memory)

o = **Name of Image, 1-8 Alphanumeric Characters**
(Default, the name "UNKNOWN" is used.)

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .GRF}

p = **Print Image After Storing**
Default value: Y = Yes
Other value: N = No

The following is an example of using the **^IS** instruction to save a label format to DRAM. The name used to store the graphic is SAMPLE2.GRF.

```
^XA
^LH10,15^FWN^BY3,3,85^CFD,36
^GB430,750,4^FS
^FO10,170^GB200,144,2^F S
^FO10,318^GB410,174,2^FS
^FO212,170^GB206,144,2^FS
^FO10,498^GB200,120,2^FSR^FO212,498^GB209,120,2^FS
^FO4,150^GB422,10,10^FS
^FO135,20^A0,70,60^FDZEBRA^ FS
^FO80,100^A0,40,30^FDTECHNOLOGIES CORP^FS
^CFD,18,10^FS^FO15,180^FDARTICLE #^FS
^FO218,180^FDLOCATION^FS^FO15,328^FDDESCRIPTION^FS
^FO15,508^FDREQ. NO.^FS^FO220,508^FDWORK NUMBER^FS
^FO15,630^AD,36,20^FDCOMMENTS:^FS
^ISR:SAMPLE2.GRF,Y
^XZ
```

~JA Cancel All

The **~JA** (Cancel All) instruction cancels all format instructions in the buffer. It also cancels any batches that may be printing.

The printer will stop printing after the current label (if one is printing) is finished printing. All internal buffers will be cleared of data. The "DATA" LED will turn off.

Effective for Version 18.6.5

In the past, the **~JA** command deleted data received after the **~JA**; now it scans the buffer for the **~JA** and only deletes the data before the **~JA** in the input buffer—it doesn't scan the remainder of the buffer for additional **~JA** commands.

~JB Reset Battery Dead

The **~JB** (Reset Battery Dead) instruction is used for the following two conditions.

1) This instruction ***must*** be sent to the printer if the battery supplying power to the Battery Powered Font Card fails and is replaced. (A bad battery would show a "battery dead" condition on the Printer Configuration Label.)

NOTE: If the battery is replaced and this instruction is not sent to the printer, the Battery Powered Font Card will not function.

2) To intentionally clear (reinitialize) the Battery Powered Font Card (the card must not be write protected).

^JB Initialize Flash Memory

The **^JB** (Initialize Flash Memory) instruction is used to initialize the two types of Flash Memory available in the Zebra printers.

^ JBa

where

^ JB = **Reset Battery Dead**

a = **Parameter:**
B = Flash Card (PCMCIA)
E = Flash Memory

NOTE: This command is only available in certain Zebra printers and based on the firmware installed in the printer. Please consult the Command Quick Reference Chart (Appendix A) for a complete listing of firmware that supports ^JB.

Example:

^ JBB - initializes the optional Flash Card when installed in the Zebra printer.

^ JBE - initializes the optional Flash Memory when installed in the Zebra printer.

^JC Set Media Sensor Calibration

The **~JC** (Set Media Sensor Calibration) is used to force a label length measurement and recalibrate the media and ribbon sensors.

NOTE: In continuous mode, only the media and ribbon sensors will be recalibrated.

~JD Enable Communications Diagnostics

The **~JD** (Enable Communications Diagnostics) instruction initiates a diagnostic mode that produces an ASCII printout (using current label length and full width of printer) of all characters received by the printer. This printout includes the ASCII Characters, the HEX value and any communication errors.

~JE Disable Diagnostics

The **~JE** (Disable Diagnostics) instruction cancels the diagnostic mode and returns the printer to normal label printing.

~JG Graphing Sensor Calibration

The **~JG** (Graphing Sensor Calibration) is used to force a label length measurement, recalibrate the media and ribbon sensors and print a graph (media sensor profile) of the sensor values.

^JJ Set Auxiliary Port

The ^**JJ** (Set Auxiliary Port) command allows you to control an online verifier or applicator device via ZPL.

The format for the **^JJ** instruction is:

^JJo,a

where

^JJ = **Set Auxiliary Port**

o = **Operational Modes for the Aux Port.**

Factory Default: 0 Off - The auxiliary port output signal is not provided for the verifier.

Initial Value at Power-up: The last value saved.

Other Values:

1. Reprint on Error - The printer stops on a label with a verification error. When the pause key is pressed, this label is then reprinted (if Reprint on Error, **^JZ**, is set to reprint) . If a bar code is near the upper edge of a label, the label will feed out far enough for the bar code to be verified and then backfeed to allow the next label to be printed and verified.

2. Maximum Throughput - The printer stops when a verification error is detected. In this mode, the printer starts printing the next label while the verifier is still checking the previous label. This mode provides maximum throughput, but does not allow the printer to immediately stop on a label with a verification error.

NOTE: When set to Maximum throughput via this command, the ^JZ (Reprint on Error) command has no affect - ^JJ overrides it so that the label will not be reprinted after an error.

Continued on next page

Effective for Version 18.6.0

a = **Applicator Mode**

Factory Default: 0 Off **-** The auxiliary port output signal is not provided for the applicator.

Initial Value at Power-up: The last value saved.

Other Values:

0. Off - The ~END_PRINT output signal is not active in mode zero and the output remains deasserted HIGH, regardless of printer activity. The ~START_PRINT input signal is also ignored in mode 0.

1. Mode 1 - The ~END_PRINT output signal is asserted LOW only while media is moving forward.

2. Mode 2 - The ~END_PRINT output signal is asserted HIGH only while media is moving forward.

3. Mode 3 - The ~END_PRINT output signal is asserted LOW for 20 milliseconds when a label has been completed and positioned. Not asserted during continuous printing modes.

4. Mode 4 - The ~END_PRINT output signal is asserted HIGH for 20 milliseconds when a label has been completed and positioned. Not asserted during continuous printing modes.

~JL Set Label Length)

The **~JL** (Set Label Length) is used to set the label length. Depending on size of label, the printer will feed one or more blank labels.

^JM Set Dots/Millimeter

Use the **^JM** (Set Dots/Millimeter) instruction to change the number of dots per millimeter. Depending on the print head, normal dots per millimeter on a Zebra Printer is 12-dots/mm (304-dots/inch), 8-dots/mm (203-dots/inch) or 6-dots/mm (153-dots/inch). In some applications, this high density is not required. For these applications, a lower density of 4-dots/mm (102-dots/inch) or 3-dots/mm (77-dots/inch) can be selected.

If used, this instruction must be entered before the first **^FS** instruction.

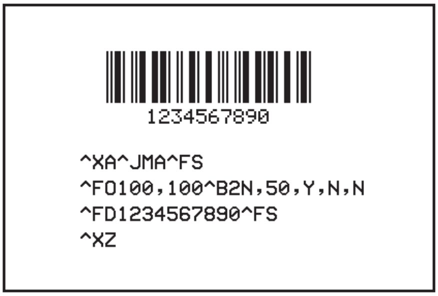
The format for the **^JM** instruction is:

^JMn

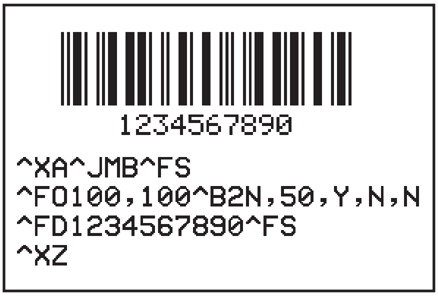
where

^JM = **Set Dots per Millimeter**

n = *Default value:* A = 12 dots/mm, 8 dots/mm or 6 dots/mm
Other value: B = 6 dots/mm, 4 dots/mm or 3 dots/mm


1234567890

```
^XA^JMA^FS
^FO100,100^B2N,50,Y,N,N
^FD1234567890^FS
^XZ
```


1234567890

```
^XA^JMB^FS
^FO100,100^B2N,50,Y,N,N
^FD1234567890^FS
^XZ
```

~JN Head Test Fatal

The **~JN** (Head Test Fatal) instruction resets the printhead element error override, acting as a toggle for **~JO**. Printer then goes into fault status (i.e., turns head indicator on steadily) if any subsequent execution of the printing element test detects bad printing elements.

~JO Head Test Non-Fatal

The **~JO** (Head Test Non-Fatal) instruction overrides a failure of head element status check and allows printing to continue. The override is canceled when the printer is turned off or receives a **~JR** or **~JN** instruction. The printhead test will not produce an error if the **~JO** override is active.

~JP Pause and Cancel Format

The **~JP**(Pause and Cancel Format) instruction, clears the format currently being processed and places the printer in the Pause mode.

The instruction clears the next format that would print, or the oldest format from the buffer. Each subsequent issuance of **~JP** clears the next buffered format until the buffer is empty. The "DATA" indicator turns off when the buffer is empty and nothing is being transmitted.

Issuing the **~JP** instruction is identical to using the Cancel switch on the printer except that the printer *does not* have to be in the Pause mode first.

~JR Power On Reset

The **~JR** (Power On Reset) instruction resets all of the printer's internal software, performs a power-on self-test, clears the buffer and DRAM, and resets communication parameters and default values. **~JR** performs the same function as a manual power-on reset.

~JS Change Backfeed Sequence

The **~JS** (Change Backfeed Sequence) instruction is used to control the backfeed sequence. This instruction can be used on printers both with and without built-in cutters.

The primary applications are: **1)** to allow programming of the "rest point" of the cut edge of continuous media, and **2)** provide immediate backfeed after peel-off when the printer is used in a print/apply application configuration.

This instruction only stays in effect until the printer is powered OFF, a new **~JS** instruction is sent or it is changed on the front panel. When a **~JS** instruction is encountered, it will supersede the current 'front panel' setting for the Backfeed Sequence.

NOTE: The ~JSx instruction has replaced the ^XBA and ^XBB instructions (found only in ZPL Version 8.1.0). ^XB operates normally. ~JS is not applicable to Zebra STRIPE Printers.

The most common way of eliminating backfeed is to operate in rewind mode. Rewind mode does not backfeed at all. After a label is printed, the leading edge of the next label is placed at the print line. This eliminates the need to backfeed and does not introduce a non-printable area at the leading edge/bottom of the label. It also does not allow the label to be taken from the printer since it is not fed out from under the printhead.

Running in another mode with backfeed turned off allows the label to be taken and eliminates the time overhead of the backfeed sequence. It does introduce a 1-inch, non-printable area at the leading edge/bottom of the label on 170***PAX*** printers in applicator mode.

The format for the **~JS** instruction is:

~JSb

where

~JS = **Change Backfeed Sequence**

b = **Order in which Backfeed Occurs with Respect to Printing**

Default value:
N = Normal (90% backfeed after label is printed)
Other values:
A = 100 % Backfeed After Printing (and cutting)
B = 0% Backfeed After Printing (and cutting) and 100% Before Printing the Next Label

Effective for Version 18.6.5
O = Off - backfeeding turns off completely

NOTE: When using a specific value, difference between value entered and 100% is done before the next label is printed. For example, a value of 4z0 means 40% of the backfeed takes place after the label is cut or removed. The remaining 60% takes place before the next label is printed.

The value for this instruction is also reflected in the “Backfeed” parameter on the Printer Configuration label.

For ~JSN	the “Backfeed” parameter is listed as “Default”.
For ~JSA or 100	the “Backfeed” parameter is listed as “After”.
For ~JSB or 0	the “Backfeed” parameter is listed as “Before”.
For ~JS10 to 90	the “Backfeed” parameter is listed as the value.

The front panel setting that controls the Backfeed Sequence appears on the unprotected side of the password, right after the Print Mode setting. It is displayed as:

BACKFEED SEQ

The three choices are AFTER PRINT, BEFORE PRINT and DEFAULT. These front panel settings can be permanently saved.

^JT Head Test Interval

The **^JT** (Head Test Interval) instruction lets you change the printhead test interval from 100 to any desired interval. The printer automatically performs an internal printhead element test which occurs every 100 labels. This takes place during formatting which minimizes a delay in printing. Therefore, the test may be performed while the printer is in PAUSE.

The format for the **^JT** instruction is:

^JT#,a,b,c

where

^JT = **Head Test Interval**

= **The Four-Digit Number Representing the Amount of Labels to be Printed Between Head Tests**
Default value: 0100

Effective for Version 16.4.0
Default value: 0 (Now off)

Acceptable values: 0000-9999

Parameters a,b,c Effective for Version 16.4.0

a = **Automatically Select Range of Elements to Test**
Y = Yes **{I.V.P = Y}**
N = No (test range specified by parameters "**b**" and "**c**")

b = **First Element to Check when Parameter "a" is "No"**
Acceptable values: 0-9999 **{I.V.P = 0}**

c = **Last Element to Check when Parameter "a" is "No"**
Acceptable values**:** 0-9999 **{I.V.P = 0}**

Effective for Version 16.4.0

The **^JT** instruction now supports testing a range of print elements. The printer automatically selects the test range by tracking which elements have been used since the previous test.

Also, it is now possible to turn the automatic mode to specify the first and last elements for the head test. This makes it possible to select any specific area of the label or the entire print width.

NOTE: If the last element selected is greater than the print width selected, the test stops at the selected print width.

Whenever the head test instruction is received, a head test is performed on the next label unless the count is set to zero.

^JU Configuration Update

The **^JU** (Configuration Update) instruction sets the active configuration for the printer.

There are three choices for this instruction. They are defined as follows:

S = Save Current Settings
The current configuration will be saved. This is the configuration that will be used at Power-On.

F = Reload Factory Values (Default)
The factory values (default values) will be loaded.
(These values will be lost at Power Off if they are not saved with the **^JUS** instruction.)

R = Recall Last Saved Values
The last values saved using this (**^JU**) instruction or the Mode Sequencing from the front panel will be loaded.

The format for the **^JU** instruction is:

^JUa

where

^JU	=	**Configuration Update**

a	=	**Active Configuration**
		F = Reload Factory Defaults
		R = Recall Last Saved Values
		S = Save Current Settings
		
		(Instruction ignored if parameter missing or incorrect.)

^JW Set Ribbon Tension

The **^JW** (Set Ribbon Tension) instruction is used only for the 170 PAX-Series printers.

The format for the **^JW** instruction is:

^JWt

where

^JW	=	**Set Ribbon Tension**

t	=	**Tension**
		L = Low
		M = Medium
		H = High

~JX Cancel Current Partially Input Format

The **~JX** (Cancel Current Partially Input Format) instruction cancels a format that is currently being sent to the printer.

It does not affect any formats currently being printed, or any subsequent formats that may be sent.

^JZ Reprint After Error

The **^JZ** (Reprint After Error) instruction is used to reprint a partially printed label caused by a Ribbon Out, Media Out or Head Open error condition. The label will be reprinted as soon as the error condition is corrected.

This instruction will remain active until another **^JZ** instruction is sent to the printer or the printer is turned off.

The format for the **^JZ** instruction is:

^JZa

where

^JZ = **Reprint After Error**

a = **Reprint After Error**
Y = Yes **{I.V.P.}**
N = No
(Instruction ignored if parameter missing or incorrect.)

{I.V.P. = Last permanent value saved}

NOTE: The ^JZ instruction sets the error mode for the printer. (If ^JZ is changed, only labels after the change will be affected.)

^KL Define Language

The **^KL** (Define Language) instruction is used to select the language used for the front panel display.

The format for the **^KL** instruction is:

^KLa

where

^KL = **Define Language**

a = *Default value:* 1 = English
Other Value: 2 = Spanish
3 = French
4 = German
5 = Italian
10 = Spanish

Effective for Version 18.6.5
Default Value: 1 = English
Other Values: 2 = Spanish
3 = French
4 = German
5 = Italian
6 = Norwegian
7 = Portuguese
8 = Swedish
9 = Danish
10 = Spanish2 (same as Spanish above - this is for compatibility with older versions)
11 = Dutch
12 = Finnish
13 = Custom (not currently supported)

^KP Define Password

The **^KP** (Define Password) instruction is used to define the password that must be entered to access the front panel switches and LCD set up mode.

NOTE: If the password is forgotten, the printer can be returned to a default setup mode in which the default password of 1234 will be entered. Caution should be used, however, because this will also set the printer configuration values back to default.

The format for the **^KP** instruction is:

```
^KP<nnnn>
```

where

^KP	=	**Define Password**
<nnnn>	=	**Mandatory Four Digit Password**

^LH Label Home

The **^LH** (Label Home) instruction sets the label home position.

The default home position of a label is the upper-left corner (position **0,0** along the x-axis and y-axis). This is the axis reference point for labels. Any area below, and to the right of this point is available for printing. The Label Home instruction changes this reference point. For instance, when working with preprinted labels, use this instruction to move the reference point below the preprinted area.

NOTE: This instruction will only affect fields that come after it. It is suggested that this be one of the first instructions in the label format.

The format for the **^LH** instruction is:

^LHx,y

where

^LH = **Set Label Home**

x = **Number of Dots along X-axis**
{I.V.P. = 0}
Acceptable values: 0 - 9999

y = **Number of Dots along Y-axis**
{I.V.P. = 0}
Acceptable values: 0 - 9999

{I.V.P. = Last permanent value saved}

Depending on the printhead used in your printer, use one of the following when figuring the values for **x** and **y**:

6 dots = 1 mm (millimeter), 152 dots = 1 inch.
8 dots = 1 mm (millimeter), 203 dots = 1 inch.
11.8 dots = 1 mm (millimeter), 300 dots = 1 inch.
12 dots = 1 mm (millimeter), 304 dots = 1 inch.

To be compatible with existing printers, this instruction *must* come before the first **^FS** (Field Separator) instruction. Once you have issued an **^LH** command, the setting is retained until you turn off the printer or send a new **^LH** instruction to the printer.

^LL Label Length

The **^LL** (Label Length) instruction defines the length of the label. This instruction is necessary when using continuous media (i.e. media not divided into separate labels by gaps, spaces, notches, slots or holes).

To affect the current label, and/or be compatible with existing printers, this instruction *must* come before the first **^FS** instruction. Once you have issued an **^LL** command, the setting is retained until you turn off the printer or send a new **^LL** instruction to the printer.

The format for the **^LL** instruction is:

^LLy

where

^LL = **Set Label Length**

y = **Number of Dots Along Y-Axis**
Default value:
1225 for Stripe
1244 for Xi printers
NOTE: Value must be entered or instruction is ignored.
(8 in. using 6 dot/mm printhead)
(6 in. using 8 dot/mm printhead)
(3 in. using 12 dot/mm printhead)
Acceptable values: from 1 up to some 4-digit number that does not exceed the maximum label size.

The following formula can be used for figuring the value of ‘***y***.’

For 6 dot/mm printheads.....
Label length in inches x 152.4 (dots/inch) = value for ‘y’

For 8 dot/mm printheads.....
Label length in inches x 203.2 (dots/inch) = value for ‘y’

For 12 dot/mm printheads.....
Label length in inches x 304.8 (dots/inch) = value for ‘y’

NOTE 1: Values for y depend on the memory size. If the entered value for y exceeds acceptable limits, bottom of label will be cut off. Label will also shift down from top to bottom.

NOTE 2: If multiple ^LL instructions are issued in the same label format, the last ^LL instruction will also affect the next label. unless it is prior to the first ^FS.

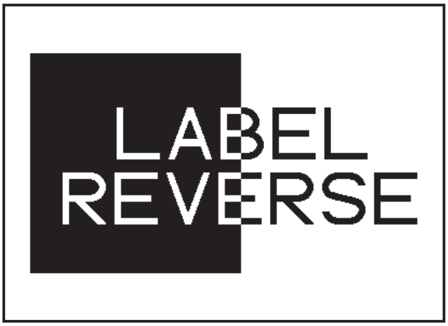
^LR Label Reverse Print

The **^LR** (Label Reverse Print) instruction reverses the printing of all fields in the label format. It allows a field to appear as white over black or black over white. When printing a field, if the dot to print is black, it is made white; if the dot is white, it is made black.

Using the **^LR** is identical to placing a **^FR** in all current and subsequent fields.

The following is an example of how to use the **^LR** instruction.

```
^XA^LRY
^FO100,60
^GB195,203,195^FS
^FO180,110
^CFG^FDLABEL^FS
^FO130,170
^FDREVERSE^FS
^XZ
```



The format for the **^LR** instruction is:

^LRa

where

^LR = **Label Reverse Print**

a = **Reverse Print All Fields**

Y = Yes
N = No **{I.V.P. = N}**
[Instruction is ignored if no parameter given.]

{I.V.P. = Last permanent value saved}

NOTE 1: The ^LR will remain active unless turned off by ^LRN instruction or the printer is powered down.

NOTE 2: The effects of an ^LR instruction will not be seen unless fields overlap as shown in the above example.

NOTE 3: Only fields that come after this instruction will be affected.

^LS Label Shift

The **^LS** (Label Shift) instruction allows for compatibility with Z-130 Printer formats that are set for less than full label width. It is used to shift all field positions to the left so that the same instructions used on a Z-130 or Z-220 Printer can be used on other Zebra printers.

To determine the value for the **^LS** instruction use the following formula. Z-130/Z-220 values for **^LHx** + **^FOx** **-** (distance from edge of label) = printer value for **^LSa**. If the print position is less than 0, then set **^LS** to 0.

To be compatible with existing Zebra printers, this instruction *must* come before the first **^FS** instruction. Once you have issued an **^LS** command, the setting is retained until you turn off the printer or send a new **^LS** instruction to the printer.

The format for the **^LS** instruction is:

^LSa

where

^LS = **Set Label Shift**

a = **Shift Left Value in Dots**
{I.V.P. = 0}
Acceptable values: 0 to 9999 dots.

Effective for Versions 14.4.0, 15.4.0, 20.4.0, 23.6.0, 25.6.0
Acceptable values: -9999 to +9999 dots.
NOTE: When entering positive values, it is not necessary to use the plus (+) sign. The value is assumed to be positive unless preceded by a negative (-) sign

{I.V.P. = Last permanent value saved}

^LT Label Top

The **^LT** (Label Top) instruction moves the entire label format a maximum of 64 dot rows up or down from its current position with respect to the top edge of the label. A negative value moves the format towards the top of the label; a positive number moves the format away from the top of the label.

This instruction can be used to fine-tune the position of the finished label without having to change any of the existing parameters.

NOTE: This instruction does not change the Media Rest position.

The format for the **^LT** instruction is:

^LTx

where

^LT = **Label Top**

x = **-64 to +64 Dot Rows.**

(Positive values do not require a "+" sign to be entered and the "+" sign ***should not*** be used.*)*

(Instruction ignored if parameter missing or incorrect.)

Effective for Version 21.6.1

-120 to +120 Dot Rows

(Positive values do not require a "+" sign to be entered and the "+" sign ***should not*** be used.*)*

{I.V.P. = Last permanent value saved}

^MC Map Clear

In normal operation, the bit map is cleared after the format has been printed. The **^MC** (Map Clear) instruction is used to retain the current bit map. This applies to current and subsequent labels until cleared with a second **^MCY** instruction.

The format for the **^MC** instruction is:

^MCa

where

^MC = **Map Clear**

a = Y = Yes (Clear bit map.) **{I.V.P. = N}**
N = No (Do not clear the bit map.)

NOTE: The ^MC instruction retains the image of the current label after formatting. It will appear in the background of the next label printed.

^MD Media Darkness

This **^MD** (Media Darkness) instruction adjusts the darkness relative to the current darkness setting. The minimum value is -30 and the maximum value is 30.

Examples for Using the ^MD Instruction

If the current value (value on configuration label) is 16, entering the instruction **^MD-9** would decrease the value to 7.

If the current value (value on configuration label) is 1, entering the instruction **^MD15** would increase the value to 16.

If the current value (value on configuration label) is 25, entering the instruction **^MD10** would only increase the value to 30 since that is the maximum value allowed.

NOTE: Each ^MD instruction is treated separately with respect to the current value (value on configuration label).

For example, this is what would happen if two **^MD** instructions were received.

Assume the current value is 15. An **^MD-6** instruction is received that changes the current value to 9. Another instruction, **^MD2**, is received. The current value is changed 17. The two **^MD** instructions were treated individually with respect to the current value of 15.

The format for the **^MD** instruction is:

^MDa

where

^MD = **Media Darkness**

a = -30 to 30 depending on the current value. (Positive values do not require a "+ " sign to be entered.)

(Instruction ignored if parameter missing or incorrect.)

{I.V.P. = 0}

^MF Media Feed

The **^MF** (Media Feed) instruction dictates what happens to the media at “power up.”

The format for the **^MF** instruction is:

^MFp,h

where

^MF = **Media Feed**

p = **Feed Action at Power Up**
Default value: F = Feed to first web after sensor.
Other values:
C = (See **~JC** definition)
L = (See **~JL** definition)
N = No Media Feed

h = **Feed Action After Closing Print Head**
Default value: F = Feed to first web after sensor.
Other values:
C = (See **~JC** definition)
L = (See **~JL** definition)
N = No Media Feed

NOTE: *It is important to remember that, if you choose the ‘N’ parameter, the printer assumes that the media and its position relative to the printhead is exactly the same as it was before power was turned off or the printhead was opened. Use* ***^JU*** *instruction to save changes.*

^ML Maximum Label Length

The **^ML** (Maximum Label Length) instruction lets you adjust the maximum label length via ZPL.

The format for the **^ML** instruction is:

^ MLa

where

^ ML = **Maximum Label Length**

a = **Maximum Label Length in Dot Rows**

NOTE: In order for calibration to work properly, you must set the maximum label length equal to or greater than your actual label length.

*Default value:*Last permanently saved value

^MM Print Mode

The **^MM** (Print Mode) instruction determines the action the printer takes after a label or group of labels has been printed. There are four different modes of operation.

1. **Tear-Off -** After printing, the label is advanced so that the web is over the tear bar. Label, with backing attached, can then be torn off manually.

2. **Rewind -** The label and backing are rewound on an *(optional)* ***external*** rewind device. The next label is positioned under the print head (no backfeed motion).

3. **Peel-Off -** After printing, the label is moved forward and activates a Label Available Sensor. Printing stops until the label is manually removed from the printer.

4. **Cutter -** After printing, the media feeds forward and is automatically cut into predetermined lengths.

Effective for Version 22.8.6 (Peel Off)

(Power Peel) Backing material is automatically rewound using an optional internal rewind spindle.
(Value Peel) Backing is fed down the front of the printer and manually removed.

A **Pre-Peel** feature is available as an option for the Peel-Off mode. After each label is manually removed, this parameter causes the printer to feed the next label forward to pre-peel a small portion of the label material away from the backing material prior to backfeeding and printing the label. The pre-peel feature assists in the proper peel operation of some media types.

The format for the **^MM** instruction is:

^MMa,b

Where

^MM = **Print Mode**

a = **Desired Mode**
Default value:
T = Tear Off
Other Values:
P = Peel Off (not available on S-300 printers)
R = Rewind (Instruction ignored if parameter missing or incorrect.)
A = Applicator

Effective for Version 14.4.3
C = Cutter (S-500 printers only)
(Instruction ignored if parameter missing or incorrect.)

Effective for Version 22.8.6

b = **Pre-Peel Select** (Valid for Peel-Off mode only!)
Default value:
Y = Yes
Other Value:
N = No
(Instruction ignored if parameter missing or incorrect. The current value of the parameter will remain unchanged.)

NOTE: Make sure that you select the appropriate command for the print mode you are using. Otherwise, you may get unexpected results!

^MN Media Tracking

This **^MN** (Media Tracking) instruction tells the printer what type of media is being used (continuous or non-continuous) for purposes of tracking. There are two choices for this instruction:

1. **Continuous Media -** This media has no physical characteristic (i.e. a web, notch, perforation, etc.) to separate labels. Label Length is determined by the **^LL** instruction (described on Page 278).

2. **Non-Continuous Media -** This media has some type of physical characteristic (i.e. a web, notch, hole, etc.) to separate the labels.

The format for the **^MN** instruction is:

^MNa

where

^MN = **Media Tracking**

a = **Media Being Used**

N = Continuous Media
Y = Non-Continuous Media Web Sensing

Effective for Version 14.5.3, 18.6.0

W = Non-Continuous Media Web Sensing
M = Non-Continuous Media Mark Sensing

(Instruction ignored if parameter missing or incorrect.)

^MP Mode Protection

The **^MP** (Mode Protection) instruction is used to disable the various Mode functions on the front panel. Once disabled, the settings for the particular mode function can no longer be changed and the LED associated with the function will not light.

Since this instruction has only one parameter, each mode will have to be disabled with an individual **^MP** instruction.

The format for the **^MP** instruction is:

^MPa

where

^MP = **Mode Protection**

a = **Mode to Protect**

Default value: No changes
Other acceptable values:
D = Disable Darkness Mode
P = Disable Position Mode
C = Disable Calibration Mode
E = Enable All Modes
S = Disable all Mode Saves. (Modes can be adjusted but values will not be saved.)

Effective for Version 18.6.0
Default value: E = Enable All Modes
Other values: W = Disable Pause Key
F = Disable Feed Key
X = Disable Cancel Key
M = Disable Menu Changes
(Instruction ignored if parameter missing or incorrect.)

Example:

```
^XA^MPD^MPC^XZ
```

^MT Media Type

This **^MT** (Media Type) instruction selects the type of media being used in the printer. There are two choices for this instruction:

1)**Thermal Transfer Media -** This media uses a high carbon black or colored ribbon. The ink on the ribbon is bonded to the media.

2) **Direct Thermal Media -** The media is heat sensitive and requires no ribbon.

The format for the **^MT** instruction is:

^MTa

where

^MT = **Media Type**

a = **Media Being Used**
T = Thermal Transfer Media
D = Direct Thermal Media
(Instruction ignored if parameter missing or incorrect.)

^MU Mode Units

This command sets the printer units of measurements. The **^MU** (Mode Units) command works on a field by field basis. Once the mode units is set, it carries over from field to field until a new mode units is entered.

The format for the **^MU** instruction is:

^ MUa

where

^ MU = **Mode Units**

a = **Units:**

Default:	D = Dots
	I = Inches
	M = Millimeters

Example (ZPL and label output):

Assume 8 dot per millimeter - 203 dot per inch printer.

^ MUd ^ FO100,100 ^ GB1024,128,128 ^ FS
(field based on dots))

^ MUm ^ FO12.5,12.5 ^ GB128,16,16 ^ FS
(field based on millimeters)

^ MUi ^ FO.493,.493 ^ GB5.044,.631,.631 ^ FS
(field based on inches)

~NC Network Connect

The **~NC** (Network Connect) instruction is used to connect a particular printer into the network by calling up the printer's Network ID Number.

The format for the **~NC** instruction is:

~NC#

where

~NC = **Network Connect**

= **The Network I.D. Number Assigned to the Printer**
Default value: 000 (same as None)
Acceptable values: 001–250

Use this instruction at the beginning of any label format to specify which printer on the network is to be used. This instruction MUST be included in all label formats to "wake up the printer." This number must be three digits in length.

^NI Network ID Number

The **^NI** (Network ID Number) instruction is used to assign a Network ID number to the printer. This must be done before the printer can be used in a network.

The format for the **^NI** instruction is:

^ NI#

where

^ NI = **Network ID Number**

= **The I.D. Number to be Assigned to the Printer**
Factory Default value: 000 (same as None)
Acceptable values: 001–250
NOTE: Values must be three digit numbers or they will be ignored. If this happens, last ^NI value is used.

NOTE: The last Network ID Number set will be the one recognized by the system.

~NR Set All Network Printers Transparent

The ~**NR** (Set All Network Printers Transparent) instruction sets all printers in the network, regardless of ID or current mode, transparent.

The format for the ~**NR** instruction is:

~NR

where

~NR = **Set Network Printer Transparent**

~NT Set Currently Connected Printer Transparent

The ~**NT** (Set Network Printer Transparent) instruction sets the currently connected network printer transparent.

The format for the ~**NT** instruction is:

~NT

where

~NT = **Set Network Printer Transparent**

^PF Slew Given Number of Dot Rows

The **^PF** (Slew Given Number of Dot Rows) instruction causes the printer to slew labels (move labels at a high speed without printing) a specified number of dot rows, at the bottom of the label. This allows faster printing when the bottom portion of a label is blank.

The format for the **^PF** instruction is:

^PF#

where

^PF = **Slew a Number of Dot Rows**

= **Number of Dot Rows to Slew**
Default value: None. Instruction is ignored if no value, or incorrect value is specified.
Acceptable values: Minimum=0, Maximum=9999

^PH ~PH Slew to Home Position

The **~PH** or **^PH** (Slew to Home Position) instruction causes the printer to feed one blank label.

The **~PH** instruction feeds one label after the format currently being printing is done or when the printer is placed in pause.

The **^PH** instruction feeds one blank label after the format it is in prints.

^PM Printing Mirror Image of Label

The **^PM** (Print Mirror Image of Label) instruction prints the entire printable area of the label as a mirror image. This instruction flips the image from left to right.

The format for the **^PM** instruction is:

^PMa

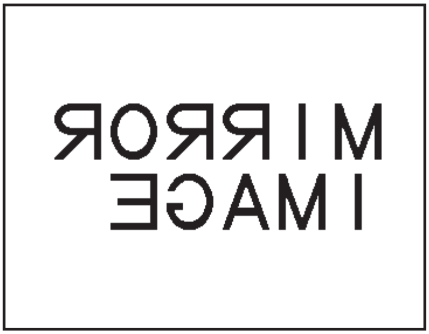
where

^PM = **Print Mirror Image**

a = **Mirror Print Entire Label**
Y = Yes
N = No **{I.V.P. = N}**
[Instruction is ignored if no parameter given.]

The following is an example of how to use the **^PM** instruction.

```
^XA^PMY
^FO130,110
^CFG^FDMIRROR^FS
^FO130,170
^FDIMAGE^FS
^XZ
^XA^PMN^XZ
```



NOTE: The ^PM will remain active unless turned off by ^PMN instruction or the printer is powered down.

^PO Print Orientation

The **^PO** (Print Orientation) instruction inverts the label format 180 degrees. In essence, the label is printed upside down.

The format for the **^PO** instruction is:

^POa

where

^PO = **Set Print Orientation**

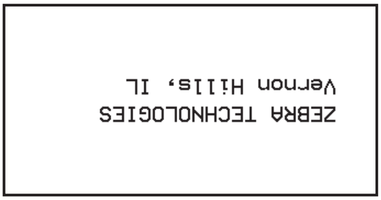
a = **Invert 180 Degrees**
N = Normal **{I.V.P. = N}**
I = Invert

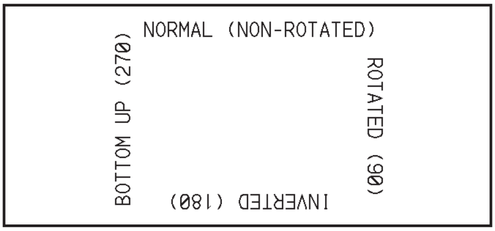
Once you issue a **^PO** command, the setting is retained until you turn off the printer or send the opposite **^PO** instruction to the printer.

The **^POI** instruction moves the Label Home position to the furthest point away from the main frame. Therefore, a different **^LH** (Label Home) can be used to move the print back onto the label.

NOTE: If multiple ^PO instructions are issued in the same label format, only the last instruction sent to the printer is used.

```
^XA^CFD
^POI
^LH330,10
^FO50,50^FDZEBRA TECHNOLOGIES^FS
^FO50,75^FDVernon Hills, IL
^XZ
```





Defining Field Orientation Parameters

^PP

Programmable Pause

~PP

The **~PP** (Programmable Pause) instruction stops printing after the current label is printed (if one is printing) and places the printer in the Pause mode.

The **^PP** (Programmable Pause) is not immediate. Therefore, several labels may be printed before a pause is performed. This instruction will pause the printer after the format it is in prints.

The operation is identical to pressing the PAUSE button on the front panel of the printer. The printer will remain paused until the PAUSE button is pressed or a **~PS** instruction is sent to the printer.

^PQ Print Quantity

The **^PQ** (Print Quantity) instruction gives control over several printing operations. It controls the number of labels to print, the number of labels printed before printer pauses, and the number of replications of each serial number.

This format of the **^PQ** instruction is:

^PQq,p,r,o

where

^PQ = **Print Quantity**

q = **Total Quantity of Labels to Print**
Default value: 1
Acceptable values: 1 - 99,999,999

p = **Pause ('Group') Count**
Default value: 0 = no pause
Acceptable values: 0 - 99,999,999 labels between pauses

Effective for Versions 14.4.3, 16.5.0
p parameter now equals "**Pause** or **Cut** value"

r = **Replicates of Each Serial Number**
Default value: 0 = no replicates
Acceptable values: 0 - 99,999,999 replicates

o = **Override Pause Count**
Default value: N = No
Other value: Y = Yes

Effective for Versions 14.4.3, 16.5.0
If **o** parameter is set to "Y", the printer cuts but doesn't pause

Explanations of Values for the ^PQ 'o' Parameter

With the '**o**' parameter set to Y, the printer will NOT pause after every group count ('**p**' parameter) of labels has been printed. With the '**o**' parameter set to N (the default), the printer will pause after every group count of labels has been printed.

Examples of the ^PQ Instruction

^PQ50,10,1,Y: Print a total quantity of 50 labels with one replicate of each serial number. Print the total quantity in groups of 10, but do not pause after every group.

^PQ50,10,1,N: Print a total quantity of 50 labels with one replicate of each serial number. Print the total quantity in groups of 10, pausing after every group.

^PR Print Rate

The **^PR** (Print Rate) instruction determines the media speed during printing and the slew speed (feeding a blank label).

The printer will operate with the selected speeds until the setting is reissued in a subsequent format or the printer is turned off.

The print speed is application specific. ***Since print quality is affected by media and ribbon, printing speeds and printer operating modes, it is very important to run tests for your applications.***

The format for the **^PR** instruction is:

^PRp,s,b

where

^PR = **Print Rate**

p = **Print Speed**

Default value: Speed A

Acceptable values :

A or 2	50.8 mm/sec.	(2 inches/sec.)
B or 3	76.2 mm/sec.	(3 inches/sec.)
C or 4	101.6 mm/sec.	(4 inches/sec.)
5	127 mm/sec.	(5 inches/sec.)
D or 6	152.4 mm/sec.	(6 inches/sec.)
E or 8	203.2 mm/sec.	(8 inches/sec.)

s = **Slew Speed**

Default value: Speed D

Acceptable values :

A or 2	50.8 mm/sec.	(2 inches/sec.)
B or 3	76.2 mm/sec.	(3 inches/sec.)
C or 4	101.6 mm/sec.	(4 inches/sec.)
5	127 mm/sec.	(5 inches/sec.)
D or 6	152.4 mm/sec.	(6 inches/sec.)
E or 8	203.2 mm/sec.	(8 inches/sec.)

Effective for Version 16.3.0

b = **Backfeed Speed**

Default value: Speed D

Acceptable values :

A or 2	50.8 mm/sec.	(2 inches/sec.)
B or 3	76.2 mm/sec.	(3 inches/sec.)
C or 4	101.6 mm/sec.	(4 inches/sec.)
5	127 mm/sec.	(5 inches/sec.)
D or 6	152.4 mm/sec.	(6 inches/sec.)
E or 8	203.2 mm/sec.	(8 inches/sec.)

~PS Print Start

The **~PS** (Print Start) instruction causes a printer in the Pause mode to resume printing. The operation is identical to pressing the PAUSE button on the front panel of the printer when the printer is already in the Pause mode.

^PW Print Width

The **^PW** (Print Width) command lets you set the print width via ZPL.

The format for the **^PW** instruction is:

^PWa

where

^PW = **Print Width**

a = **Label Width in Dots**

NOTE: The ^PW command is not available to all Zebra printers, specifically the Zebra 160S, 105S, 105Se and the S300 and S500 printers.

^SC Set Communications

The **^SC** (Set Communications) command allows you to change the communications parameters you are using.

The format for the **^SC** command is:

^SCa,b,c,d,e,f

where

^SC = **Set Communications**

a = **Baud Rate (110-19200 baud)**

b = **Word Length (7 or 8 data bits)**

c = **Parity (N = none, E = even, O = odd)**

d = **Stop Bits (1 or 2)**

e = **Handshake (X = XON/XOFF, D = DTR/DSR)**

f = **Zebra Protocol**
N = NONE
Z = Zebra
A = Ack/Nak)

Effective for Version 20.5.2
Parameter “**f**”:
Y = Zebra

NOTE: If you do not specify a new setting for a parameter, it remains unchanged (it does not change to the default value).

~SD Set Darkness

The **~SD** (Set Darkness) command lets you set the darkness of printing via ZPL. It is equivalent to the darkness setting parameter on the front panel display.

The format for the ~**SD instruction** is:

~SD#

where

~SD = **Set Darkness**

= **A Two-Digit Numeric Value Corresponding to the Desired Darkness Setting**
Default value: Last permanently saved value
Range: 00 to 30

NOTE: The ^MD (Media Darkness) instruction value, if any, is added to the ~SD value.

^SE Select Encoding

The **^SE** (Select Encoding) command has been created to select the desired ZPL/ZPL II encoding table.

The format for the **^SE** instruction is:

^SEn

where

^SE = **Select Encoding**

n = **The Name of the Encoding Table**

^SF Serialization Field (with a standard ^FD string)

The **^SF** (Serialization Field) command allows the user to serialize a standard **^FD** string. Fields serialized with this command will be right justified or would end with the last character of the string. The increment string is aligned with the mask starting with the right-most position. The maximum size of the mask and increment string is 3K combined.

Example (ZPL):

```
^FD12A^SFnnA,C
```

This mask has the first characters as alphanumeric (nn = 12) and the last digit as upper case alphabetic (A). The decimal value of the increment number is equivalent to 2 (C).

The print sequence on a series of labels would be:
12A, 12C, 12E, 12G...

```
^FDBL0000^SFAAdddd,1
```

The print sequence on a series of labels would be:
BL0000, BL0001,...BL0009, BL0010,...
BL0099, BL0100,...BL9999, BM0000...

```
^FDBL00-0^SFAAdd%d,1%1
```

The print sequence on a series of labels would be:
BL00-0, BL01-1, BL02-2,...BL09-9,
BL11-0, BL12-1...

The format for the **^SF** instruction is:

^SFa,b

where

^SF = **Serialization Fields**

a = **Mask String**

1. The Mask String sets the serialization scheme. The length of the string mask defines the number of characters in the current ^**FD string** to be serialized. The mask is aligned to the characters in the **^FD string** starting with the right-most position.

   Mask String placeholders:

   D or d - Decimal numeric 0-9

   H or h - Hexadecimal 0-9 plus a-f or A-F

   O or o - Octal 0-7

   A or a - Alphabetic a-z or A-Z

   N or n - Alphanumeric 0-9 plus a-z or A-Z

   % - Ignore character or skip

b = **Increment String**

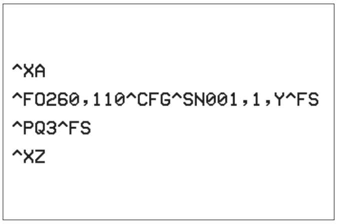
1. The increment string is the value to be added to the field on each label. The default value is equivalent to a decimal value of one. The string is composed of any characters defined in the serial string. Invalid characters will be assumed to be equal to a value of zero in that character position.
2. The increment value for Alphabetic strings will start with ‘A’ or ‘a’ as the zero place holder. This means to increment an alphabetic character by one a value of ‘B’ or ‘b’ must be in the increment string.
3. There may be times when the “%” character needs to be added to the Increment String.

^SN Serialization Data

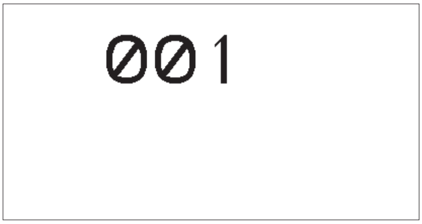
The **^SN** (Serialization Data) instruction allows the printer to index data fields by a selected increment or decrement value (i.e., make the data fields increase or decrease by a specified value) each time a label is printed. This can be performed on up to 100 to 150 fields in a given format and can be performed on both alphanumeric and bar code fields. A maximum of 12 of the rightmost integers are subject to indexing. The first integer found when scanning from right to left starts the indexing portion of the data field.

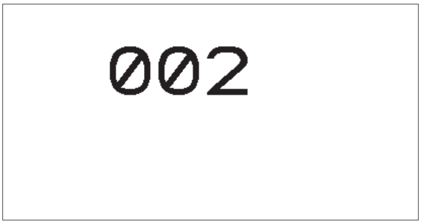
If the alphanumeric field to be indexed ends with an alpha character, the data will be scanned, character-by-character, from right to left until a numeric character is encountered. Serialization will take place using the value of the first number found.

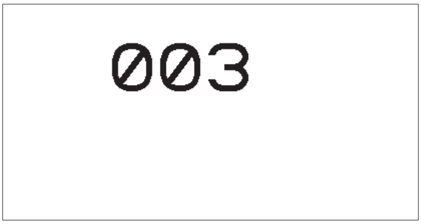
The following is an example of how to use the **^SN** instruction.



```
^XA
^FO260,110^CFG^SN001,1,Y^FS
^PQ3^FS
^XZ
```







NOTE: Incrementing/Decrementing takes place for each serial numbered field when all replicates for each serial number have been printed, as specified in parameter "r" of the Print Quantity ^PQ instruction.

The format for the **^SN** instruction is:

^SNv,n,z

where

^SN = **Serialized Data**

v = **Starting Value**
Default value: 1
Other values: 12-digit maximum for portion to be indexed.

n = **Increment/Decrement Value**
Default value: 1
Other values: 12-digit maximum

NOTE: To indicate a decrement value, precede the value with a minus sign (-).

z = **Add Leading Zeros if Needed**
Default value: N = No
Other value: Y = Yes

Using Leading Zeros

In the **^SN** instruction, the “z” parameter determines if leading zeros will be printed or suppressed. The default value for this parameter is to not print the leading zeros. Depending on which value is used (Y = Yes, print leading zeros; N = No, do not print leading zeros) the printer will do the following.

Printing Leading Zeros

The starting value consists of the right most consecutive sequence of digits. The width (number of digits in the sequence) is determined by scanning from right to left until the first non-digit (space or alpha character) is encountered. To create a specific width, manually place leading zeros as necessary.

Suppressing Leading Zeros

The starting value consists of the right most consecutive sequence of digits, *including any leading spaces.* The width (number of digits in the sequence) is determined by scanning from right to left until the first alpha character (except a space) is encountered. To create a specific width, manually place leading spaces or zeros as necessary. Suppressed zeros are replaced by spaces. During the serialization process, when the entire number contains all zeros, the last zero is not suppressed. In this case a single zero is printed.

NOTE: If, during the course of printing serialized labels the printer runs out of either paper or ribbon, the first label printed (after the media or ribbon has been replaced and calibration completed) will have the same serial number as the "partial" label printed before the "out" condition occurred. This is done in case the last label before the "out" condition did not fully print. This is controlled by the ^JZ instruction (see Page 273).

The Serialize Data Instruction replaces the Field Data (**^FD**) instruction within a label formatting program.

^SP Start Print

The **^SP** (Start Print) instruction allows a label to start printing at a specified point before the entire label has been completely formatted. On extremely complex labels, this instruction can increase the overall throughput of the print.

The instruction works as follows. You specify the dot row at which the **^SP** instruction is to take affect. This then creates a label 'segment.' Once the **^SP** instruction is processed, all information in that segment will be printed. During the printing process, all of the instructions after the **^SP** will continue to be received and processed by the printer.

If the segment after the **^SP** instruction (or the remainder of the label) is ready for printing, media motion does not stop. If the next segment is not ready, the printer will stop "mid-label" and wait for the next segment to be completed. Precise positioning of the **^SP** instruction is somewhat of a trial-and-error process as it depends primarily on print speed and label complexity.

The **^SP** instruction can be effectively used to determine the worst case print quality. You can determine if using the **^SP** instruction is appropriate for the particular application by using the following procedure. If you send the label format up to the first **^SP** instruction and then wait for printing to stop before sending the next segment, the printed label will be a sample of the worst case print quality. It will also drop any field that is out of order.

NOTE: If you use the procedure in the above paragraph, the end of the label format must be as follows:

```
^ SP# ^ FS
```

The format for the **^SP** instruction is:

^SPa

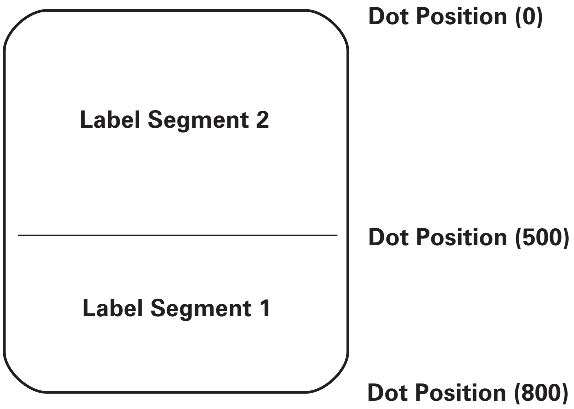
where

^SP = **Start Print**

a = **The Dot Row at which Printing is to Start**
Default value: 0
Other values: Any number up to that used in the **^LL** (Label Length) instruction.

The following page shows an example of using the **^SP** command.

In the following illustration, a label 800 dot rows in length has an **^SP500** instruction. Segment 1 will print while instructions in Segment 2 are being received and formatted.



^SR Set Head Resistance

The ^**SR (Set** Head Resistance) command lets you set the printhead resistance via ZPL.

The format for the **^SR** instruction is:

^SR#

where

^SR = **Set Head Resistance**

= **A Numeric Value up to 4 Digits Long Corresponding to the Resistance Value You Want to Use.**
Default value: Last permanently saved value
Range: 488 to 1175

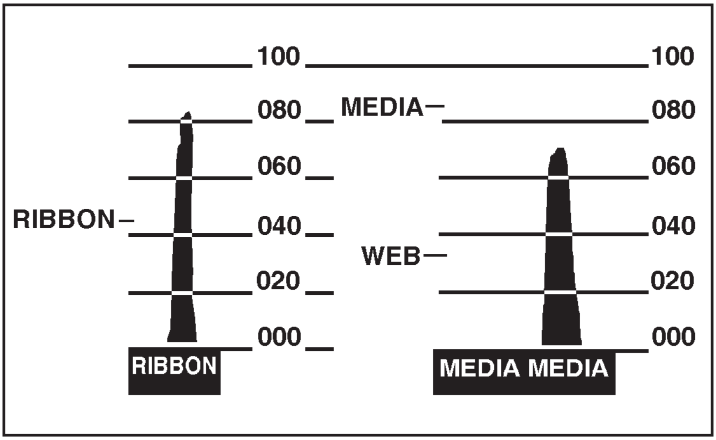
NOTE: To avoid damaging the printhead, this value should be less than or equal to the value shown on the printhead you are using. Setting a higher value may damage the printhead.

^SS Set Media Sensors

The **^SS** (Set Media Sensor) instruction is used to change the values for media, web, ribbon and label length that were set during the "media calibration" process. The "Media Calibration" process is described in your specific printer's user's guide.

In the illustration below is an example of a Media Sensor Profile. Notice the numbers from 000 to 100 and where the words WEB, MEDIA and RIBBON appear in relation to those numbers. Also notice the black vertical spike. This represents where the printer sensed the transition from media-to-web-to-media.

NOTE: Media and Sensor Profile produced on your printer may look different than the one shown here.



The format for the **^SS** instruction is:

^SSw,m,r,l,m2,r2,a.b.c

where

^SS = **Set Media Sensors**

w = **3-Digit Value for the Web (000 to 100)**
Default value: Value shown on the media sensor profile or configuration label.

m = **3-Digit Value for the Media (000 to 100)**
Default value: Value shown on the media sensor profile or configuration label.

r = **3-Digit Value for the Ribbon (000 to 100)**
Default value: Value shown on the media sensor profile or configuration label.

l = **4-Digit Value for the Label Length in Dots (0001 to 9999)**
Default value: The value calculated in the "Calibration" process. (See the configuration label).

m2 = **3-Digit Value for Intensity of Media LED (000 to 100)**
Default value: The value calculated in the "Calibration" process. (See the configuration label).

r2 = **3-Digit Value for Intensity of Ribbon LED (000 to 100)**
Default value: The value calculated in the "Calibration" process. (See the configuration label)

Effective for Version 14.5.3

a = **3-Digit Value for Mark Sensing (000 to 100)**

b = **3-Digit Value for Mark Media Sensing (000 to 100)**

c = **3-Digit Value for Mark LED Sensing (000 to 100)**

NOTE: The 'm2' and 'r2' values have no effect in Stripe Printers.

^SZ Set ZPL

The **^SZ** (Set ZPL) instruction is used to select the programming language used by the printer. This instruction gives you the ability to print labels formatted in both ZPL or ZPL II.

This instruction will remain active until another **^SZ** instruction is sent to the printer or the printer is turned off.

The format for the **^SZ** instruction is:

^SZa

where

^SZ = **Set ZPL**

a = **Set ZPL**

1 = ZPL
2 = ZPL II

(Instruction ignored if parameter missing or incorrect.)

~TA Tear-Off Adjust Position

The **~TA** (Tear-Off Adjust Position) command lets you adjust the rest position of the media after a label is printed, which changes the position at which the label is torn or cut.

The format for the **~TA** instruction is:

~TA#

where

~TA = **Tear-Off Adjust Position**

= **Two-Digit Numeric Value (-64 to +64 Dot Rows) Representing the Desired Change in Media Rest Position**

Effective for Version 18.6.6, 21.6.1
Three-Digit Numerical Value (-120 to +120 Dot Rows)

NOTE: Positive values do not require a "+" sign to be entered. Instruction is ignored if the parameter is missing or incorrect.
I.V.P. = Last Permanent Value Saved

^TO Transfer Object

The **^TO** (Transfer Object) instruction is used to copy an object or group of objects from one storage device to another. It is quite similar to the copy function used in PC's.

Source and destination devices must be supplied and must be different and valid for the action specified. Invalid parameters will cause the instruction to be ignored.

There are no defaults associated with this instruction. However, the asterisk (*) may be used as a wild card for objectnames and extensions. For instance, ZEBRA.* or *.GRF would be acceptable forms for use with **^TO** instruction.

The format for the **^TO** instruction is:

^TOd,o,x,s,o,x

where:

^TO = **Transfer Object.**

d = **Source Device where Object is Stored**.*{R:, B:}*

o = **Name of Stored Object**
(Supports use of *wild cards*.)

x = **Extension, 3 Alphanumeric Characters**
(Supports use of *wild cards*)

s = **Destination Device where Object is to be Stored**
{R:, *B:}*

o = **Name of Object Stored at Destination**
(Supports use of *wild cards*.)

x = **Extension, 3 Alphanumeric Characters**
(Supports use of *wild cards*)

NOTE 1: If the destination device does not have enough free space to store the object being copied, the entire operation will be negated.

NOTE 2: Zebra Files (Z:*.*) cannot be transferred. These files are copyrighted by Zebra Technologies Corp.

The following are some examples of using the **^TO** instruction. To copy the object ZLOGO.GRF from DRAM to an optional Memory Card and rename it ZLOGO1.GRF:

```
^ XA
^ TOR:ZLOGO.GRF,B:ZLOGO1.GRF
^ XZ
```

To copy the object SAMPLE.GRF from an optional Memory Card to DRAM and keep the same name

```
^ XA
^ TOB:SAMPLE.GRF,R:SAMPLE.GRF
^ XZ
```

Transferring Multiple Objects

The Asterisk (*) can be used to transfer multiple object files (except *.FNT) from the DRAM to the Memory Card. For example, you have several object files that contain logos. These files are named LOGO1.GRF, LOGO2.GRF, and LOGO3.GRF.

For example...

You want to transfer all of these files to the Memory Card using the name NEW instead of LOGO. By placing an Asterisk (*) after both LOGO and NEW in the transfer instruction, you can copy all of these files with one instruction. The format for this would be as follows.

```
^ XA
^ TOR:LOGO*.GRF,B:NEW*.GRF
^ XZ
```

NOTE: If, during a multiple transfer, a file is to big to be stored on the Memory Card, it will be skipped. All remaining files will be checked to see if they can be stored. Those that can be stored, will be stored.

~WC Print Configuration Label

The **~WC** (Print Configuration Label) instruction is used to generate a Printer Configuration Label.

NOTE: This instruction only works when the printer is idle.

The format for the **~WC** instruction is:

^ WC

where

~WC = **Print Configuration Label**

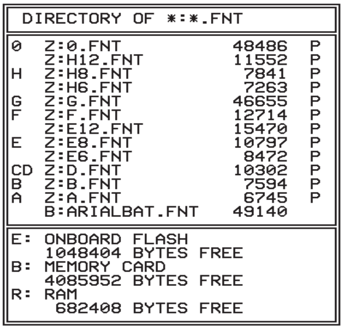
Effective for Version 22.8.5
Specific changes include the following new descriptive parameter names:

E: ONBOARD FLASH
B: MEMORY CARD
R: RAM

^WD Print Directory on Label

The **^WD** (Print Directory on Label) instruction is used to print a label listing bar codes, objects stored in DRAM, or fonts (if an optional font ROM is installed in the printer).

For bar codes the list will show the name of the bar code. For fonts the list shows the name of the font, number to use with **^Af** instruction and size. For objects stored in DRAM the list shows the name of the object, extension, size and option flags. All lists are enclosed in a double line box.



```
 DIRECTORY OF *:*.FNT

0   Z:0.FNT              48486   P
    Z:H12.FNT            11552   P
H   Z:H8.FNT              7841   P
    Z:H6.FNT              7263   P
G   Z:G.FNT              46655   P
F   Z:F.FNT              12714   P
    Z:E12.FNT            15470   P
E   Z:E8.FNT             10797   P
    Z:E6.FNT              8472   P
CD  Z:D.FNT              10302   P
B   Z:B.FNT               7594   P
A   Z:A.FNT               6745   P
    B:ARIALBAT.FNT       49140

E:  ONBOARD FLASH
    1048404 BYTES FREE
B:  MEMORY CARD
    4085952 BYTES FREE
R:  RAM
     682408 BYTES FREE
```

The format for the **^WD** instruction is:

^WDd,o,x

where

^WD = **Print Directory on Label**

d = **Source Device to Store Image**
{Optional. Default is Search Priority}

o = **Name of Object**
{Optional. Default is "". A "?" can also be used}*

x = **Extension.**

Effective for Version 22.8.5
Specific changes include the following new descriptive parameter names:

E: ONBOARD FLASH
B: MEMORY CARD
R: RAM

The following are examples of using the **^WD** instruction.

To print a label listing all objects in DRAM.

```
^XA^WDR:*.*
^XZ
```

To print a label listing all the bar codes.

```
^XA^WDZ:*.BAR
^XZ
```

To print a label listing all fonts.

```
^XA^WDE:
^XZ
```

^XA Start Format

The **^XA** (Start Format) instruction is the beginning (opening) bracket. It indicates the start of a new label format. This instruction can also be issued as a single ASCII control character **STX** (Control-B, Hex 02).

^XB Suppress Backfeed

The **^XB** (Suppress Backfeed) instruction suppresses forward feed of media to tear-off position depending on the current printer mode. Since no forward feed is done, a backfeed before printing of the next label is not necessary, therefore, throughput will be improved. When printing a batch of labels, the last label should not contain this instruction.

The format for the **^XB** instruction is:

^XB

where

^XB = **Suppress Backfeed**

In the Tear-Off Mode:

Normal Operation - Backfeed, Print, Feed to rest
^XB Operation - Print (i.e Rewind Mode)

In the Peel-Off Mode:

Normal Operation - Backfeed, Print, Feed to rest
^XB Operation - Print (i.e Rewind Mode)

^XF Recall Format

The **^XF** (Recall Format) recalls a stored format to be merged with variable data. There can be multiple **^XF** instructions and they can be located anywhere in the label format.

When recalling a stored format and merging data utilizing the **^FN** (Field Number) function, the calling format must contain the (**^FN**) instruction to properly merge the data.

While use of stored formats will reduce transmission time, no formatting time is saved since the ZPL II format being recalled was saved as text strings which need to be formatted at print time.

The format for the **^XF** instruction is:

^XFd,o,x

where

^XF = **Recall Stored Format**

d = **Source Device of Stored Image**
{Optional. Default is Search Priority}

o = **Name of Stored Image, 1-8 Alphanumeric Characters**
(Default, the name "UNKNOWN" is used.)

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .ZPL}

The following is an example of using the **^XF** instruction to recall the format STOREFMT.ZPL from DRAM and also send new reference data:

```
^XA
^XFR:STOREFMT.ZPL^FS
^FN1^FDZEBRA^FS
^FN2^FDPRINTER^FS
^XZ
```

^XG Recall Graphic

The **^XG** (Recall Graphic) instruction is used to recall one or more graphic images for printing. This instruction is used in a label format to merge pictures such as company logos and piece parts, with text data to form a complete label.

An image may be recalled and resized as many times per format as needed. Other images and data may be added to the format.

The format for the **^XG** instruction is:

^XGd,o,x,x,y

where

^XG = **Recall Graphic Image**

d = **Source Device where Image is Stored**
{Optional. Default is Search Priority.}

o = **Name of Stored Image, 1-8 Alphanumeric Characters**
(Default, the name "UNKNOWN" is used.)

x = **Extension, 3 Alphanumeric Characters**
{Fixed. Will always be .GRF}

x = **Magnification Factor Along X-axis**
Default value: 1
Minimum value: 1, Maximum value: 10

y = **Magnification Factor Along Y-axis**
Default value: 1
Minimum value: 1, Maximum value: 10

The following is an example of using the **^XG** instruction to recall the image SAMPLE.GRF from DRAM and print it in 5 different locations and 5 different sizes on the same label:

```
^XA
^FO100,100^XGR:SAMPLE.GRF,1,1^FS
^FO100,200^XGR:SAMPLE.GRF,2,2^FS
^FO 100,300^XGR:SAMPLE.GRF,3,3^FS
^FO100,400^XGR:SAMPLE.GRF,4,4^FS
^FO100,500^XG R:SAMPLE.GRF,5,5^FS
^XZ
```

^XZ End Format

The **^XZ** (End Format) instruction is the ending (closing) bracket. It indicates the end of a label format. When this instruction is received, a label will be printed. This instruction can also be issued as a single ASCII control character **ETX** (Control-C, Hex 03).

^ZZ Printer Sleep

The **^ZZ** (Printer Sleep) instruction places the printer in an idle or shutdown mode.

The format for the **^ZZ** instruction is:

^ZZt,b

where

^ZZ = **Printer Sleep**

t = **Number of Seconds of Idle Time Prior to Shutdown**
1-999999
0 = disables automatic shutdown
Default Value: Last permanently saved value
Factory Default Value: 0

b = **Label Status at Shutdown**
Y = Indicates to shutdown when labels are still queued.
N = Indicates all labels must be printed before shutting down.

APPENDIX A

ZPL II Command Quick Reference Chart

This table is a summary of ZPL commands.

An asterisk (*) indicates that the command has been supported since the initial release of the firmware. Commands that were added in subsequent releases are signified by the firmware version number.

"N/A" means the command is not supported.

★★IMPORTANT★★

The ZPL II commands listed in this Programming Guide are available depending on which version of firmware is installed in your printer and which printer you are using. Please consult this Command Quick Reference Chart to see which commands are available for your version of firmware and printer.

To determine which version of firmware resides in your printer, you will need to print out a Printer Configuration Label. Consult your printer user's guide for instructions on how to print the label. The label provides valuable information about your printer's configuration, memory, options, etc. A sample of the Printer Configuration Label is shown in Chapter 1 on page 3 with an arrow pointing to the firmware information

COMMAND	DESCRIPTION	V14	V15	V16	V18	V20	V21	V22	V23	V24	V25	V26
^A	Scalable/Bitmapped Font	*	*	*	*	*	*	*	*	*	*	*
^A@	Use Font Name to Call Font	n/a	n/a	n/a	n/a	n/a	n/a	*	n/a	n/a	n/a	*
^B1	Code 11	*	*	*	*	*	*	*	*	*	*	*
^B2	Interleaved 2 of 5	*	*	*	*	*	*	*	*	*	*	*
^B3	Code 39	*	*	*	*	*	*	*	*	*	*	*
^B4	Code 49	14.2.1	n/a	*	*	*	*	*	*	*	*	*
^B7	PDF417	14.2.1	n/a	16.4.0	*	*	*	*	*	*	*	*
^B8	EAN-8	*	*	*	*	*	*	*	*	*	*	*
^B9	UPC-E	*	*	*	*	*	*	*	*	*	*	*
^BA	Code 93	*	*	*	*	*	*	*	*	*	*	*
^BB	CODABLOCK	14.4.0	n/a	16.3.0	*	*	*	*	*	*	*	*
^BC	Code 128	*	*	*	*	*	*	*	*	*	*	*
^BD	Maxicode	14.4.0	15.4.0	16.4.0	18.7.0	*	21.7.0	*	*	*	*	*
^BE	EAN-13	*	*	*	*	*	*	*	*	*	*	*
^BF	Micro-PDF417	14.8.0	n/a	n/a	18.8.0	n/a	21.8.0	22.8.5	23.8.1	n/a	25.8.1	*
^BI	Industrial 2 of 5	*	*	*	*	*	*	*	*	*	*	*
^BJ	Standard 2 of 5	*	*	*	*	*	*	*	*	*	*	*
^BK	ANSI Codabar	*	*	*	*	*	*	*	*	*	*	*
^BL	LOGMARS	*	*	*	*	*	*	*	*	*	*	*
^BM	MSI	*	*	*	*	*	*	*	*	*	*	*
^BP	Plessey	*	*	*	*	*	*	*	*	*	*	*
^BQ	QR Code	n/a	n/a	n/a	n/a	n/a	n/a	22.8.3	n/a	n/a	n/a	*
^BS	UPC/EAN Extensions	*	*	*	*	*	*	*	*	*	*	*
^BU	UPC-A	*	*	*	*	*	*	*	*	*	*	*
^BX	Data Matrix	14.7.0	n/a	*	18.7.0	20.5.3	21.7.0	*	*	24.5.3	*	*
^BY	Change Narrow Bar Width	*	*	*	*	*	*	*	*	*	*	*
^BZ	POSTNET	*	*	*	*	*	*	*	*	*	*	*
^CC, ~CC	Change Carat	*	*	*	*	*	*	*	*	*	*	*
^CD, ~CD	Change Delimiter	*	*	*	*	*	*	*	*	*	*	*
^CF	Change Alphanumeric Default Font	*	*	*	*	*	*	*	*	*	*	*
^CI	Change International Font	*	*	*	*	*	*	*	*	*	*	*
^CO	Cache On	*	n/a	*	*	n/a	*	*	*	n/a	*	*
^CT, ~CT	Change Tilde	*	*	*	*	*	*	*	*	*	*	*

COMMAND	DESCRIPTION	V14	V15	V16	V18	V20	V21	V22	V23	V24	V25	V26
^CV	Code Validation	14.2.1	*	*	*	*	*	*	*	*	*	*
^CW	Font Identifier	*	*	*	*	*	*	*	*	*	*	*
~DB	Download Bitmapped Font	*	*	*	*	*	*	*	*	*	*	*
^DD	Download Direct Bitmap	n/a	n/a	n/a	n/a	n/a	n/a	*	n/a	n/a	n/a	*
~DE	Download Encoding Table for Unbounded Unicode TrueType Font	*	n/a	16.5.0	*	n/a	*	*	n/a	n/a	n/a	*
^DF	Download Format	*	*	*	*	*	*	*	*	*	*	*
^DG	Download Graphic	*	*	*	*	*	*	*	*	*	*	*
^DN	Abort Download Graphic	*	*	*	*	*	*	*	*	*	*	*
~DS	Download Scalable Font	*	n/a	*	*	n/a	*	*	*	n/a	*	*
~DT	Download a TrueType Font	14.5.3	n/a	16.5.0	*	n/a	*	*	n/a	n/a	n/a	*
~DU	Download Unbounded Unicode TrueType Font	*	n/a	16.5.0	*	n/a	*	*	n/a	n/a	n/a	*
^EF, ~EF	Erase Format	*	*	*	*	*	*	*	*	*	*	*
^EG, ~EG	Erase Downloaded Graphics	*	*	*	*	*	*	*	*	*	*	*
^FA	Field Allocate	*	*	*	*	*	*	*	*	*	*	*
^FB	Field Block	*	*	*	*	*	*	*	*	*	*	*
^FD	Field Data	*	*	*	*	*	*	*	*	*	*	*
^FH	Field Hex	*	*	*	*	*	*	*	*	*	*	*
^FN	Field Number	*	*	*	*	*	*	*	*	*	*	*
^FO	Field Origin	*	*	*	*	*	*	*	*	*	*	*
^FP	Field Parameter	*	*	16.5.0	*	*	*	*	*	*	*	*
^FR	Field Reverse Print	*	*	*	*	*	*	*	*	*	*	*
^FS	Field Separator	*	*	*	*	*	*	*	*	*	*	*
^FT	Field Typeset	*	*	*	*	*	*	*	*	*	*	*
^FV	Variable Field Data	*	*	*	*	*	*	*	*	*	*	*
^FW	Field Orientation	*	*	*	*	*	*	*	*	*	*	*
^FX	Comment	*	*	*	*	*	*	*	*	*	*	*
^GB	Graphic Box	*	*	*	*	*	*	*	*	*	*	*
^GF	Graphic Field	n/a	n/a	n/a	n/a	n/a	n/a	*	n/a	n/a	n/a	*
^GS	Graphic Symbol	*	*	*	*	*	*	*	*	*	*	*
~HB	Battery Status	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	*
^HG	Host Graphic	*	*	*	*	*	*	*	*	*	*	*

COMMAND	DESCRIPTION	V14	V15	V16	V18	V20	V21	V22	V23	V24	V25	V26
~HI	Host Identification	*	*	*	*	*	*	*	*	*	*	*
~HM	Memory Status	*	*	*	*	*	*	*	*	*	*	*
~HS	Host Status	*	*	*	*	*	*	*	*	*	*	*
^HV	Host Verification	*	*	*	*	*	*	*	*	*	*	*
^HW	Host Directory List	*	*	*	*	*	*	*	*	*	*	*
^ID	Image Delete	*	*	*	*	*	*	*	*	*	*	*
^IL	Image Load	*	*	*	*	*	*	*	*	*	*	*
^IM	Image Move	*	*	*	*	*	*	*	*	*	*	*
^IS	Image Save	*	*	*	*	*	*	*	*	*	*	*
~JA	Cancel All	*	*	*	*	*	*	*	*	*	*	*
~JB	Reset Battery Dead	*	*	*	*	*	*	*	*	*	*	*
^JB	Initialize Flash Memory	n/a	n/a	n/a	n/a	n/a	n/a	*	n/a	n/a	n/a	*
~JC	Set Media Sensor Calibration	*	*	*	*	*	*	*	*	*	*	*
~JD	Enable Communications Diagnostics	*	*	*	*	*	*	*	*	*	*	*
~JE	Disable Diagnostics	*	*	*	*	*	*	*	*	*	*	*
~JG	Graphing Sensor Calibration	*	*	*	*	*	*	*	*	*	*	*
^JJ	Set Auxiliary Port	*	n/a	16.4.0	*	n/a	*	*	n/a	n/a	n/a	*
~JL	Set Label Length	*	*	*	*	*	*	*	*	*	*	*
^JM	Set Dots per Millimeter	*	*	*	*	*	*	*	*	*	*	*
~JN	Head Test Fatal	*	n/a	*	*	n/a	*	*	n/a	n/a	n/a	*
~JO	Head Test Non-Fatal	*	n/a	*	*	n/a	*	*	n/a	n/a	n/a	*
~JP	Pause and Cancel Format	*	*	*	*	*	*	*	*	*	*	*
~JR	Power On Reset	*	*	*	*	*	*	*	*	*	*	*
~JS	Change Backfeed Sequence	14.4.0	*	*	*	*	*	*	*	*	*	*
^JT	Head Test Interval	*	n/a	*	*	n/a	*	*	n/a	n/a	n/a	*
^JU	Configuration Update	*	*	*	*	*	*	*	*	*	*	*
^JW	Set Ribbon Tension	n/a	n/a	n/a	18.6.1	n/a	n/a	n/a	n/a	n/a	n/a	*
~JX	Cancel Current Partially Input Format	*	*	*	*	*	*	*	*	*	*	*
^JZ	Reprint After Error	*	*	*	*	*	*	*	*	*	*	*
^KL	Define Language	*	*	*	*	*	*	*	*	*	*	*
^KP	Define Password	*	*	*	*	*	*	*	*	*	*	*
^LH	Label Home	*	*	*	*	*	*	*	*	*	*	*
^LL	Label Length	*	*	*	*	*	*	*	*	*	*	*

COMMAND	DESCRIPTION	V14	V15	V16	V18	V20	V21	V22	V23	V24	V25	V26
^LR	Label Reverse Print	*	*	*	*	*	*	*	*	*	*	*
^LS	Label Shift	*	*	*	*	*	*	*	*	*	*	*
^LT	Label Top	*	*	*	*	*	*	*	*	*	*	*
^MC	Map Clear	*	*	*	*	*	*	*	*	*	*	*
^MD	Media Darkness	*	*	*	*	*	*	*	*	*	*	*
^MF	Media Feed	*	*	*	*	*	*	*	*	*	*	*
^ML	Maximum Label Length	*	*	16.5.3	*	*	*	*	*	*	*	*
^MM	Print Mode	*	*	*	*	*	*	*	*	*	*	*
^MN	Media Tracking	14.5.3	*	*	*	*	*	*	*	*	*	*
^MP	Mode Protection	*	*	*	*	*	*	*	*	*	*	*
^MT	Media Type	*	*	*	*	*	*	*	*	*	*	*
^MU	Mode Units	n/a	n/a	n/a	n/a	n/a	n/a	*	n/a	n/a	n/a	*
~NC	Network Connect	*	*	*	*	*	*	*	*	*	*	*
^NI	Network ID Number	*	*	*	*	*	*	*	*	*	*	*
~NR	Set all Network Printers Transparent	*	*	*	*	*	*	*	*	*	*	*
~NT	Set Network Printer Transparent	*	*	*	*	*	*	*	*	*	*	*
^PF	Slew Given Number of Dot Rows	*	*	*	*	*	*	*	*	*	*	*
^PH, ~PH	Slew to Home Position	*	*	*	*	*	*	*	*	*	*	*
^PM	Print Mirror Image	*	*	*	*	*	*	*	*	*	*	*
^PO	Print Orientation	*	*	*	*	*	*	*	*	*	*	*
^PP, ~PP	Programmable Pause	*	*	*	*	*	*	*	*	*	*	*
^PQ	Print Quantity	*	*	16.5.0	*	*	*	*	*	*	*	*
^PR	Print Rate	*	*	*	*	*	*	*	*	*	*	*
~PS	Print Start	*	*	*	*	*	*	*	*	*	*	*
^PW	Print Width	*	*	*	*	*	*	*	*	*	*	*
^SC	Set Communications	n/a	n/a	n/a	n/a	*	n/a	n/a	*	*	*	*
~SD	Set Darkness	*	n/a	16.5.3	*	20.4.2	*	*	*	*	*	*
^SE	Select Encoding	14.7.0	n/a	n/a	18.7.0	*	21.7.0	*	*	*	*	*
^SF	Serialization Fields with a Standard ^FD String	n/a	n/a	n/a	n/a	n/a	n/a	*	n/a	n/a	n/a	*
^SN	Serialized Data	*	*	*	*	*	*	*	*	*	*	*
^SP	Start Print	*	*	*	*	*	*	*	*	*	*	*

COMMAND	DESCRIPTION	V14	V15	V16	V18	V20	V21	V22	V23	V24	V25	V26
^SR	Set Head Resistance	n/a	n/a	16.5.3	*	n/a	*	*	n/a	n/a	n/a	*
^SS	Set Media Sensor	*	*	*	*	*	*	*	*	*	*	*
^SZ	Set ZPL	*	*	*	*	*	*	*	*	*	*	*
~TA	Tear Off Adjust Position	*	*	16.5.3	*	20.5.0	*	*	*	*	*	*
^TO	Transfer Object	14.4.0	*	*	*	*	*	*	*	*	*	*
~WC	Print Configuration Label	*	*	*	*	*	*	*	*	*	*	*
^WD	Print Directory on Label	*	*	*	*	*	*	*	*	*	*	*
^XA	Start Format	*	*	*	*	*	*	*	*	*	*	*
^XB	Suppress Backfeed	*	*	*	*	*	*	*	*	*	*	*
^XF	Recall Format	*	*	*	*	*	*	*	*	*	*	*
^XG	Recall Graphic	*	*	*	*	*	*	*	*	*	*	*
^XZ	End Format	*	*	*	*	*	*	*	*	*	*	*
^ZZ	Printer Sleep	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	*

APPENDIX B
ASCII Code Chart

The following page contains a chart of the ASCII (American Standard Code for Information Exchange) Code used by the Zebra printers.

ASCII Code Chart

HEX	CHAR	HEX	CHAR	HEX	CHAR	HEX	CHAR
00	NUL	20	space	40	@	60	‘
01	SOH	21	!	41	A	61	a
02	STX	22	“	42	B	62	b
03	ETX	23	#	43	C	63	c
04	EOT	24	$	44	D	64	d
05	ENQ	25	%	45	E	65	e
06	ACK	26	&	46	F	66	f
07	BEL	27	‘	47	G	67	g
08	BS	28	(	48	H	68	h
09	HT	29	)	49	I	69	i
0A	LF	2A	*	4A	J	6A	j
0B	VT	2B	+	4B	K	6B	k
0C	FF	2C	,	4C	L	6C	l
0D	CR	2D	-	4D	M	6D	m
0E	SO	2E	.	4E	N	6E	n
0F	SI	2F	/	4F	O	6F	o
10	DLE	30	0	50	P	70	p
11	DC1	31	1	51	Q	71	q
12	DC2	32	2	52	R	72	r
13	DC3	33	3	53	S	73	s
14	DC4	34	4	54	T	74	t
15	NAK	35	5	55	U	75	u
16	SYN	36	6	56	V	76	v
17	ETB	37	7	57	W	77	w
18	CAN	38	8	58	X	78	x
19	EM	39	9	59	Y	79	y
1A	SUB	3A	:	5A	Z	7A	z
1B	ESC	3B	;	5B	[	7B	{
1C	FS	3C	<	5C	\	7C	|
1D	GS	3D	=	5D	]	7D	}
1E	RS	3E	>	5E	^	7E	~
1F	US	3F	?	5F	_	7F	DEL

▨ *NOTE: NOT recommended for use as a Command Prefix, Format Prefix, or Delimiter Character*

APPENDIX C
Mod 10 Check Digit

The calculations for determining the Mod 10 Check Digit character are as follows:

1. Start at the first position and add the value of every other position together.

   0 + 2 + 4 + 6 + 8 + 0 = 20

2. The result of Step 1 is multiplied by 3.

   20 x 3 = 60

3. Start at the second position and add the value of every other position together.

   1 + 3 + 5 + 7 + 9 = 25

4. The results of steps 1 and 3 are added together.

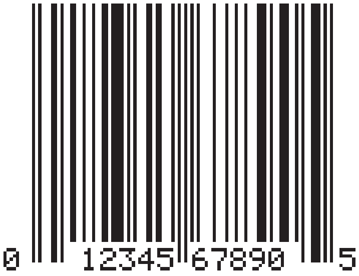
   60 + 25 = 85

5. The check character (12th character) is the smallest number which, when added to the result in step 4, produces a multiple of 10.

   85 + X = 90 (next higher multiple of 10)

   X = 5 Check Character

The following is a bar code that illustrates the above example. The digit on the right (5) is the check digit.



APPENDIX D
Mod 43 Check Digit

The calulations for determining the Mod 43 Check Digit character are as follows:

Each character in the Code 39 Character set has a specific value. These are shown in the chart below.

0=0	B=11	M=22	X=33
1=1	C=12	N=23	Y=34
2=2	D=13	O=24	Z=35
3=3	E=14	P=25	- =36
4=4	F=15	Q=26	. = 37
5=5	G=16	R=27	Space=38
6=6	H=17	S=28	$=39
7=7	I=18	T=29	/=40
8=8	J=19	U=30	+=41
9=9	K=20	V=31	%=42
A=10	L=21	W=32	

Sample Data String: **12345ABCDE/**

1. Add the sum of all the character values in the data string. Using the Chart above, the sum of the character values is as follows:

   1 + 2 + 3 + 4 + 5 + 10 + 11 + 12 + 13 + 14 + 40 = 115

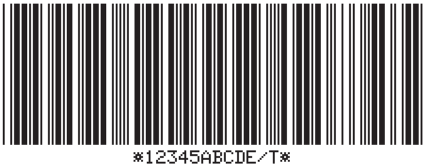
2. Divide the total by 43. Keep track of the remainder.

   115/43 = 2 Remainder is 29

3. The “check digit” is the character that corresponds to the value of the remainder.

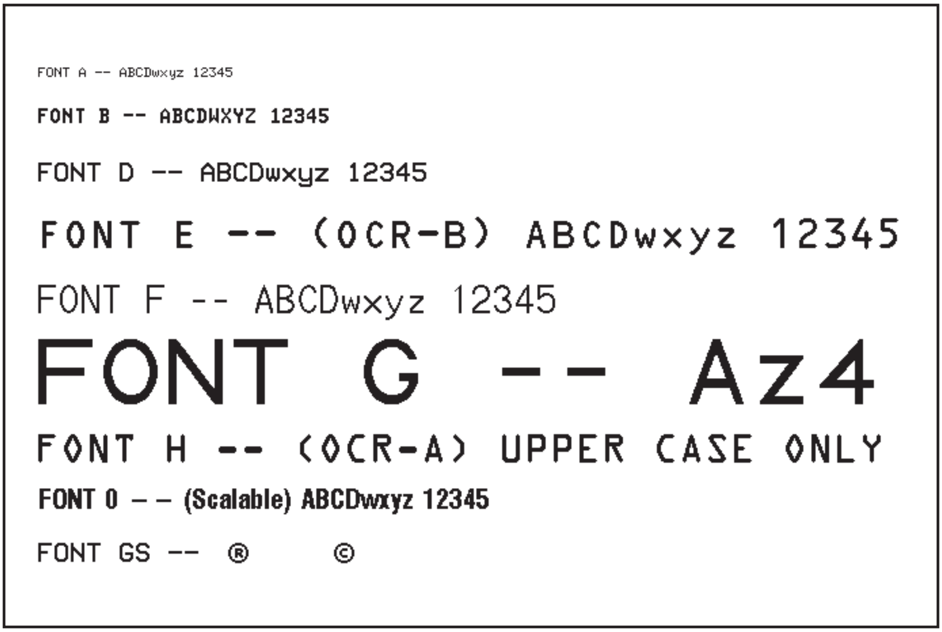
   Remainder = 29.
   29 is the value for the letter T.
   T is the check digit.

The following is a bar code that illustrates the above example. The digit on the right (“**T**”) is the check digit.



```
^FO125,100^B3N,Y,150,Y,N^FD12345ABCDE/^FS
```

APPENDIX E
Fonts and Font Matrices



FONT A -- ABCDwxyz 12345

FONT B -- ABCDWXYZ 12345

FONT D -- ABCDwxyz 12345

FONT E -- (OCR-B) ABCDwxyz 12345

FONT F -- ABCDwxyz 12345

FONT G -- Az4

FONT H -- (OCR-A) UPPER CASE ONLY

FONT 0 – – (Scalable) ABCDwxyz 12345

FONT GS -- ® ©

Standard Printer Fonts

Font	Matrix	Type*	Character Size			
	H×W (in dots)		H×W (in in.)	char. /in.	H×W (in mm)	char. /mm
A	9 x 5	U-L-D	.059 x .039	25.4	1.50 x 0.99	1.01
B	11 x 7	U	.072 x .059	16.9	1.82 x 1.50	0.66
C,D	18 x 10	U-L-D	.118 x .079	12.7	2.99 x 2.00	0.50
E	21 x 10	OCR-B	.138 x .085	11.7	3.50 x 2.16	0.46
F	26 x 13	U-L-D	.170 x .105	9.53	4.32 x 2.67	0.37
G	60 x 40	U-L-D	.394 x .315	3.18	10.0 x 8.00	0.125
H	17 x 11	OCR-A	.111 x .098	10.20	2.81 x 2.48	0.40
GS	24x24	SYMBOL	.157 x .157	6.35	3.98 x 3.98	.251
Ø	DEFAULT: 15x12	SCALABLE See SCALABLE FONT SIZE “Page 4-12.				

**U = Uppercase L = Lowercase D = Descenders*

Font Matrices (6 dot/mm print head)

Font	Matrix	Type*	Character Size			
	H×W (in dots)		H×W (in in.)	char. /in.	H×W (in mm)	char. /mm
A	9 x 5	U-L-D	.044 x .030	33.3	1.12 x 0.76	1.31
B	11 x 7	U	.054 x .044	22.7	1.37 x 1.12	0.89
C,D	18 x 10	U-L-D	.089 x .059	16.9	2.26 x 1.50	0.66
E	28 x 15	OCR-B	.138 x .098	10.2	3.50 x 2.49	0.40
F	26 x 13	U-L-D	.128 x .079	12.7	3.25 x 2.00	0.50
G	60 x 40	U-L-D	.295 x .197	4.2	7.49 x 5.00	0.167
H	21 x 13	OCR-A	.103 x .093	10.8	2.61 x 2.36	0.423
GS	24x24	SYMBOL	.118 x .118	8.5	2.99 x 2.99	0.334
Ø	DEFAULT: 15x12	SCALABLE See SCALABLE FONT SIZE “Page 4-12.				

**U = Uppercase L = Lowercase D = Descenders*

Font Matrices (8 dot/mm print head)

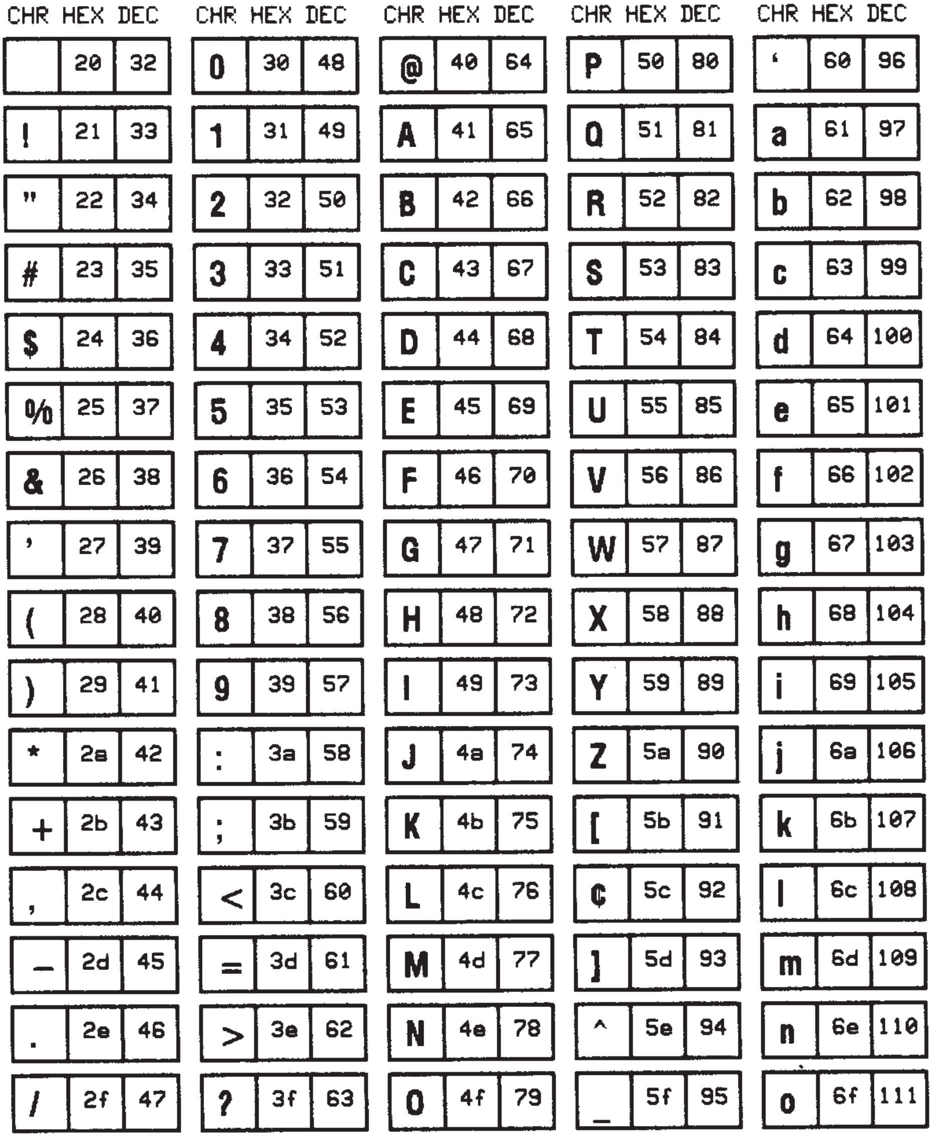
Font	Matrix	Type*	Character Size			
	H×W (in dots)		H×W (in in.)	char. /in.	H×W (in mm)	char. /mm
A	9 x 5	U-L-D	.030 x .020	50.8	0.75 x 0.50	2.02
B	11 x 7	U	.036 x .030	33.8	0.91 x 0.75	1.32
C,D	18 x 10	U-L-D	.059 x .040	25.4	1.50 x 1.00	1.00
E	42 x 20	OCR-B	.138 x .085	23.4	1.75 x 1.08	0.92
F	26 x 13	U-L-D	.085 x .053	19.06	2.16 x 1.34	0.74
G	60 x 40	U-L-D	.197x .158	6.36	5.00 x 4.00	0.25
H	34 x 22	OCR-A	.111 x .098	10.20	2.81 x 2.48	0.40
GS	24x24	SYMBOL	.079 x .079	12.70	1.99 x 1.99	0.52
Ø	DEFAULT: 15x12	SCALABLE See SCALABLE FONT SIZE “Page 4-12.				

**U = Uppercase   L = Lowercase   D = Descenders*

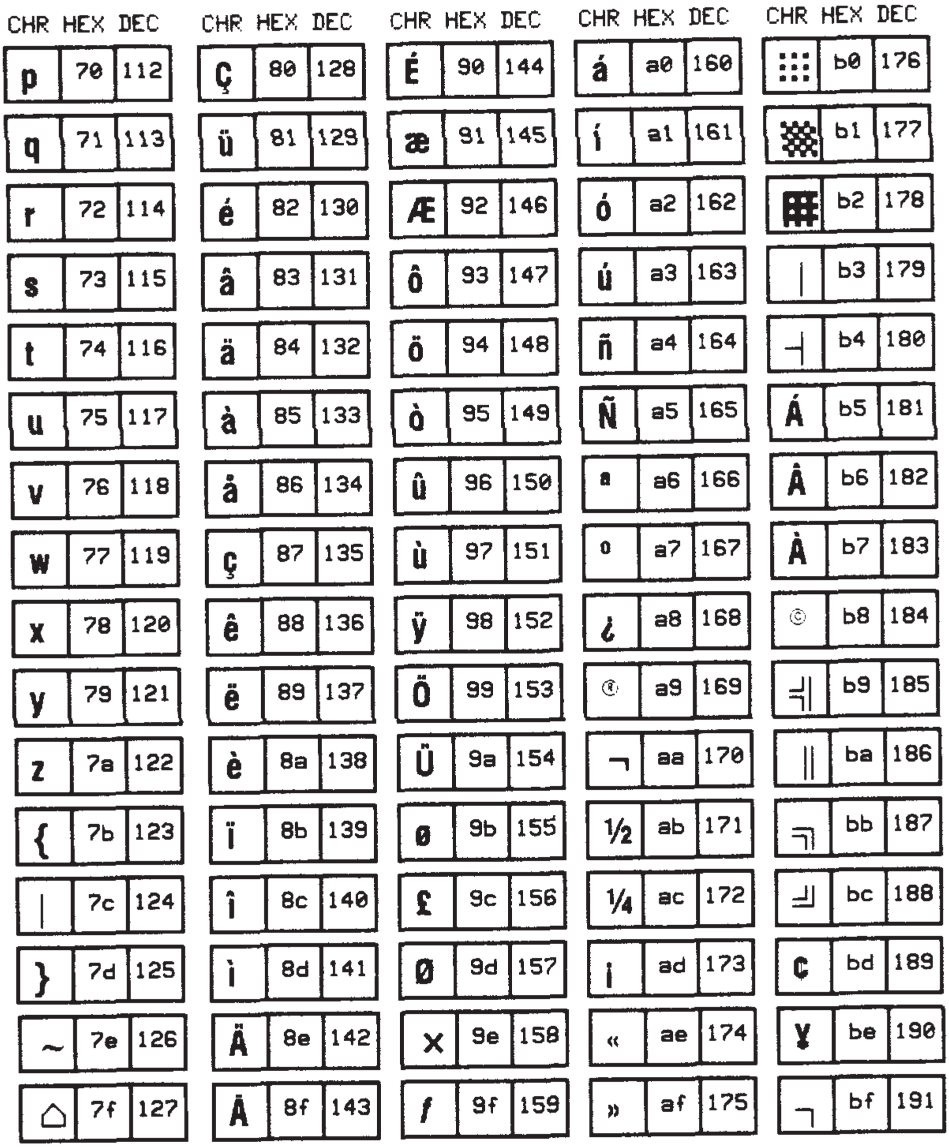
Font Matrices (12 dot/mm print head)

APPENDIX F
Code Page 850 Chart

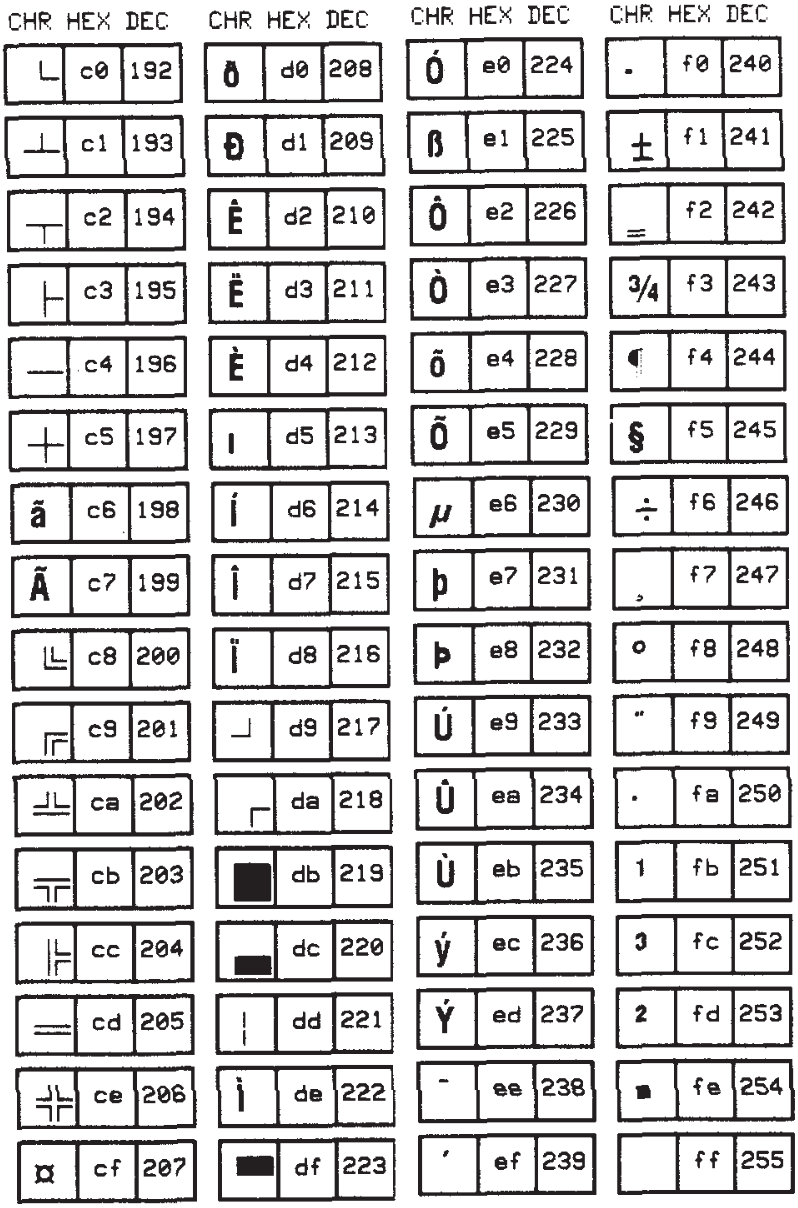
The following pages contains charts of the Code Page 850 character set used by the Zebra printers.



CHR	HEX	DEC	CHR	HEX	DEC	CHR	HEX	DEC	CHR	HEX	DEC	CHR	HEX	DEC
	20	32	0	30	48	@	40	64	P	50	80	‘	60	96
!	21	33	1	31	49	A	41	65	Q	51	81	a	61	97
"	22	34	2	32	50	B	42	66	R	52	82	b	62	98
#	23	35	3	33	51	C	43	67	S	53	83	c	63	99
$	24	36	4	34	52	D	44	68	T	54	84	d	64	100
%	25	37	5	35	53	E	45	69	U	55	85	e	65	101
&	26	38	6	36	54	F	46	70	V	56	86	f	66	102
’	27	39	7	37	55	G	47	71	W	57	87	g	67	103
(	28	40	8	38	56	H	48	72	X	58	88	h	68	104
)	29	41	9	39	57	I	49	73	Y	59	89	i	69	105
*	2a	42	:	3a	58	J	4a	74	Z	5a	90	j	6a	106
+	2b	43	;	3b	59	K	4b	75	[	5b	91	k	6b	107
,	2c	44	<	3c	60	L	4c	76	¢	5c	92	l	6c	108
–	2d	45	=	3d	61	M	4d	77	]	5d	93	m	6d	109
.	2e	46	>	3e	62	N	4e	78	^	5e	94	n	6e	110
/	2f	47	?	3f	63	O	4f	79	_	5f	95	o	6f	111



CHR	HEX	DEC	CHR	HEX	DEC	CHR	HEX	DEC	CHR	HEX	DEC	CHR	HEX	DEC
p	70	112	Ç	80	128	É	90	144	á	a0	160	░	b0	176
q	71	113	ü	81	129	æ	91	145	í	a1	161	▒	b1	177
r	72	114	é	82	130	Æ	92	146	ó	a2	162	▓	b2	178
s	73	115	â	83	131	ô	93	147	ú	a3	163	│	b3	179
t	74	116	ä	84	132	ö	94	148	ñ	a4	164	┤	b4	180
u	75	117	à	85	133	ò	95	149	Ñ	a5	165	Á	b5	181
v	76	118	å	86	134	û	96	150	ª	a6	166	Â	b6	182
w	77	119	ç	87	135	ù	97	151	º	a7	167	À	b7	183
x	78	120	ê	88	136	ÿ	98	152	¿	a8	168	©	b8	184
y	79	121	ë	89	137	Ö	99	153	®	a9	169	╣	b9	185
z	7a	122	è	8a	138	Ü	9a	154	¬	aa	170	║	ba	186
{	7b	123	ï	8b	139	ø	9b	155	½	ab	171	╗	bb	187
|	7c	124	î	8c	140	£	9c	156	¼	ac	172	╝	bc	188
}	7d	125	ì	8d	141	Ø	9d	157	¡	ad	173	¢	bd	189
~	7e	126	Ä	8e	142	×	9e	158	«	ae	174	¥	be	190
⌂	7f	127	Å	8f	143	ƒ	9f	159	»	af	175	┐	bf	191



CHR	HEX	DEC	CHR	HEX	DEC	CHR	HEX	DEC	CHR	HEX	DEC
└	c0	192	ð	d0	208	Ó	e0	224	-	f0	240
┴	c1	193	Đ	d1	209	ß	e1	225	±	f1	241
┬	c2	194	Ê	d2	210	Ô	e2	226	‗	f2	242
├	c3	195	Ë	d3	211	Ò	e3	227	¾	f3	243
─	c4	196	È	d4	212	õ	e4	228	¶	f4	244
┼	c5	197	ı	d5	213	Õ	e5	229	§	f5	245
ã	c6	198	Í	d6	214	µ	e6	230	÷	f6	246
Ã	c7	199	Î	d7	215	þ	e7	231	¸	f7	247
╚	c8	200	Ï	d8	216	Þ	e8	232	°	f8	248
╔	c9	201	┘	d9	217	Ú	e9	233	¨	f9	249
╩	ca	202	┌	da	218	Û	ea	234	·	fa	250
╦	cb	203	█	db	219	Ù	eb	235	¹	fb	251
╠	cc	204	▄	dc	220	ý	ec	236	³	fc	252
═	cd	205	¦	dd	221	Ý	ed	237	²	fd	253
╬	ce	206	Ì	de	222	¯	ee	238	■	fe	254
¤	cf	207	▀	df	223	´	ef	239		ff	255

APPENDIX G
Error Detection Protocol

Introduction

There are many instances when it is vitally important that the information sent to the Zebra printer is received completely *Error-Free.* ZPL II supports an error detection protocol called Zebra Packet Response Protocol to meet this need.

NOTE: This protocol only works when using serial interface. It does not function when using parallel interface.

What is a Protocol

A Protocol is a precisely defined set of rules. In the case of data communications, a Protocol defines how data is transmitted, received and acknowledged between two devices.

The sole purpose of the Packet Response Protocol is to ensure that the information sent from a Host computer to the Zebra printer is received accurately. *Remember, the protocol cannot insure the accuracy of the data that is actually sent from the Host computer.* The commands and data needed to make a label (ZPL II Format) are encapsulated within the information sent from the Host computer.

How Protocol Works

The basic unit of data transfer in the Packet Response Protocol is called a “Transaction.” A Transaction is a two-way communication procedure which consists of information being sent from the Host computer to the Zebra printer, and the printer sending back a response to the Host computer. This response is an indication that the Zebra printer has either accepted or rejected the information sent from the Host computer.

Information is sent in the form of “Packets.” Packets sent from the Host computer are called Request Packets.

When a Request Packet is received, the Zebra printer analyzes the information in the Packet. If the Request Packet is accepted, the Zebra printer will send a positive response back to the Host computer. The Host computer can then send the next Request Packet. If the information is rejected, the Zebra printer will send a negative response back to the Host computer. The Host computer then sends the same Request Packet again.

The Zebra Packet Response Protocol can be used in both single-printer applications, where there is only one Zebra printer connected to the Host computer, and multi-drop systems in which several Zebra printers are connected to the same Host computer.

Request Packet Formats (from the Host computer)

The first part of each data transfer Transaction is the sending of a Request Packet by the Host computer. The Request Packet contains a fixed length ‘Header’ block and a variable length “Data” block. Each Packet sent from the Host computer to the Zebra printer must always use the following format.

HEADER BLOCK					DATA BLOCK				
SOH	DST. Z-ID	SRC. Z-ID	TYPE	SEQ. #	STX	FORMAT	ETX	CRC	EOT
1	3	3	1	1	1	≤ 1024	1	2	1

The Request Packet Header Block is comprised of five fixed-length fields which are defined as follows:

SOH - (Start of Header Character) The Zebra printer interprets this character as the beginning of a new Request Packet. The ASCII Control Code character SOH (01H) is used as the Start of Header Character.

DST. Z-ID (Destination Zebra-ID) This is the three digit ASCII I.D. number used to identify which Zebra printer is to receive the Request Packet. The Zebra printer compares this number to the Network ID number assigned to it during Printer Configuration. The Zebra printer will act on the Request Packet only if these numbers match.

SRC. Z-ID (Source Zebra-ID) This is a three digit ASCII number used to identify the Host computer. This number is determined by the user.

TYPE (Packet Type) This field is used to define the type of Request Packet being sent by the Host. Only two characters are valid in this field.

‘**P**’ indicates a Print Request Packet

‘**I**’ indicates an Initialize Request Packet

Most of the Packets sent by the Host to the Zebra printer will be of the **‘P’** variety, requesting a label to be printed.

The **‘I’** character tells the Zebra printer to initialize the packet sequence numbering. It is required in the first packet of a new printing session, after starting up the Host computer or the Zebra printer.

SEQUENCE # (The Sequence Number of the Request Packet) This block contains a single digit number used to denote the current Transaction Number. The Host computer must increment this number by “1" for each new Request/Response Transaction pair, i.e. 0, 1, 2,..., 9. The numbers repeat after every 10 Transactions.

The Request Packet Data Block is comprised of four fixed-length fields and one variable-length field. These fields are defined as follows.

STX - (Start of Text) The Zebra printer interprets this character as the beginning of the variable-length Data Format portion of the Request Packet. The ASCII Control Code character STX (02H) is used as the Start of Text Character.

DATA FORMAT (Label Information) A variable-length portion of the Request Packet that contains the complete or partial ZPL II label format, or partial data string (such as a downloaded graphic).

This field can contain from 0 to 1024 characters. If the Format of a label is longer than 1024 characters, the Data Format fields from consecutive packets will be concatenated together in the printer's Receive Data Buffer as if they were sent as one long direct transmission.

Special consideration has been given to the possible requirement to include ASCII Control Characters (values less than 20H) in the Data Format portion of a Request Packet. Characters such as EOT (04H), STX (02H), SOH (01H), and ETX (03H), are part of the Error Detection Protocol and could interrupt normal communication procedures if received at the wrong time. See DISGUISING CONTROL CODE CHARACTERS later in this description.

ETX - (End of Text) The Zebra printer interprets this character as the end of the variable length Data Format portion of the Request Packet. The ASCII Control Code character ETX (03H) is used as the End of Text Character.

CRC - (Cyclic Redundancy Check) The CRC is a 2 character field. A Cyclic Redundancy Check is a type of error checking used to maintain the validity and integrity of the information transmitted between the Host computer and the Zebra printer. This Protocol uses the 16-bit CCITT method of producing a CRC.

The CRC is a two Byte value derived from the contents of the packet between, but not including, the SOH character and the CRC code itself. The Zebra printer will calculate a CRC of the Request Packet received and compare the value with the CRC Value in this field. The CRC of the Request Packet must match the CRC calculated by the Zebra printer in order for the Request Packet to be valid.

EOT - (End of Transmission) The Zebra printer interprets this character as the end of the Request Packet. The ASCII Control Code character EOT (04H) is used as the End of Transmission Character.

Response From the Zebra Printer

When the Zebra printer receives the EOT character, it will begin acting on the Request Packet received. The printer will compare certain characters and numeric values within the received Request Packet and send a response back to the Host computer.

Zebra Packet Response

The Packet Response protocol provides the highest degree of error checking and is well suited to the Host-Multiple Printer application. The Response Packet from the Zebra printer will always use the following format.

HEADER BLOCK					DATA BLOCK				
SOH	DST. Z-ID	SRC. Z-ID	TYPE	SEQ. #	STX	FORMAT	ETX	CRC	EOT
1	3	3	1	1	1	≤ 1024	1	2	1

The Response Packet Header Block is comprised of five fixed-length fields which are defined as follows:

SOH - (Start of Header Character) The Zebra printer sends this character as the beginning of a new Response Packet. The ASCII Control Code character SOH (01H) is used as the Start of Header Character.

DST. Z-ID (Destination Zebra-ID) This is the same three digit ASCII number used to identify the Host Computer that was contained in the SRC. Z-ID field of the Request Packet that initiated this Response Packet. The Host compares this number to its known value to insure it is the proper destination.

SRC. Z-ID (Source Zebra-ID) This is the three character ASCII Network I.D. of the Zebra printer that is sending the Response Packet.

TYPE (Packet Type) This block is used to define the type of Response Packet being sent to the Host. Only three characters are valid in this field.

'A' This is a Positive Acknowledgment to the Host computer. It indicates that the Request Packet was received without a CRC error. The Host computer may send the next Request Packet.

'N' This is the Negative Acknowledgment to the Host computer. It indicates that an error was detected in the packet sent from the Host computer. The Host computer must retransmit the same Request Packet again.

'S' This character indicates that the Response Packet contains the Zebra Printer Status requested by a **~HS** (Host Status) instruction received from the Host.

SEQUENCE # (Used to denote the current message sequence number.) This number is identical to the message sequence number in the Request Packet. It denotes the message sequence number to which the Response Packet is replying.

The Response Packet Data Block is comprised of four fixed-length fields and one variable-length field. These fields are defined as follows:

STX - (Start of Text) The Zebra printer sends this character as the beginning of the variable length Data Format portion of the Response Packet. The ASCII Control Code character STX (02H) is used as the Start of Text Character.

DATA FORMAT (Label Information) The 'variable length' portion of the Response Packet. If the **Packet Type** field in the Response Header contains an **'A'** or an **'N'**, no data will appear in this field. If the **Packet Type** field contains an **'S'**, this field will contain the Printer Status Message.

ETX - (End of Text) The Zebra printer sends this character as the end of the variable length Data Format portion of the Request Packet. The ASCII Control Code character ETX (03H) is used as the End of Text Character.

CRC - (Cyclic Redundancy Check) This is the CRC of the Response Packet as calculated by the Zebra printer. This Cyclic Redundancy Check maintains the validity and integrity of the information transmitted between the Zebra printer and the Host computer.

This CRC is a two Byte value derived from the contents of the packet between, but not including, the SOH character and the CRC code itself. The Host computer will calculate a CRC of the received Response Packet and compare it to the CRC value in this field. The CRC of the Response Packet must match the CRC calculated by the Host computer in order for the Response Packet to be valid.

EOT - (End of Transmission) The Zebra printer sends this character as the end of the Response Packet. The ASCII Control Code character EOT (04H) is used as the End of Transmission Character.

Disguising Control Code Characters

There may be occasions when ASCII Control Codes (00H - 19H) must be included as part of the Data Format block of a Request Packet. To eliminate any problems, these characters must be disguised so that the communication protocol does not act on them.

A three step procedure must be used to disguise each Control Code.

1. A SUB (1AH) character must precede each Control Code placed in the Data Format block.

2. The value of 40H must be added to the Hex value of the Control Code.

3. The ASCII Character corresponding to the total value produced in step 2 must be entered in the Data Format right after the SUB character.

The Zebra printer automatically converts the modified control character back to its correct value by discarding the SUB (1AH) character and subtracting 40H from the next character.

Example:

To include a DLE (10H) character in the Data Format block:

1. Enter a SUB (1AH) character into the Data Format.

2. Add 40H to the DLE value of 10H for a resulting value of 50H.

3. Enter the ASCII character "P" (50H) in the Data Format after the SUB character.

NOTE: This technique is counted as two characters of the 1024 allowed in the Data Format block.

Rules for Transactions

1. Every Transaction is independent of every other Transaction and can only be initiated by the Host computer.

2. A valid Response Packet must be received by the Host computer to complete a Transaction before the next Request Packet is sent.

3. If an error is encountered during a Transaction, the entire Transaction (i.e. Request Packet and Response Packet) must be repeated.

4. The Zebra printer does not provide for system time-outs and has no responsibility for insuring that its Response Packets are received by the Host computer.

5. The Host computer must provide time-outs for all of the Transactions and insure that communication continues.

6. If any part of a Transaction is lost or received incorrectly, it is the responsibility of the Host computer to retry the whole Transaction.

Error Detection Protocol Application

The following are the three basic requirements for setting up the Zebra printer to use the Error Detection Protocol.

Activating the Protocol

Protocol is a front panel selection.

Setting Up Communications

Insure that the Host computer and the Zebra printer are characterized with the same communication parameters, i.e. Parity, Baud Rate, etc. (the communications ***must*** be set up for 8 data bits).

Setting the Printer ID Number

The Protocol uses the printer's Network ID number to insure communication with the proper unit. The Network ID is programmed into the printer by sending the printer a **^NI** (Network ID Number) instruction.

If there is only one printer connected to the Host computer, the Network ID number should be set to all zeros (default).

If there is more than one printer, such as in a broadcast or multi-drop environment, each printer should be assigned its own unique ID number. Printers in this environment, with an ID of all zeros, will receive ALL label formats regardless of the actual printer ID number in the DST. Z-ID block of the Request Packet.

Error Conditions and System Faults

Restarting a Transmission

If a break in communication occurs, the Host must restart the transmission of the current label format with an Initialization Request Packet. The Zebra printer will not respond to Request Packets sent out of sequence. However, the Zebra printer ***will respond*** to an Initialization Request Packet and restart its internal counting with the sequence number of the Request Packet.

CRC Error Conditions and Responses

A CRC error condition can be detected when the printer receives a Request Packet or when the Host computer receives a Response Packet. The following list defines each of these errors and how the Host computer should respond to them.

1. **Error:** The CRC calculated by the Zebra printer does not match the one received as part of the Request Packet.
   Response: The Zebra printer will return a Negative Acknowledgment Response Packet. The Host computer should retry the same Transaction with the same Sequence Number.

2. **Error:** The CRC calculated by the Host computer does not match the one received as part of the Response Packet.
   Response: The Host computer should retry the same Transaction with the same Sequence Number.

Time-Out Error Conditions and Responses

There are certain conditions at the Zebra printer that might cause the Host computer to time-out while processing a Transaction. The following list illustrates these conditions and how the Host computer should respond to them.

1. **Error:** A Request Packet from the Host computer is not received by the Zebra printer.
   Response: **The** Host computer times-out and re-sends the Request Packet of the same Transaction with the same Sequence Number.

2. **Error:** A Request Packet from the Host computer is partially received by the Zebra printer.
   Response: **The** Host computer times-out and re-sends the Request Packet of the same Transaction with the same Sequence Number.

3. **Error:** A Response Packet from the Zebra printer is not received by the Host computer.
   Response: The Host computer times-out and re-sends the Request Packet of the same Transaction with the same Sequence Number.

4. **Error:** A Response Packet from the Zebra printer is partially received by the Host computer.
   Response: **The** Host computer times-out and re-sends the Request Packet of the same Transaction with the same Sequence Number.

How the Zebra Printer Processes a Request Packet

The following describes the steps taken at the Zebra printer to process a Request Packet.

1. The Zebra printer looks for a SOH (Start of Header) character. As soon as it finds one, it places the SOH and all the data after it into its Receive Data Buffer. This process continues until the printer receives an EOT (End of Transmission) character.

NOTE: If a second SOH is received before an EOT is detected, the contents of the Receive Buffer will be discarded. All of the data after the second SOH will be placed in the Receive Data Buffer.

2. After detecting the EOT, the printer checks for the following:

   * The DST. Z-ID matches the printer's Network I.D.

NOTE:If the Network ID at the printer is all zeros, the printer will accept all Request Packets regardless of the DST. Z-ID received. If a Request Packet is received with the DST. Z-ID all zeros, it is accepted by all printers regardless of their Network ID setting.

   * The Data Format begins with STX and ends with ETX.

   * The Sequence Number has not been used before.

If the check is satisfactory.....
Proceed to Step 3.

If any part of the check is unsatisfactory.....
The printer discards the data in its Receive Data Buffer and waits for another SOH.
No response is sent to the computer.

Exceptions.....
It is possible that the printer will send a response to the host that the host does not receive. Therefore, the host will send the same request packet to the printer again. If this happens, the printer *will not* use the data since it already

used it before. However the printer *will send* a response back to the host.

3. The printer calculates the CRC and compares it with the one received in the Request Packet. If the CRC is valid, the printer sends a Positive Response Packet to the Host computer. It then transfers the 'Variable Length' data from the Receive Buffer to its memory for processing. If the CRC does not match, and the printer is set up to return a Negative Response Packet, the following will take place.

   a. The printer assumes that the DST. Z-ID, SRC. Z-ID, and Sequence Number are correct and that the error was in the variable data.

   b. The same DST. Z-ID, printers SRC. Z-ID, and Sequence Number will be returned back to the host in the Negative Response Packet.

   c. If the assumption in (a) is incorrect, the Host computer can time-out and retransmit the original Request Packet.

How the Zebra Printer Responds to Host Status

If a **~HS** (Host Status) instruction is received by the Zebra printer, the printer will send back an acknowledgment for the receipt of the packet. It then sends an additional packet that includes the Host Status information in the Variable Length portion of the packet.

Code for Calculating the CRC for the Zebra Protocol

```
/********************************************************
*
* name:                 do_crc_ccitt
*
* description:          Calculates a 16 bit cyclic redundancy check
*                       character using the CCITT polynomial
*                       X**16 + X**12 + X**5 + 1  which translates
*                       to the magic number 0x1021.
*
* parameters:            crc -- the check character that is being
*                                accumulated.
*                       chr -- the character being added to the crc
*
* returns:              the new crc
*
*
* date:                 26 September 1991
*
********************************************************/

const UWORD ccitt_table[256] =
{
/*  0 -- */    0x0000, 0x1021, 0x2042, 0x3063, 0x4084, 0x50A5, 0x60C6, 0x70E7,
/*  8 -- */    0x8108, 0x9129, 0xA14A, 0xB16B, 0xC18C, 0xD1AD, 0xE1CE, 0xF1EF,
/*  16 -- */   0x1231, 0x0210, 0x3273, 0x2252, 0x52B5, 0x4294, 0x72F7, 0x62D6,
/*  24 -- */   0x9339, 0x8318, 0xB37B, 0xA35A, 0xD3BD, 0xC39C, 0xF3FF, 0xE3DE,
/*  32 -- */   0x2462, 0x3443, 0x0420, 0x1401, 0x64E6, 0x74C7, 0x44A4, 0x5485,
/*  40 -- */   0xA56A, 0xB54B, 0x8528, 0x9509, 0xE5EE, 0xF5CF, 0xC5AC, 0xD58D,
/*  48 -- */   0x3653, 0x2672, 0x1611, 0x0630, 0x76D7, 0x66F6, 0x5695, 0x46B4,
/*  56 -- */   0xB75B, 0xA77A, 0x9719, 0x8738, 0xF7DF, 0xE7FE, 0xD79D, 0xC7BC,
/*  64 -- */   0x48C4, 0x58E5, 0x6886, 0x78A7, 0x0840, 0x1861, 0x2802, 0x3823,
/*  72 -- */   0xC9CC, 0xD9ED, 0xE98E, 0xF9AF, 0x8948, 0x9969, 0xA90A, 0xB92B,
/*  80 -- */   0x5AF5, 0x4AD4, 0x7AB7, 0x6A96, 0x1A71, 0x0A50, 0x3A33, 0x2A12,
/*  88 -- */   0xDBFD, 0xCBDC, 0xFBBF, 0xEB9E, 0x9B79, 0x8B58, 0xBB3B, 0xAB1A,
/*  96 -- */   0x6CA6, 0x7C87, 0x4CE4, 0x5CC5, 0x2C22, 0x3C03, 0x0C60, 0x1C41,
/*  104 -- */  0xEDAE, 0xFD8F, 0xCDEC, 0xDDCD, 0xAD2A, 0xBD0B, 0x8D68, 0x9D49,
/*  112 -- */  0x7E97, 0x6EB6, 0x5ED5, 0x4EF4, 0x3E13, 0x2E32, 0x1E51, 0x0E70,
/*  120 -- */ 0xFF9F,  0xEFBE,  0xDFDD, 0xCFFC,  0xBF1B,  0xAF3A,  0x9F59,  0x8F78,
/*  128 -- */ 0x9188,  0x81A9,  0xB1CA, 0xA1EB,  0xD10C,  0xC12D,  0xF14E,  0xE16F,
/*  136 -- */ 0x1080,  0x00A1,  0x30C2, 0x20E3,  0x5004,  0x4025,  0x7046,  0x6067,
/*  144 -- */ 0x83B9,  0x9398,  0xA3FB, 0xB3DA,  0xC33D,  0xD31C,  0xE37F,  0xF35E,
/*  152 -- */ 0x02B1,  0x1290,  0x22F3, 0x32D2,  0x4235,  0x5214,  0x6277,  0x7256,
/*  160 -- */ 0xB5EA,  0xA5CB,  0x95A8, 0x8589,  0xF56E,  0xE54F,  0xD52C,  0xC50D,
/*  168 -- */ 0x34E2,  0x24C3,  0x14A0, 0x0481,  0x7466,  0x6447,  0x5424,  0x4405,
/*  176 -- */ 0xA7DB,  0xB7FA,  0x8799, 0x97B8,  0xE75F,  0xF77E,  0xC71D,  0xD73C,
/*  184 -- */ 0x26D3,  0x36F2,  0x0691, 0x16B0,  0x6657,  0x7676,  0x4615,  0x5634,
/*  192 -- */ 0xD94C,  0xC96D,  0xF90E, 0xE92F,  0x99C8,  0x89E9,  0xB98A,  0xA9AB,
/*  200 -- */ 0x5844,  0x4865,  0x7806, 0x6827,  0x18C0,  0x08E1,  0x3882,  0x28A3,
};

static UWORD do_crc_ccitt (  UWORD crc, UBYTE in_char )
{
   crc = (UWORD)( crc << 8 ) ^ ccitt_table [ ( crc >> 8 ) ^ in_char ] ;
   return ( crc ) ;
}
```

GLOSSARY
ZPL II and Bar Code Industry Terms

alphanumeric Indicating letters, numerals, and characters such as punctuation marks.

ANSI American National Standards Institute; an organization that coordinates the development of U.S. voluntary standards used in both the private and public sectors

ANSI character set The ANSI-standard character set that defines 256 characters. The first 128 are ASCII, the second 128 contain math and foreign language symbols

ASCII American Standard Code for Information Exchange; the standard communications code used by Zebra printers to send and receive data; the built-in character code in most minicomputers and all personal computers

ASCII character set The standard character set is defined by 128 characters (the first 32 are control characters)

backfeed When the printer pulls the media and ribbon (if used) backward into the printer so that the beginning of the label to be printed is properly positioned behind the printhead. Backfeed occurs when operating the printer in tear-off, peel-off, or cutter mode.

bar code A code by which alphanumeric characters can be represented by a series of adjacent stripes of different widths. Many different code schemes exist, such as the universal product code (UPC) or Code 39.

bit Binary Digit. A single digit in a binary number (0 or 1), either on or off.

binary Meaning two. All input to the computer is converted into binary numbers made up of the two digits 0 and 1 (bits).

bitmap A binary representation in which a bit or series of bits correspond to some part of an object such as an image or font. For example, one bit in a black/white system represents one pixel on a computer screen or one pixel printed by a Zebra printer.

bitmap font A set of dot patterns for each letter and digit in a particular typeface (i.e. Times Roman, Helvetica, CG Triumvirate, etc.) for a specified size (i.e. 10 points, 12 points, etc.). *Contrast with scalable font*.

bitmap image A set of dot patterns that are grouped together to create a direct representation of a graphic image; the raster graphics method for generating images. See *raster graphics*

calibration (of a printer) A process in which the printer determines some basic information needed to print accurately with a particular media and ribbon combination. To do this, the printer feeds some media and ribbon (if used) through the printer and senses whether to use the direct thermal or thermal transfer print method, whether continuous or non-continuous media will be used, and (if using non-continuous media) the length of individual labels or stags.

character set The set of all letters, numerals, punctuation marks, and other characters that can be expressed by a particular font or barcode.

check digit A character added to a barcode symbol that indicates to the scanner that it has read the symbol correctly.

continuous media Label or tagstock media that has no notch, gap, or web (backing material only) to separate the labels or tags - the media is one long piece of material.

control instructions In ZPL II, control instructions are usually preceded by a tilde (~) character. In most cases, they cause the printer to take a specific action immediately, such as clearing the memory or feeding a blank label.

cutter A device that can cut the media into individual labels or tags immediately after it is printed.

delimiter character In ZPL II, this is the comma. The delimiter character is used to separate one item or set of data from another.

direct thermal A printing method in which the printhead presses directly against the media. Heating the printhead elements causes a discoloration of the heat-sensitive coating on the media. By selectively heating the printhead elements as the media moves past, an image is printed onto the media. No ribbon is used with this printing method. Contrast this with *thermal transfer*.

direct thermal media Media that is coated with a substance which reacts to the application of direct heat from the printhead to produce an image.

fanfold media Media that comes folded in a rectangular stack. Contrast this with *roll media*.

font A complete set of alphanumeric characters in one style of type. Ex: CG Times™, CG Triumvirate Bold Condensed™.

format instructions Format instructions are the blueprint of a label. These instructions define label length, field origin, type of field, field data and other information. Format instructions are always preceded by the caret **(^)** character.

hexadecimal Hexadecimal means 16. The base 16 numbering system is used as a shorthand for representing binary numbers. See *binary*.

ips "inches-per-second" The speed at which the label or tag is printed. Zebra offers printers that can print from 2 ips to 12 ips.

label An adhesive-backed piece of paper, plastic, or other material on which information is printed.

label backing (label liner) The material on which labels are affixed during manufacture and which is discarded or recycled by the end-users.

media Material onto which data is printed by the printer. Types of media include: tagstock, die-cut labels, continuous (with and without backing material), fanfold, and roll.

media sensor This sensor is located behind the printhead to detect the presence of media and, for non-continuous media, the position of the web, hole, or notch used to indicate the start of each label.

media supply hanger The stationary arm that supports the media roll.

narrow element module The narrow bar or space of a bar code.

non-continuous media Consumable printing stock which contains an indication of where one label/printed format ends and the next one begins. Examples are die-cut labels, notched tagstock, and stock with black mark registration marks

non-volatile memory Electronic memory that retains data even when the power to the printer is turned OFF.

parameter string A series of values used by a ZPL II code designed to customize the code's use or particular purpose. The parameters can be a range of values, a coordinate, a data string, etc. They may be specified for use within the code or optional based on the desired results and default conditions (the use of the parameter string is optional since all parameters have default values).

prefix character In ZPL II, the prefix character is either the caret (^) character or the tilde (~) character

print speed The speed at which printing occurs. For thermal transfer printers, this speed is expressed in terms of ips (inches per second). Zebra offers printers that can print from 2 ips to 12 ips.

printhead In Zebra printers, the mechanism that deposits ink onto the media. See *direct thermal* and *thermal transfer*.

quiet zone Sometimes called a "clear area", is an area adjacent to the machine-readable symbols (bar codes) that ensure proper reading (decoding) of the symbols. No printing is permissible within this area.

raster graphics An image is made up of a series of dots much like a TV screen. This type of graphics is created when images are scanned into a computer or created in a paint program. See *bitmap image.* Contrast with *scalable or vector graphics.*

registration Alignment of printing with respect to the top of a label or tag.

ribbon A band of material consisting of a base film coated with wax or resin "ink". The inked side of the material is pressed by the printhead against the media. The ribbon transfers ink onto the media when heated by the small elements within the printhead. Zebra ribbons have a coating on the back that protects the printhead from wear.

roll media Media that comes supplied rolled onto a core (usually cardboard). Contrast with *fanfold media*.

scalable or vector graphics Also known as object-oriented graphics, this method maintains an image as a series of points, lines, arcs and geometric shapes. This type of graphic is used for CAD and technical illustrations and other types of illustrations where the components of the drawing must be separable and individually scalable. On a Zebra printer, this type of graphic must be converted to a raster or bitmap image in order to be reproduced. Contrast with *bitmap image* or *raster graphics*.

scalable Capable of being changed in size and configuration.

scalable font A font that is created in the required point size as needed to print. The font is described by a mathematical representation of the typeface and is capable of being changed in size or configuration without loss of font/image quality. Scalable fonts eliminate storing many different sizes of bitmap fonts in memory since one mathematical representation of the font can be scaled to create many different sizes of the font. Contrast with *bitmap font*.

serialized data Data fields by a selected increment or decrement value (i.e., make the data fields increase or decrease by a specified value) each time a label is printed.

supplies A general term for media and ribbon.

thermal direct See *direct thermal*.

thermal transfer A printing method in which the printhead presses an ink or resin coated ribbon against the media. Heating the printhead elements causes the ink or resin to transfer onto the media. By selectively heating the printhead elements as the media and ribbon move past, an image is printed onto the media. Contrast this with *direct thermal*.

void A space where printing should have occurred, but did not due to an error condition such as wrinkled ribbon or faulty print elements. A void can cause a printed bar code symbol to be read incorrectly or not at all.

x-axis A distance defined by a specified unit of measurement along a horizontal plane

y-axis A distance defined by a specified unit of measurement along a vertical plane

ZPL II scripts A series of ZPL II instruction lines that describe a label format

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