



## **XL Series Thermal Transfer Tag Printers**



## **Operator and Technical Reference Manual for XL400 and XL410**

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# PREFACE

## **XL SERIES PRINTER OPERATOR'S MANUAL**

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The XL Series Printer Operator's Manual contains basic information about the printer such as setup, installation, cleaning and maintenance. It also contains complete instructions on how to use the operator panel to configure the printer. The following is a brief description of each section in this manual.

### **SECTION 1. PRINTER OVERVIEW**

This section contains a discussion of the printer specifications and optional features.

### **SECTION 2. INSTALLATION**

This section contains instructions on how to unpack and set up the printer.

### **SECTION 3. CONFIGURATION**

This section contains information on loading the labels and ribbon and how to use the operator panel to configure the printer.

### **SECTION 4. CLEANING AND MAINTENANCE**

This section contains instructions on how to clean and maintain the printer.

### **SECTION 5. PROGRAMMING**

This section introduces the SATO printer programming language. It contains the commands that are used with the printer to produce labels with bar codes, alphanumeric data and graphics.

### **SECTION 6. INTERFACE SPECIFICATIONS**

This section contains the printer's interface specifications, which include detailed information on how to properly interface your printer to the host system.

### **SECTION 7. TROUBLESHOOTING**

This section contains troubleshooting procedures to follow in the event you have printer problems.

## **APPENDICES**

APPENDIX A:	Command Code Quick Reference
APPENDIX B:	Bar Code Specifications
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# SECTION 1.

## PRINTER OVERVIEW

### INTRODUCTION

---

The SATO XL400 and XL410 Thermal Transfer Printers are complete, high-performance labeling systems designed specifically for printing tags and labels. All printer parameters are programmable using the front panel controls and DIP switches. All popular bar codes, including 2-D codes, eight human-readable fonts with two Care Symbol fonts and a fast and efficient vector font, are resident in memory, providing literally thousands of type styles and sizes.

The Operator's Manual will help you understand the basic operations of the printer, such as setup, installation, configuration, cleaning and maintenance.

The major difference in the XL400 and the XL410 is the resolution of the head. The XL400 with its 203 dpi head provides an economical labeling solution for most applications. The XL410 provides a higher print resolution, 305 dpi, to give laser-quality printing. It is useful when high-resolution printing is required, such as when printing detailed graphic images. Both printers can print labels up to 4.0 inches wide and 9.4 inches long using internal memory. If longer labels are required, a PCMCIA memory card option is available, allowing 203 dpi labels up to 49.2 inches (32.8 inches for 305 dpi).

All of the XL printers use the same command codes. The only differences are the allowable values representing print positions on the label. These values are specified in "dots" and will vary depending upon the resolution of the printer and the amount of memory available for imaging the label. The allowable range for each printer is specified in a table for those commands.

The standard configuration for the XL printers includes an integrated Cutter which can operate at the maximum print speed. A Stacker is available as an option and can stack up to 500 labels up to 3.9 inches wide and 5.9 inches long at maximum print speeds.

The following general information is presented in this section:

- General Printer Specifications
- Optional Accessories

**GENERAL PRINTER SPECIFICATIONS**

SPECIFICATION	XL400	XL410
PRINT		
Method	Direct or Thermal Transfer	
Speed (User Selectable)	5 to 8 ips 125 to 200 mm/s	4 to 6 ips 100 to 150 mm/s
Print Module (Dot Size)	.0049 in. .125 mm	.0033 in. .083 mm
Resolution	203 dpi 8 dpmm	305 dpi 12 dpmm
Maximum Print Width	3.94 in. 100 mm	
Maximum Print Length	9.45 in. 240 mm	
Maximum Print Length with 2MB Memory Card	49.2 in. 1249 mm	32.8 in. 833 mm
MEDIA		
Minimum Width	1.26 in. (32 mm)	
Minimum Length	.75 in. (19 mm) Labels 1.0 in. (25 mm) Tags	
Maximum Width	4.0 in. (102 mm)	
Type	Die Cut Labels, Fan-Fold, Tag Stock or Continuous	
Caliper (max)	.012 in. (.3 mm)	
Roll OD (max)	9.8 in. (249 mm)	
Core ID (min)	4.0 in. (102 mm)	
SENSING		
See-Thru Label Gap/Center Hole Tag Side Hole Tag Side Notch (R-Corner Tag)	Adjustable 0.4 in. (16mm) to 2.0 in. (50mm) 1.3 in. (34mm) to 3.7 in. (94mm) 0.1 in. (2.5mm)	
Reflective Eye-Mark Eye-Mark Label or Tag	Fixed 0.28 in. (7 mm)	
RIBBON		
Maximum Width	4.0 in. (102 mm)	
Length	1475 ft. (450 M)	
Wind	Ink-In	
Thickness	4.5 micron	

**GENERAL PRINTER SPECIFICATIONS (cont'd)**

SPECIFICATION	XL400	XL410
CONTROLS AND SIGNALS		
On-Line LED	Green	
Cutter	Green	
Error LED	Red	
LCD Panel	2 Line x 16 Character	
Start/Stop Switch	Rear	
Feed Switch	Front Panel	
Cutter	Front Panel	
Eject	Front Panel	
Media	Front Panel	
Configuration	3 x 8 DIP, Inside Cover	
Power On/Off Switch	Rear Panel	
POTENTIOMETER ADJUSTMENTS		
Print Darkness	Inside Cover	
Pitch	Inside Cover	
Offset	Inside Cover	
Display	Inside Cover	
INTERFACE CONNECTIONS		
Parallel (AMP 36 pin)	Centronics Compatible	
Serial (DB25S)	RS232C (2400 to 19.2K bps)	
Serial Protocol	Hardware Flow Control (Ready/Busy) Software Flow Control (X-On/X-Off) Bi-directional (ENQ/Response)	
Data Transmission	ASCII Format	
PROCESSING		
CPU	32 Bit RISC	
ROM	1 MByte	
DRAM	2 MByte	

## CHARACTER FONTS

SPECIFICATION	XL400	XL410
MATRIX FONTS		
XU Font	(5 dots W x 9 dots H) Helvetica	
XS Font	(17 dots W x 17 dots H) Univers Condensed Bold	
XM Font	(24 dots W x 24 dots H) Univers Condensed Bold	
OA Font	(15 dots W x 22 dots H) OCR-A	(22 dots W x 33 dots H) OCR A
OB Font	20 dots W x 24 dots H) OCR-B	(30 dots W x 36 dots H) OCR B
XCS	(24 dot W x 24 dot H) Care Symbol	
XCL	(36 dots W x 36 dots H) Care symbol	
AUTO SMOOTHING FONTS		
XB	XB Font (48 dots W x 48 dots H) Univers Condensed Bold	
XL	XL Font (48 dot W x 48 dots H) Sans Serif	
VECTOR FONT		
	Proportional or Fixed Spacing Font Size 50 x 50 dots to 999 x 999 dots 10 Font Variations	
DOWNLOADABLE FONTS		
	TrueType Fonts with Optional Memory Card	
CHARACTER CONTROL		
	Expansion up to 12X in either the X or Y coordinates Character Pitch control Line Space control Journal Print facility 0°, 90°, 180° and 270° Rotation	

## Bar Codes

SPECIFICATION	XL400	XL410
SYMBOLOLOGIES		
	Bookland (UPC/EAN Supplemental) EAN-8, EAN-13 CODABAR Code 39 Code 128 Interleaved 2 of 5 UCC/EAN-128 UPC-A and UPC-E Data Matrix Maxicode PDF417	
Ratios	1:2, 1:3, 2:5 User definable bar widths	
Bar Height	4 to 600 dots, User programmable	
Rotation	0°, 90°, 180° and 270°	
OTHER FEATURES		
Sequential Numbering	Sequential numbering of both numerics and bar codes	
Custom Characters	RAM storage for special characters	
Graphics	Full dot addressable graphics, SATO Hex/Binary or PCX formats	
Form Overlay	Form overlay for high-speed editing of complex formats	

**PHYSICAL**

SPECIFICATION	XL400	XL410
DIMENSIONS		
Wide	19.6 in. (302 mm)	
Deep	11.8 in. (552 mm)	
High	11.5 in. (294 mm)	
WEIGHT	30.8 lbs (14 Kg)	
POWER REQUIREMENTS		
Voltage	100 - 115 V (±10 %) 220V (±10 %) 50/60 Hz (±1%)	
Power Consumption	300 Watts Operating	
ENVIRONMENTAL		
Operating Temperature	41° to 104°F (5° to 40°C	
Storage Temperature	-0° to 104°F (-20° to 40°C)	
Operating Humidity	15-85 % RH, non-condensing	
Storage Humidity	Max 90% RH, non-condensing	
Electrostatic Discharge	8KV	
REGULATORY APPROVALS		
Safety	UL, CSA, CE	
RFI/EMI	FCC Class A	

**OPTIONAL ACCESSORIES**

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<b>ACCESSORY</b>	<b>XL400</b>	<b>XL412</b>
MEMORY EXPANSION	Two slots for PCMCIA Memory Cards (up to 2MB each). Can be used for graphic file storage, print buffer expansion and downloaded TrueType fonts.	
CALENDAR	An internally mounted Date/Time clock that can be used to date/time stamp labels at the time of printing.	
INTEGRATED STACKER	Allows cut labels to be stacked. Interfaces to EXT Accessory Port connector.	
LABEL REWINDER	External option rewinds labels onto a roll after they are printed.	

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# SECTION 2. INSTALLATION

## INTRODUCTION

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This section is provided to assist you in taking the XL printer from the shipping container and familiarization with the controls.

The following information is provided in this section:

- Unpacking and Parts Identification
- Setting Up the Printer
- Loading Labels or Tags
- Loading the Ribbon
- Adjusting the Sensors
- Powering On/Off

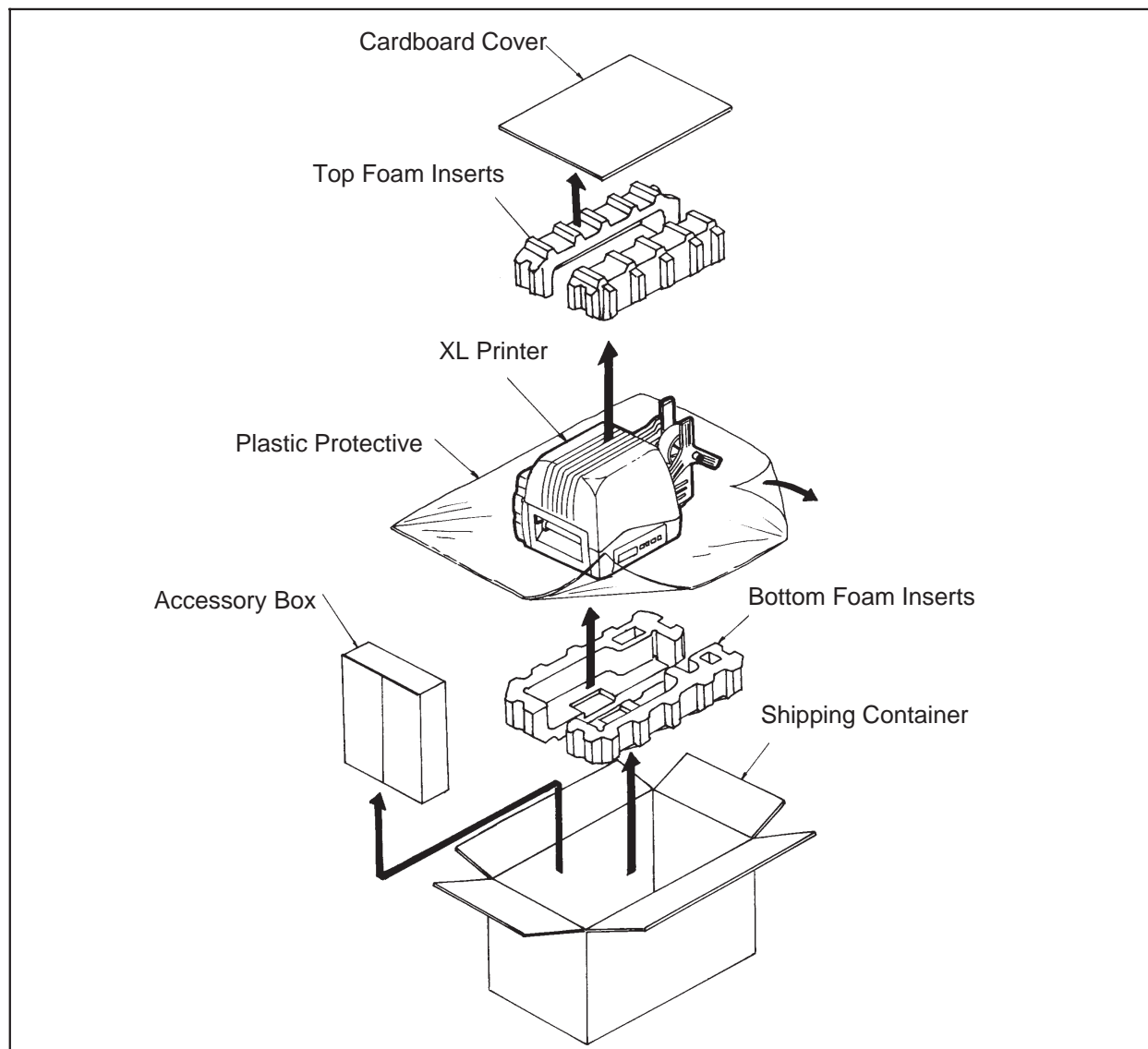
## UNPACKING AND PARTS IDENTIFICATION

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Consider the following when unpacking the printer:

- The box should stay right-side up.
- Lift the printer out of the box carefully.
- Remove the plastic covering from the printer.
- Remove the accessory items from their protective containers.
- If the printer has been stored in a cold environment, allow it to reach room temperature before powering it on.
- Set the printer on a solid, flat surface. Inspect the shipping container and printer for any sign of damage that may have occurred during shipping.

*Note: The following illustrations are representative only. Your printer may not be packed exactly as shown, but the unpacking steps are similar.*



Verify that you have the following materials when unpackaging:

- Printer
- Power Cord
- Extra Ribbon Core
- Operator's Manual

## SETTING UP THE PRINTER

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Consider the following when setting up the printer:

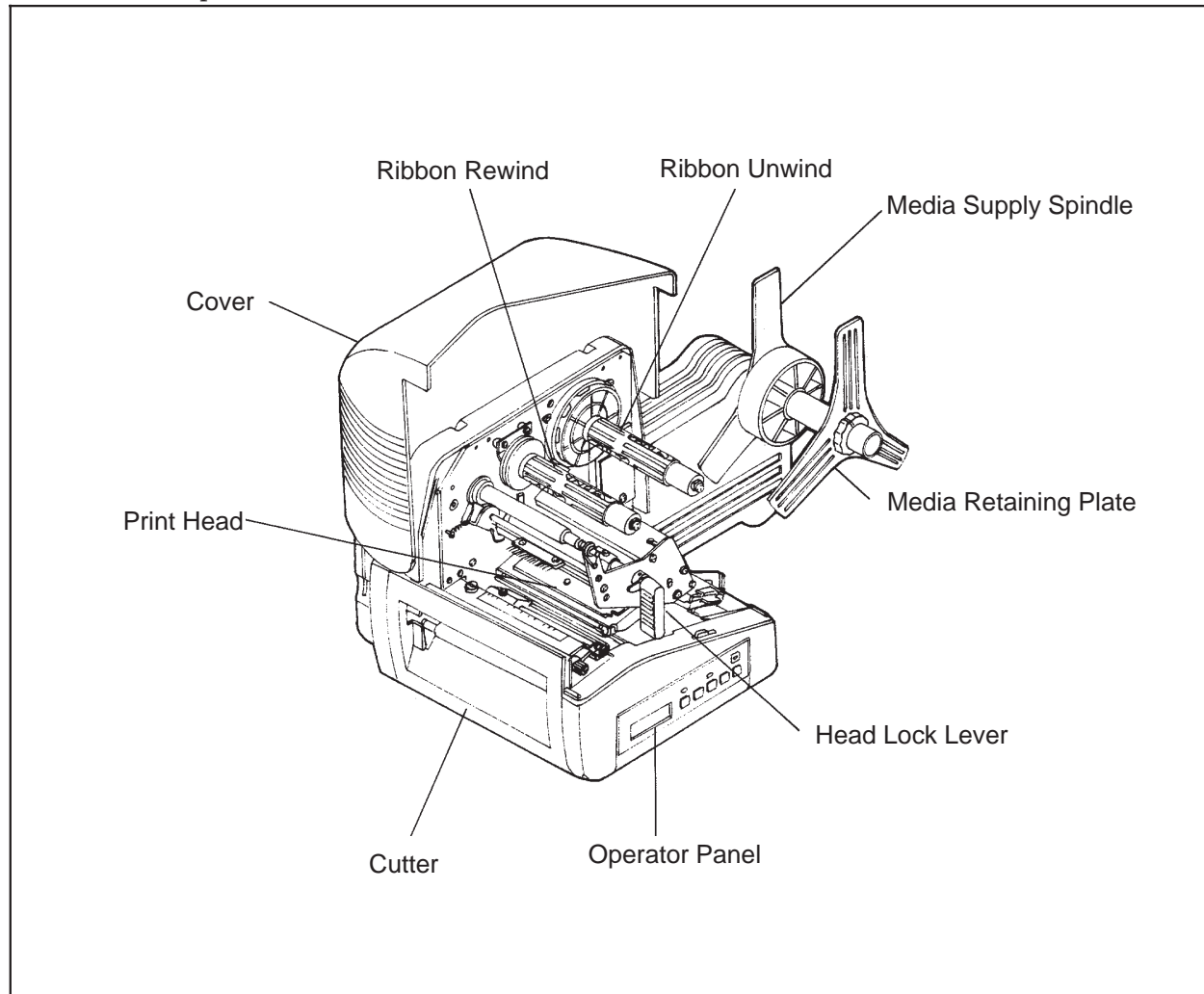
- Locate a solid, flat surface with adequate room to set the printer. If a Cutter/Stacker is to be used with the printer, make sure there is adequate room for the unit. The printer cover swings upward and back, make sure there is enough clearance for the cover to swing open.
- The location should be near the host computer or terminal. The maximum distance for RS232 cables is 50 feet and six feet for Centronics parallel cables. Cables can be purchased locally and their configuration will depend upon the host system.
- For information on interfacing the printer to a host system, see Section 6: Interface Specifications.

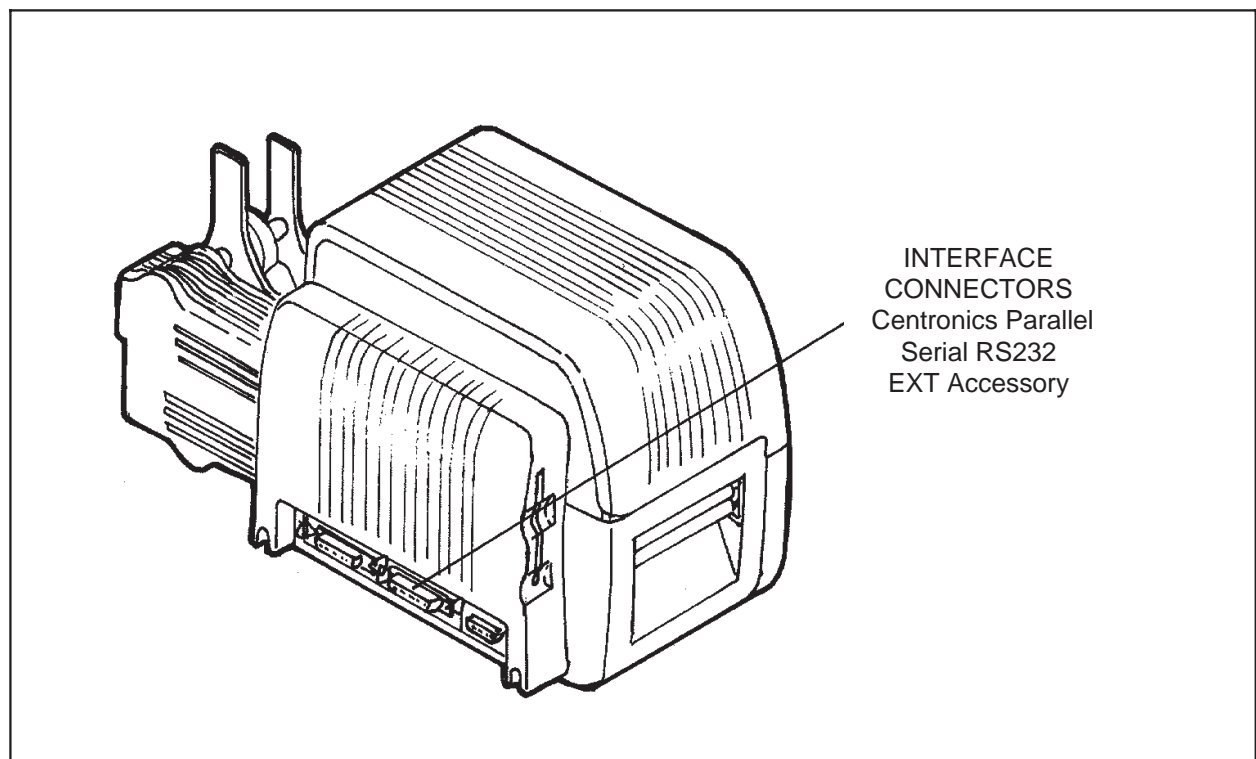
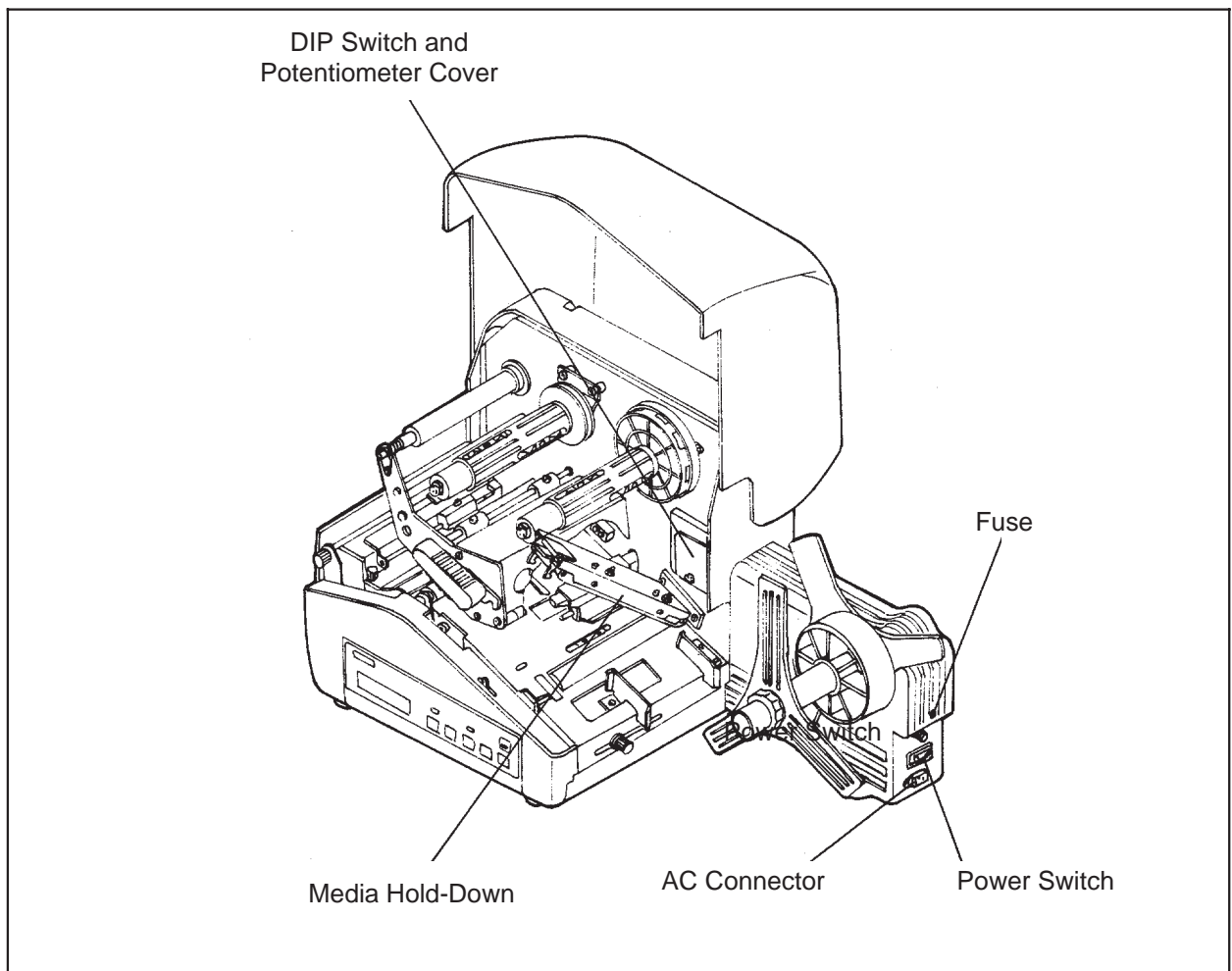
The procedures for setting up the printer and adjusting the sensors are outlined in Section 2. The procedures for setting up the operating parameters (Print Speed, Pitch Offset, etc.) are outlined in Section 3.

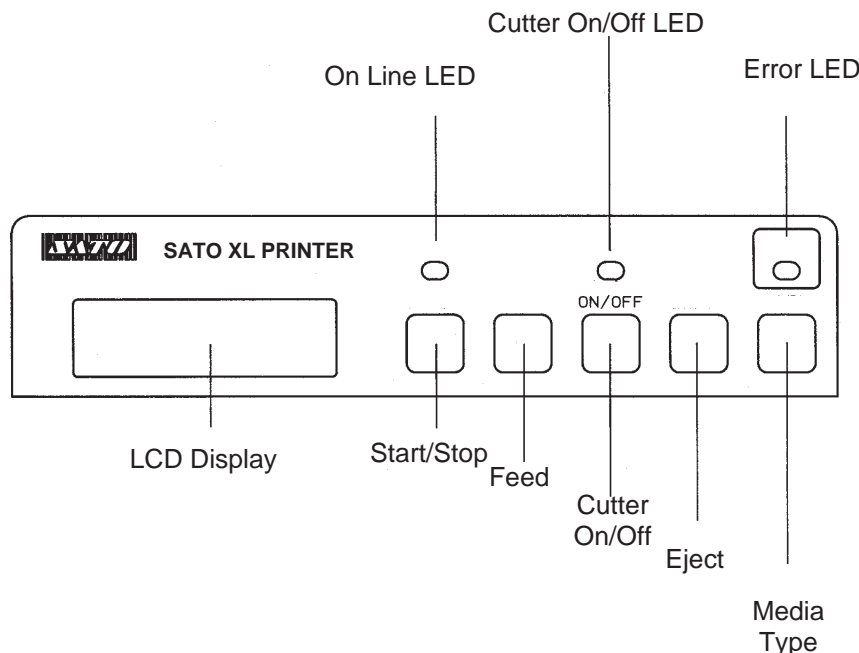
- Load the ribbon (see page 2-15).
- Load the Media (see page 2-12).
- Setup the printer for the media type (see page 2-8). You must use the LCD panel to select the proper media type (see page 2-14). The selections are:
  - Center Hole Tag
  - I-Mark Tag
  - Side Hole Tag
  - R-Corner Tag
  - Label Gap
  - I-Mark Label
- Adjust the Cutter Sensor (see page 2-18). *Note: The Cutter Sensor must be set up even if the Cutter is disabled.*
- Adjust the Cutter Offset to correctly locate the cut position. This can generally be done with the Cut Position potentiometer on the Control Panel (see page 3-20) which has a +/- 3.75mm range. If this is insufficient, the Cut Offset can be moved +/- 99 dots using the LCD panel (see page 3-15).
- Set the Pitch, Cut and Backfeed Offset using the LCD panel (see page 3-14).

## PRINTER COMPONENTS

Before attempting to set up the printer, please familiarize yourself with the major components.



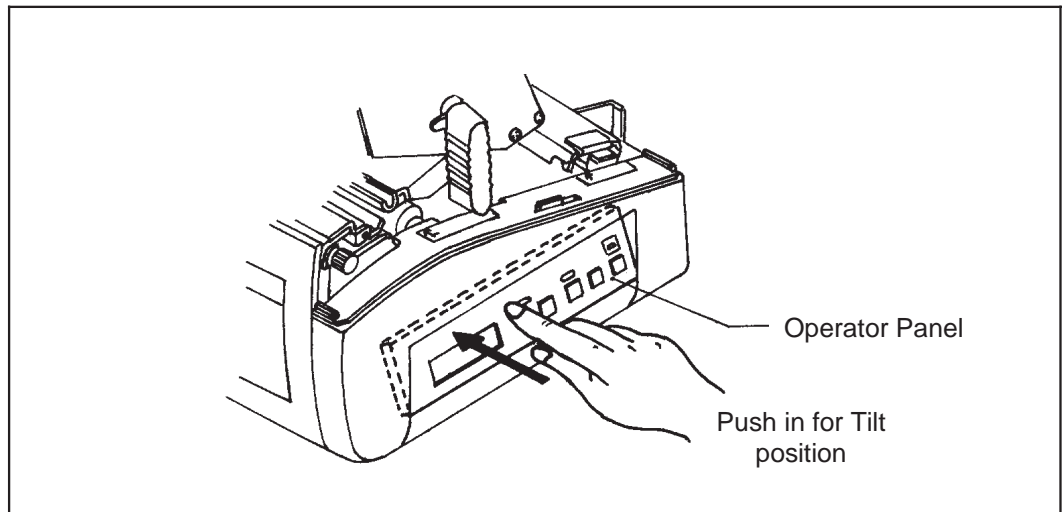




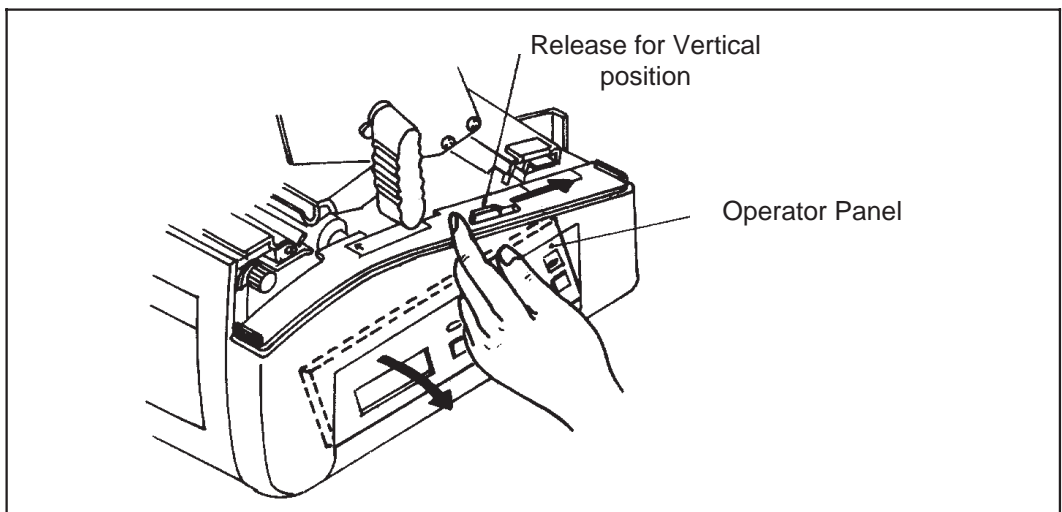
## OPERATOR PANEL

The XL Operator Panel consists of three LED indicators and five key switches. They are used to set the printer operating parameters and to indicate the status of the printer to the operator.

<b>On Line:</b>	LED. Illuminated when the printer is ready to receive data.
<b>Cutter On/Off:</b>	LED. Illuminated when the Cutter is enabled.
<b>Error:</b>	LED. Illuminated when there is a system fault such as an open print head.
<b>LCD Display:</b>	2 Line x 16 Character LCD display. Used for setting operational parameters of the printer.
<b>Start/Stop:</b>	Toggles the printer On and Off Line.
<b>Feed:</b>	Momentary Switch. Feed one tag or label each time it is pressed. Effective only when printer is Off Line.
<b>Cutter On/Off:</b>	Momentary Switch. Enables or disables the cutter. Effective only when printer is Off Line.
<b>Eject:</b>	Momentary Switch. When pressed, feeds out any printed labels. If the cutter is enabled, it feeds and cuts the label or tag.
<b>Media Type:</b>	Momentary Switch. Steps through the media types.

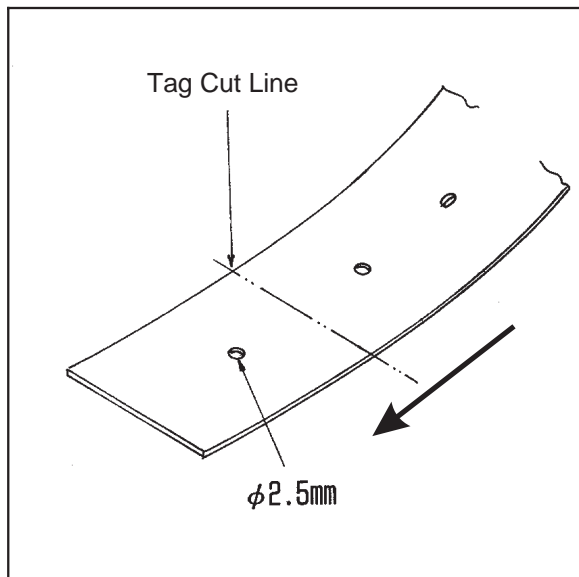


The Operator Panel has two positions; one is flush with the printer (vertical) and the other is tilted backward. The position should be set for the best viewing by the operator.

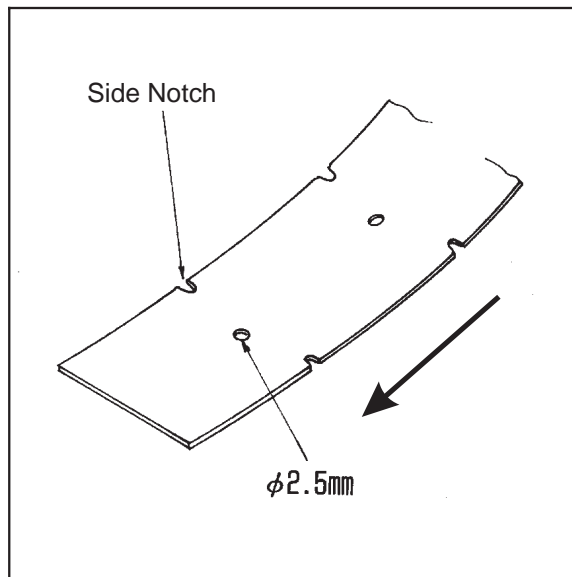


## MEDIA

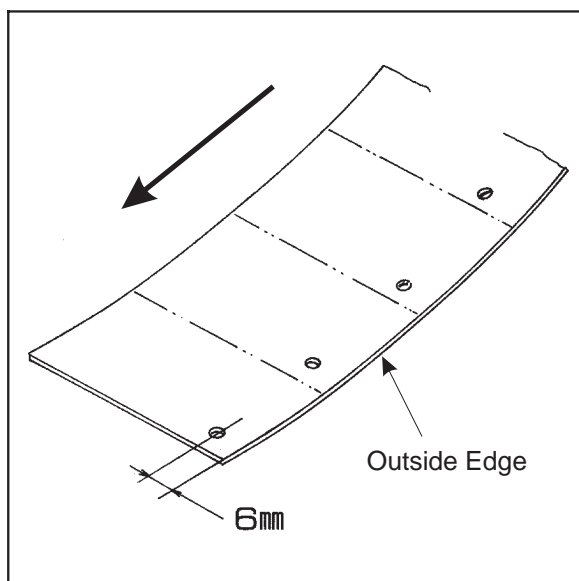
### Tag Types



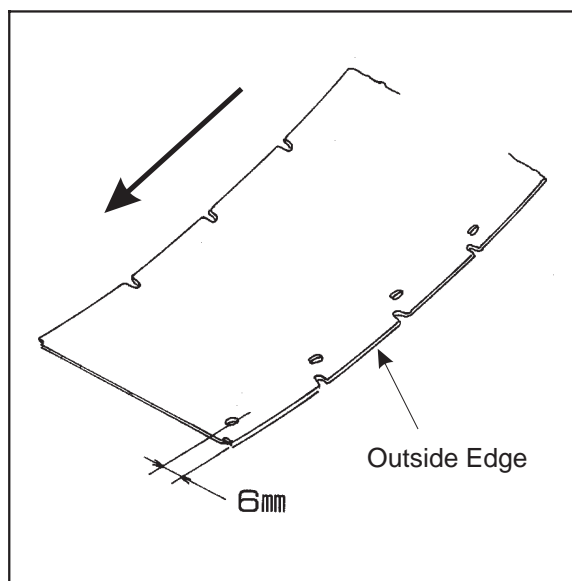
**Center-Hole Tag without Notch**  
(set printer for Center Hole)



**Center-Hole Tag with Side Notch**  
(set printer for Center Hole)

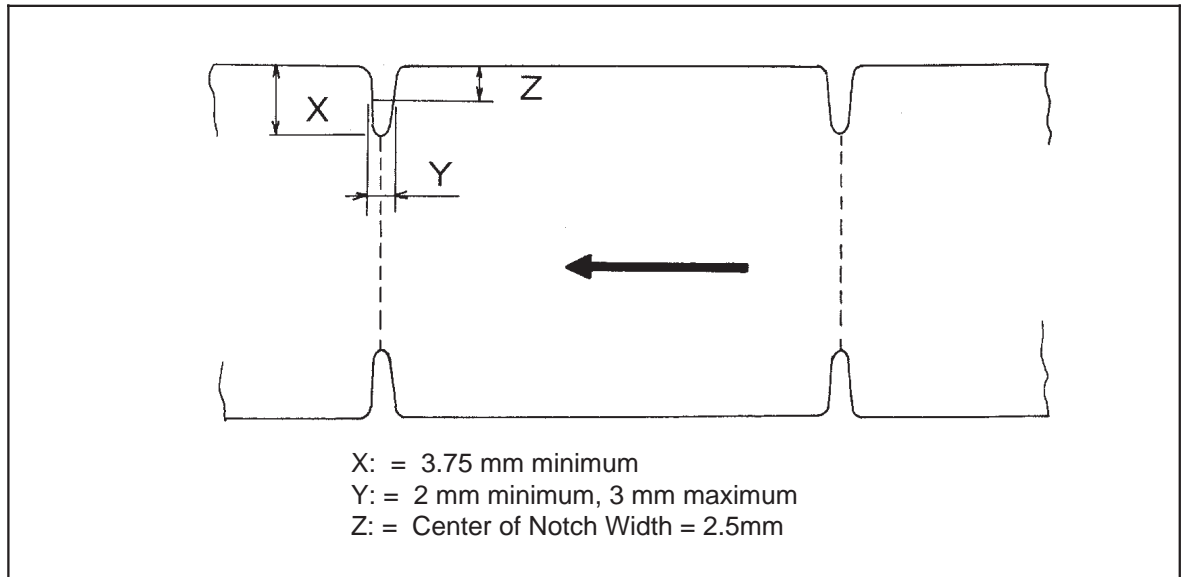


**Side-Hole Tag without Notch**  
(set printer for Side Hole)

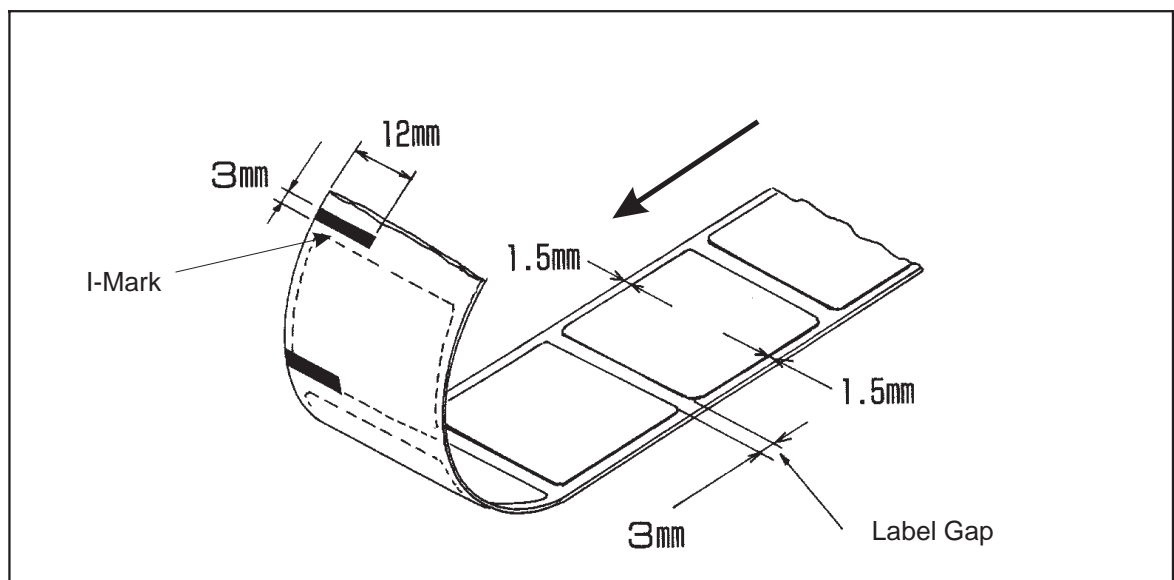


**Side-Hole Tag with Side Notch**  
(set printer for Side Hole)

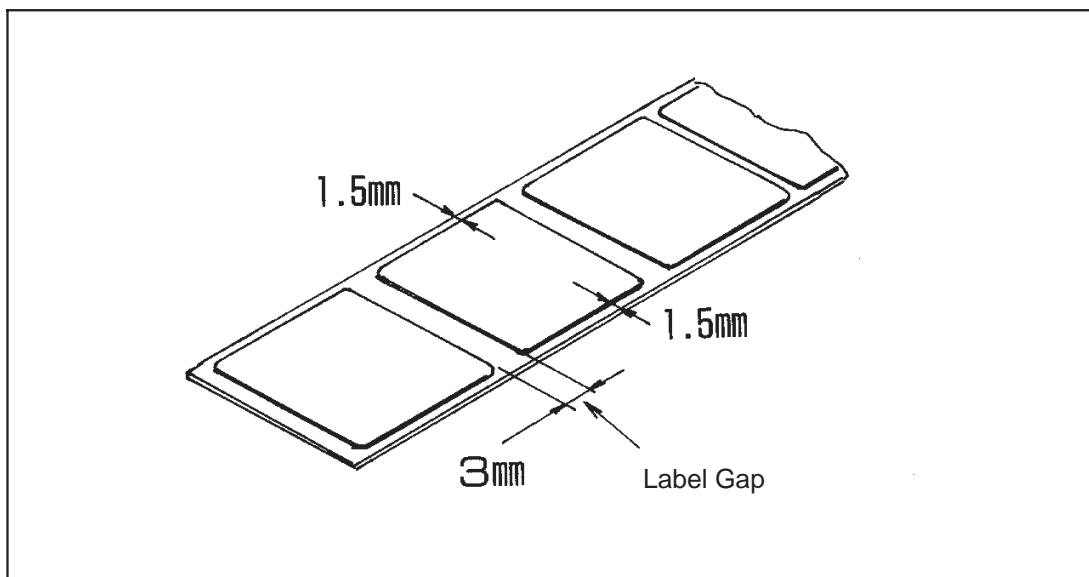




**R-Corner Specifications**  
(set printer for R-Corner Tag)



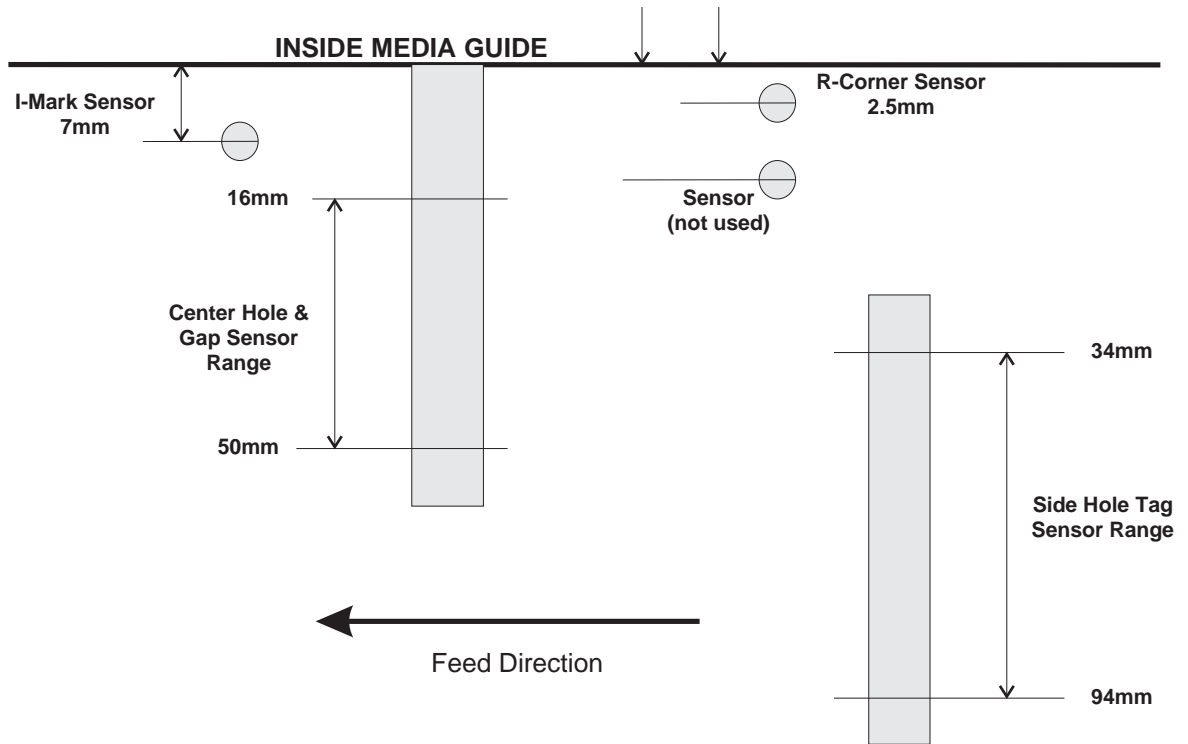
**I-Mark Specifications**  
(set printer for I-Mark Tag or Label)



**Label Gap Specifications  
(set printer for Label Gap)**

### Media Specifications

MEDIA TYPE	MINIMUM SIZE	MAXIMUM SIZE
Center Hole Tag	32mm W x 25 mm L	100mm W x 240mm L
I-Mark Tag	32mm W x 25mm L	100mm W x 240mm L
Side Hole Tag	50mm W x 25mm L	100mm W x 240mm L
R-Corner Tag	32mm W x 25mm L	100mm W x 240mm L
Label with Gap	25mm W x 16mm L	100mm W x 237mm L
I-Mark Label	32mm W x 25mm L	100mm W x 237mm L

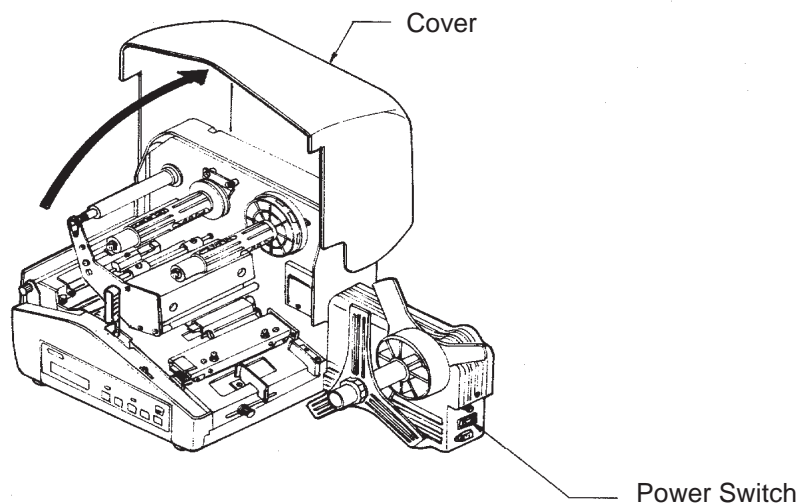


**Sensor Positions Relative to Inside Media Guide**

## LOADING TAGS AND LABELS

1

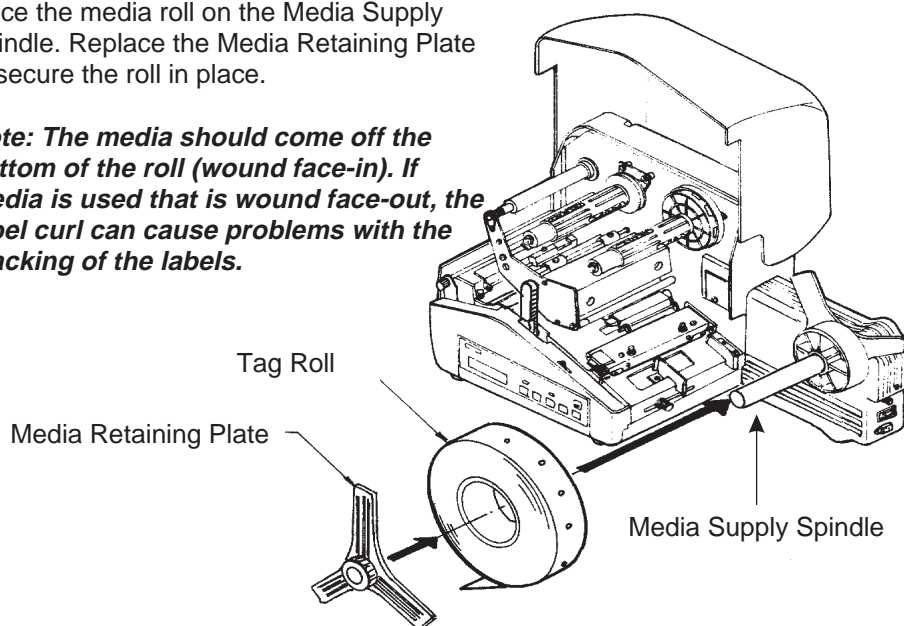
Open the Cover and power the printer on.



2

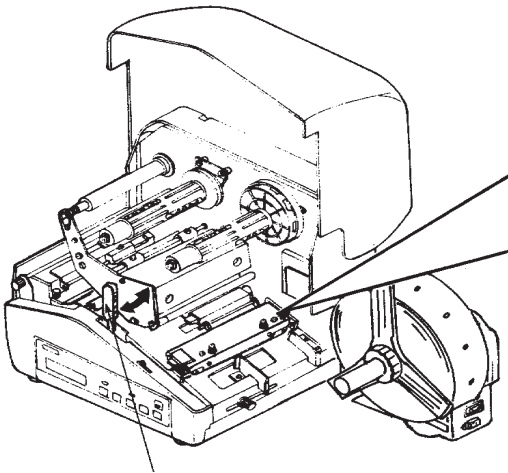
Remove the Media Retaining Plate and place the media roll on the Media Supply Spindle. Replace the Media Retaining Plate to secure the roll in place.

**Note:** The media should come off the bottom of the roll (wound face-in). If media is used that is wound face-out, the label curl can cause problems with the stacking of the labels.

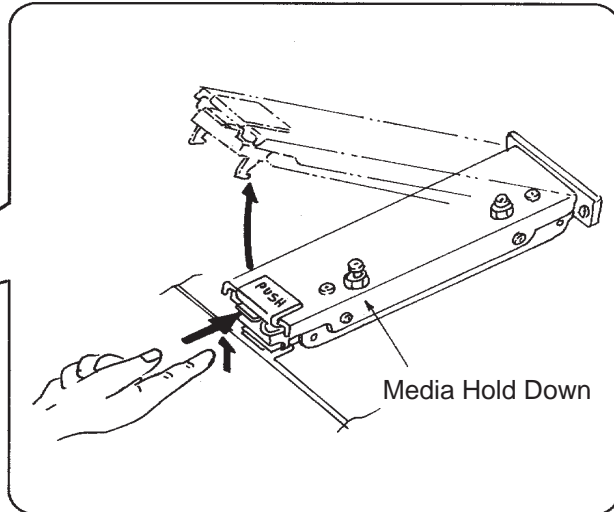


**3**

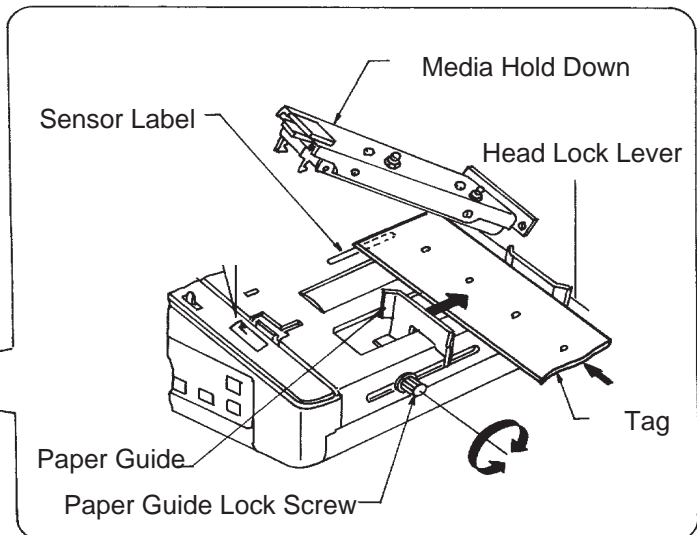
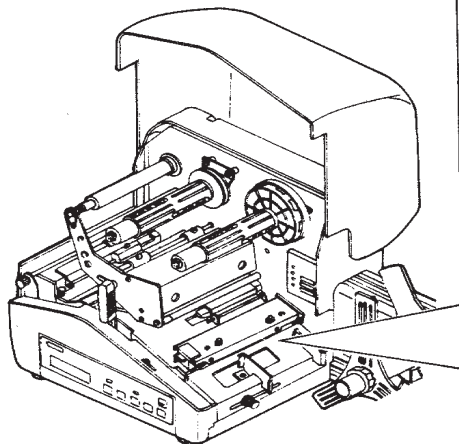
Open the print head by rotating the Head Release Lever to the rear of the printer. Open the Media Hold Down by lifting up on the release tab underneath the green tab marked "PUSH."



Head Lock Lever

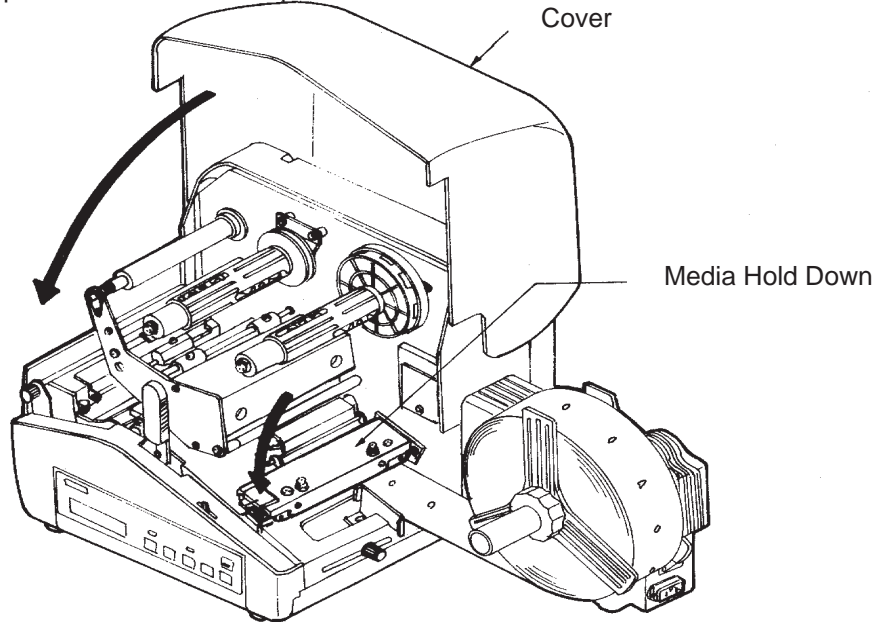
**4**

Load the tags from the rear until the leading edge of the first tag is underneath the print head. Loosen the Paper Guide Lock Screw and adjust the position of the Paper Guide until it holds the tag gently against the inside of the paper path (this also positions the sensor assembly). Retighten the Paper Guide Lock Screw. See page 2-11 for sensor locations.



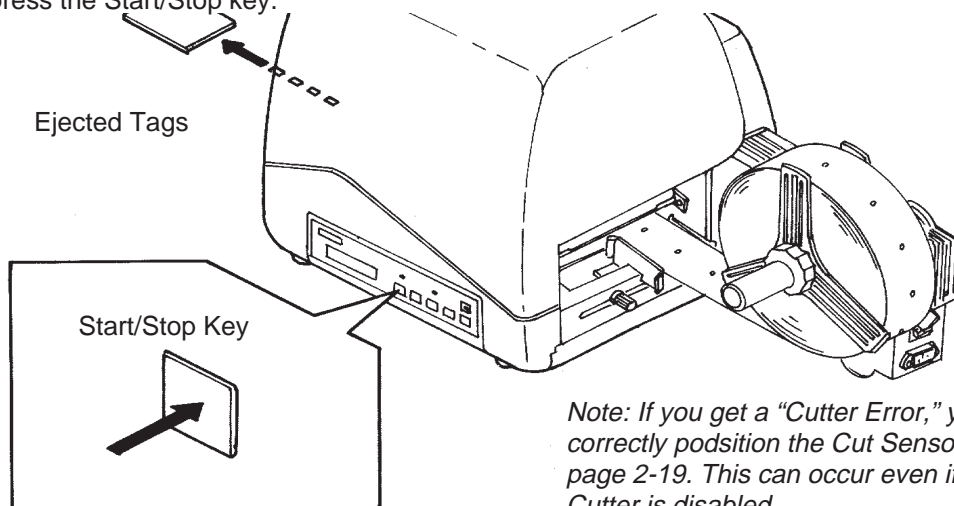
**5**

Close the Media Hold Down by pushing down on the green tab marked "PUSH." It will automatically latch in place. Close the print head by rotating the Head Lock Lever toward the front of the printer until it latches in place.



**6**

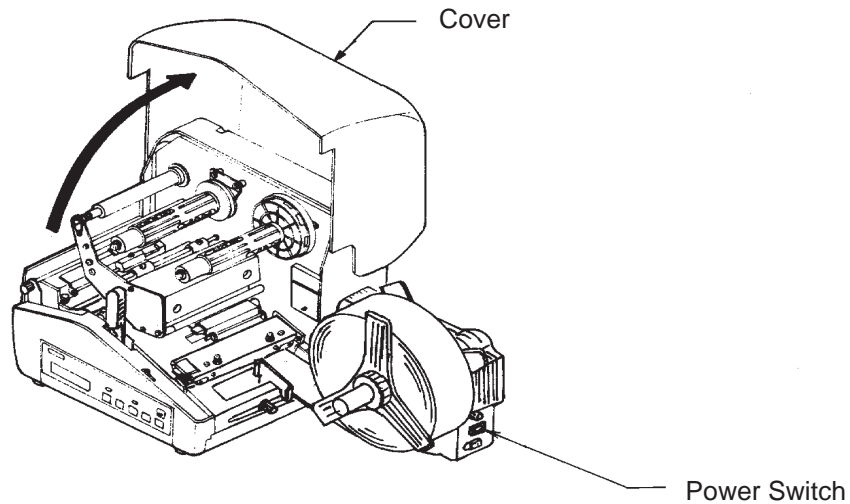
Power the printer On and press the Start/Stop key. The tags should be ejected if the Media Type setting is correct (the factory setting is Center-Hole Tag, however the printer retains the last setting entered via the LCD Panel). If the Media Type setting is incorrect, a "Sensor Error" will be displayed on the LCD. If this occurs, you must open the print head and Media Hold Down, reposition the media, close the print head and Media Hold Down and select the correct media type by pressing the Media Type key (see page 2-8) and press the Start/Stop key.



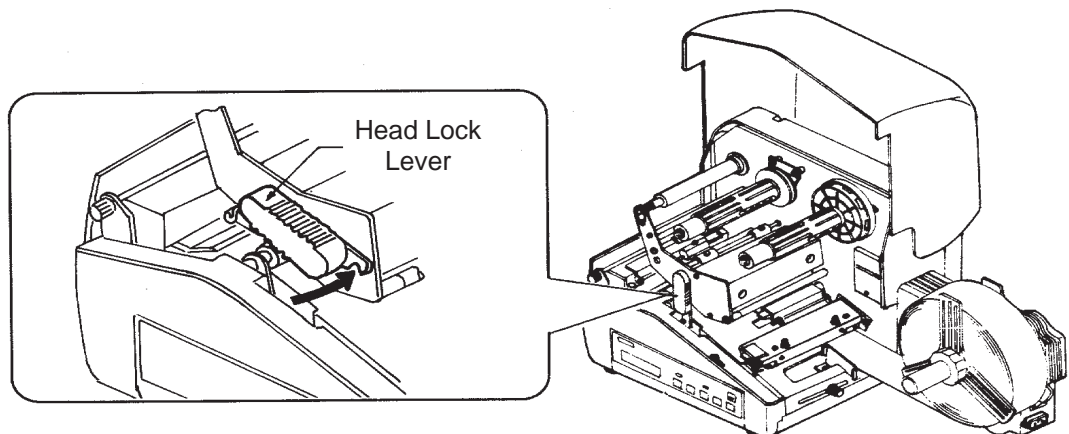
*Note: If you get a "Cutter Error," you must correctly position the Cut Sensor. See page 2-19. This can occur even if the Cutter is disabled.*

**LOADING RIBBON****1**

Turn the power off and open the Cover.

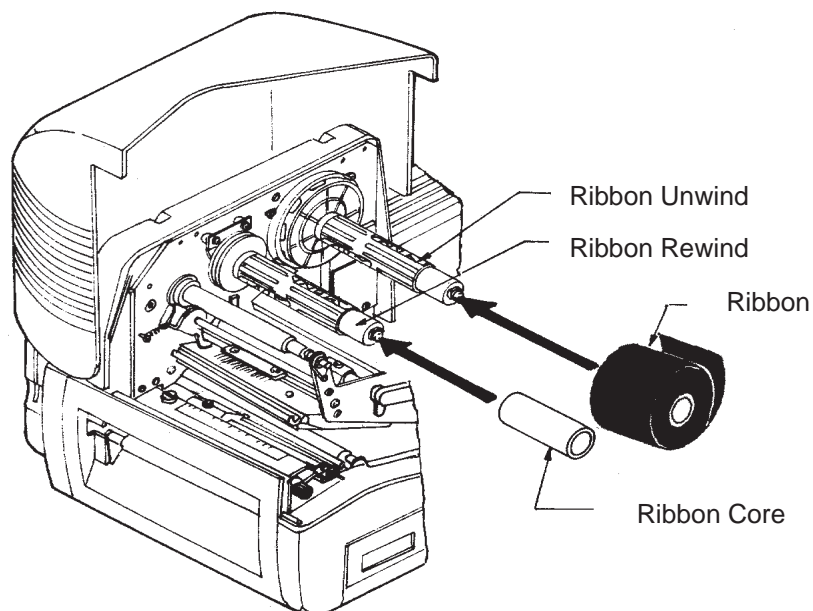
**2**

Open the print head by rotating the Head Lock Lever toward the rear of the printer. It will automatically retract to the open position.



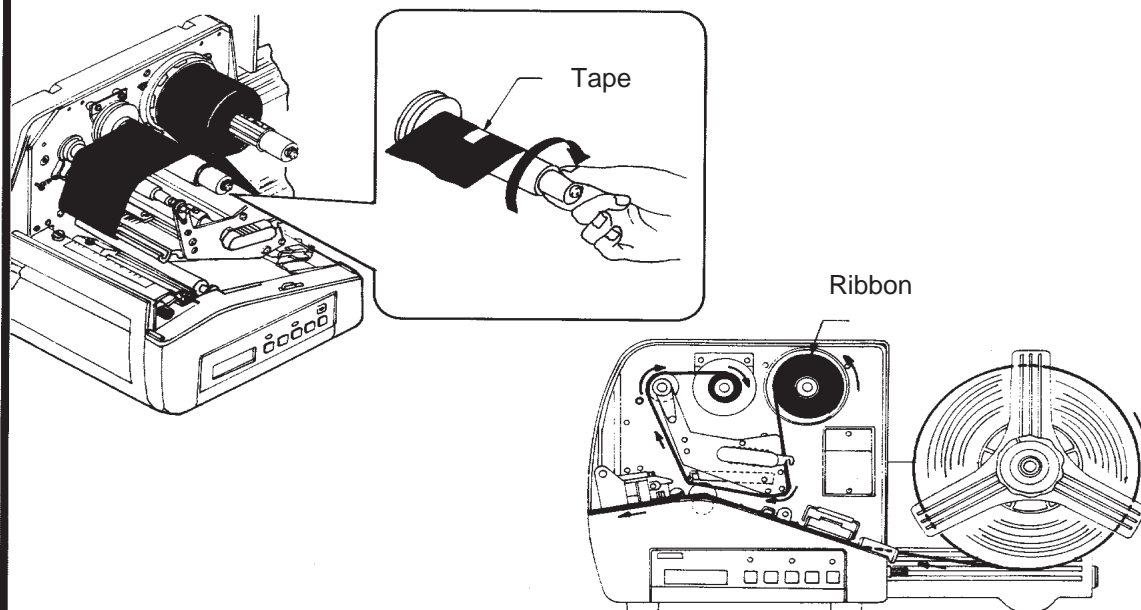
**3**

Place the ribbon on the Ribbon Unwind Shaft, making sure the ribbon unwind direction is as shown). Place an empty ribbon core on the Ribbon Rewind Shaft.



**4**

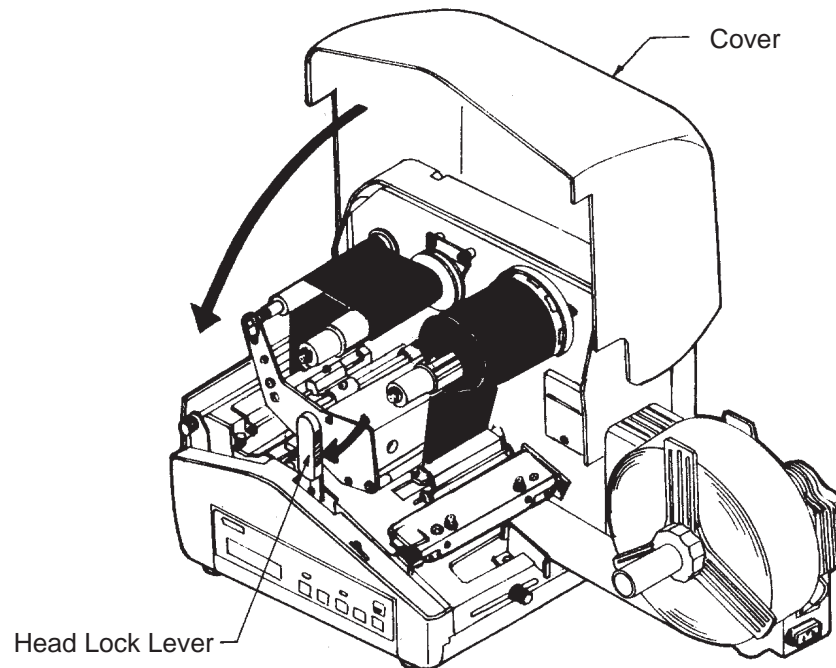
Route the ribbon as shown and tape the end to the ribbon core on the Ribbon Rewind Shaft. Rotate the shaft in a clockwise direction until several layers of ribbon are wound on the core.



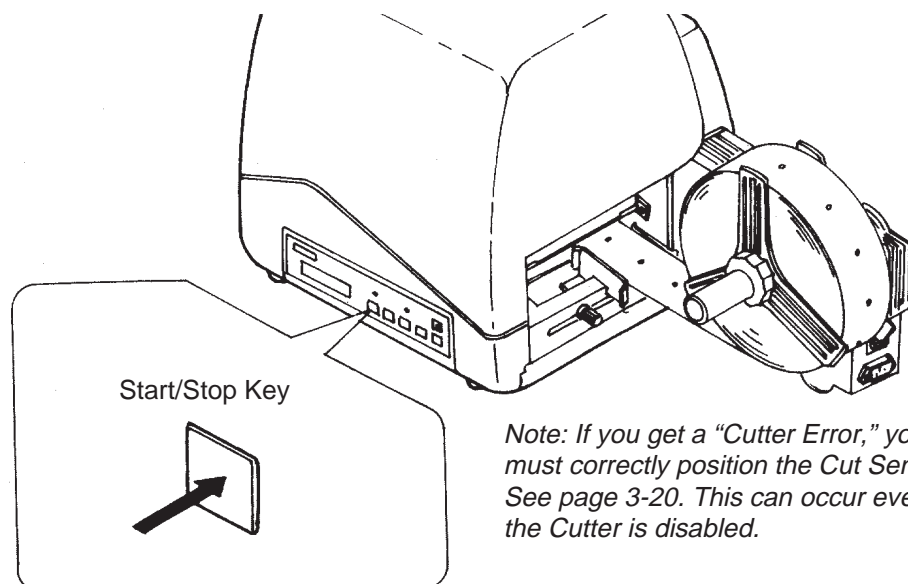


**5**

Make sure the media is fed into the printer with the leading edge underneath the print head. Close and latch the print head in the down position by rotating the Head Lock Lever.

**6**

Power the printer On. Press the Start/Stop key to initiate the automatic media feed. If the Media Type setting is incorrect, a "Sensor Error" will be displayed on the LCD. If this occurs, you must open the print head and Media Hold Down, reposition the media, close the print head and Media Hold Down and select the correct media type by pressing the Media Type key (see page 2-8). Press the Start/Stop key.



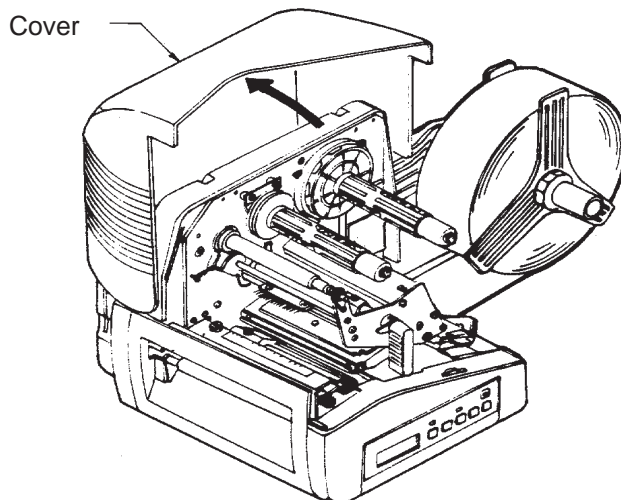
*Note: If you get a "Cutter Error," you must correctly position the Cut Sensor. See page 3-20. This can occur even if the Cutter is disabled.*

## CUT SENSOR ADJUSTMENT

These adjustments are for R-Corner Tag (Side-Notch), Center-Hole and Edge-Hole tags only.

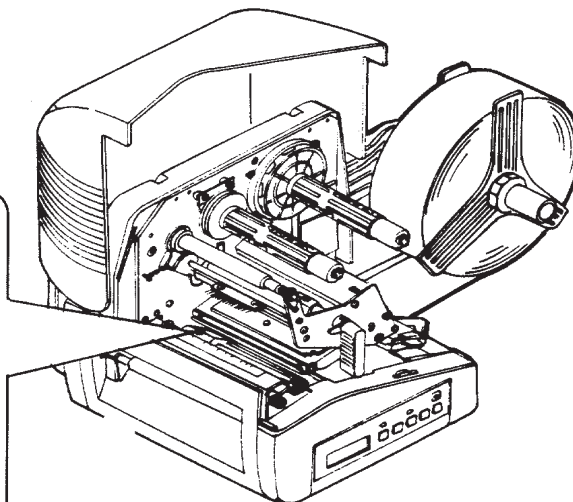
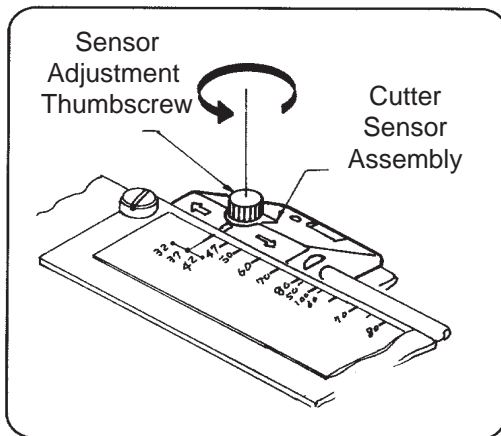
**1**

Open the cover. The Cut Sensors are located on an adjustable assembly that must be correctly positioned for the type of media used. They must be adjusted correctly even though the Cutter is disabled. If they are not, a "Cutter Error" will result when you try to feed tags.



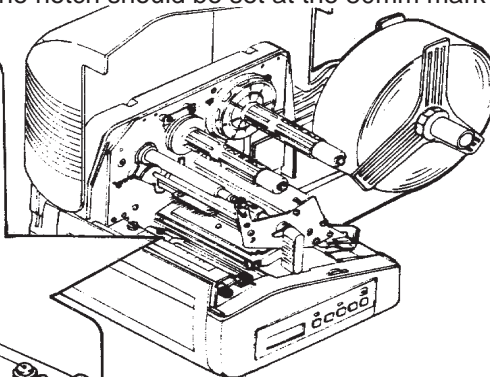
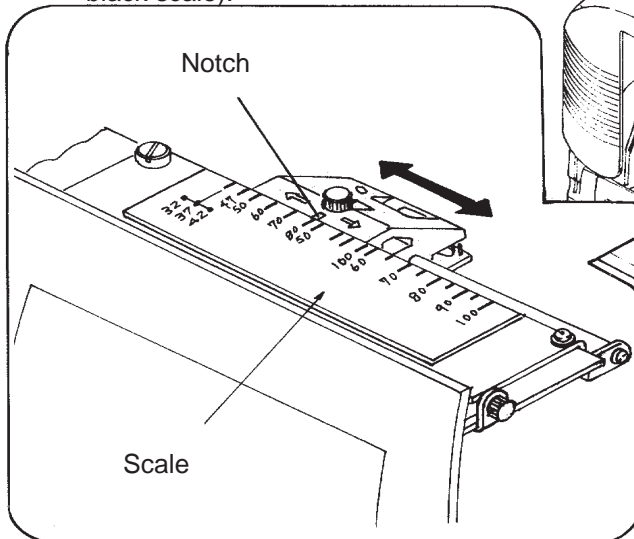
**2**

Loosen the green Sensor Adjustment Thumbscrew on the Cutter Sensor assembly. Align the notch on the Cutter Sensor Assembly to the position of the tag registration mark using the scale.



**3**

The scale used depends upon the type of media selected (i.e. R-Corner, Center-Hole or Side-Hole) and the setting corresponds to the width of the media (i.e., if you are using center hole tags that are 80mm wide, the notch should be set at the 80mm mark of the black scale).

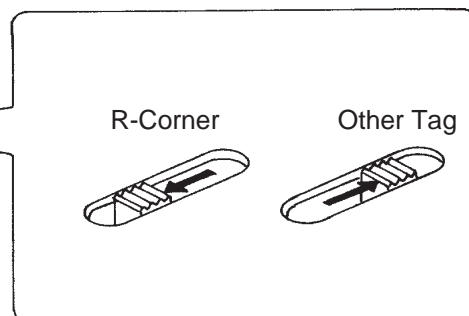
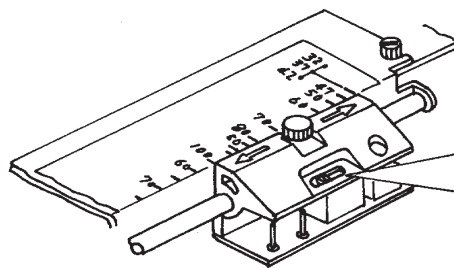


R-Corner: . . . Inside scale, 32 to 42mm.  
 Center-Hole: . . . Black scale  
 . . . . . Other Tag, 47 to 100mm  
 . . . . . R-Corner, 32 to 42mm  
 Side Hole: . . . Blue scale, 50 to 100mm

*See Tag Charts on pages 2-8 to 2-9 if you are unsure about tag type.*

**4**

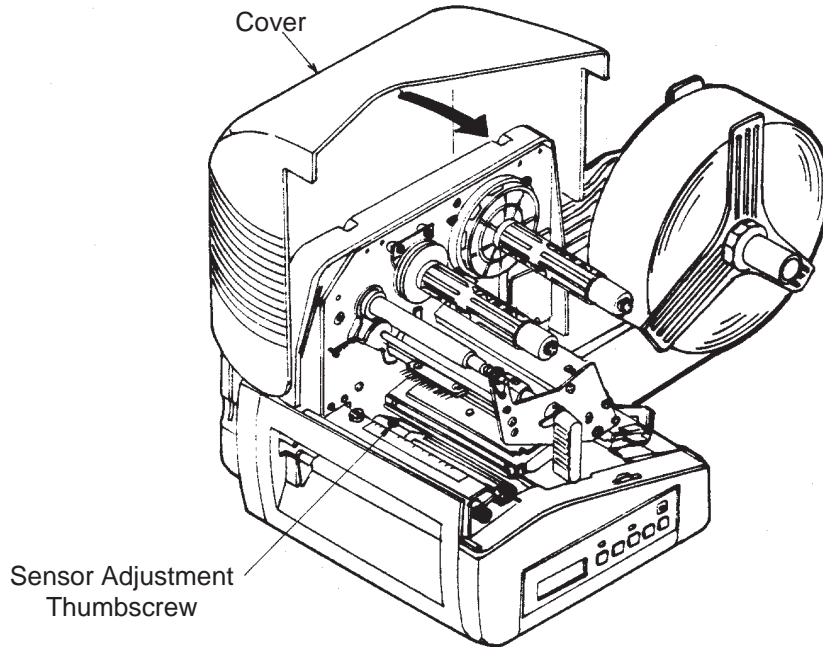
If you are using R-Corner Notch Tags, the tag notch must be on the inside edge of the tag and the position the Sensor Select Switch should be towards the outside of the printer. For all other tags, the Sensor Selector Switch should be towards the inside of the printer.



*See Tag Charts on pages 2-8 to 2-9 if you are unsure about tag type.*

**5**

After adjusting the Cutter Sensor Assembly, tighten the Sensor Adjustment Thumbscrew and close the Cover.



After adjusting the Cutter Sensor, make sure you:

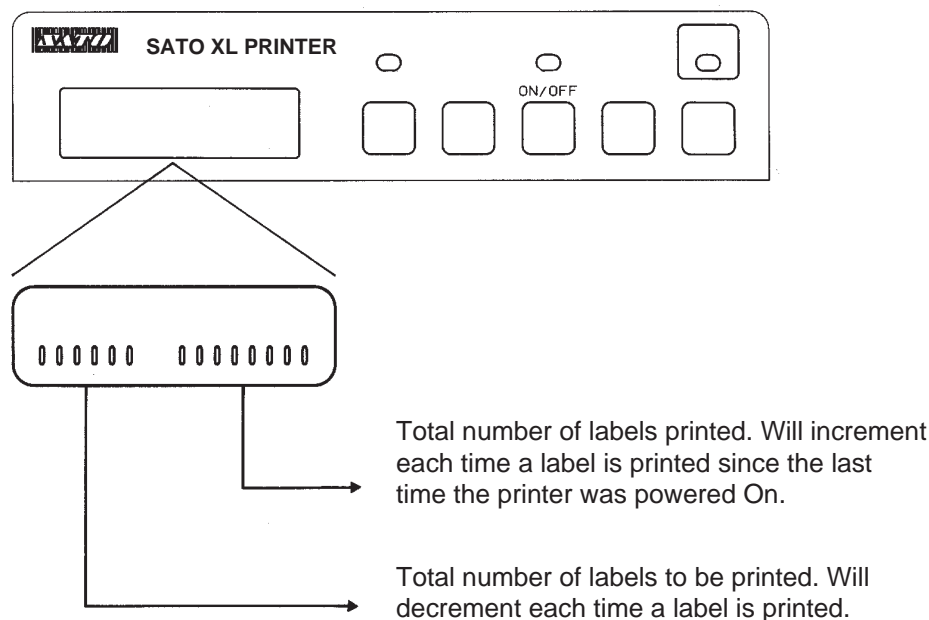
- Have the media and ribbon loaded correctly.
- The media and ribbon type are correct for the configuration.
- The Print Head and Media Hold Down are latched in the closed position.
- The cover is closed.

**NOTES:**

*If the media is not positioned correctly, press the FEED key to realign it.*

*If power is removed while printing, the media may be incorrectly positioned when power is restored and the printer may print several blank tags. Press the Start/Stop key to pause the print job and turn power off. When power is reapplied, the printer will correctly position the tags.*

## POWERING ON/OFF



### Before Turning Power Off

When removing power from the printer, you should first feed any printed labels or tags out of the printer by pressing the **EJECT** key while the printer is On Line. Any tags printed but still in the printer will be fed out, cut and the tag/label retracted to place the first print line under the head.

*Note: The **EJECT** operation can be controlled via software commands from the host.*

After the printed labels have been ejected from the printer, place the printer in the OFF LINE state before removing power. If the label/tag position is not disturbed while power is off, then the first printable label/tag will be in the correct position when power is reapplied. The Media Type setting is retained in the printer even though power is removed. When power is reapplied, the first print line of the tag/label will be correctly positioned under the print head.

### Replenishing the Tag Supply

When replenishing the tag/label supply with the same type and size, it is not necessary to power the printer off. The printer will automatically position the new media to the correct position.

- Raise the print head and relatch it to clear the “Paper End” Error.
- Unlatch the **Media Hold Down** and position the leading edge of the media even with the mark on the “Tag Setting Position” label. If labels are

being used, the leading edge of the first label should be under the print head and even with the “Label Setting Position” label.

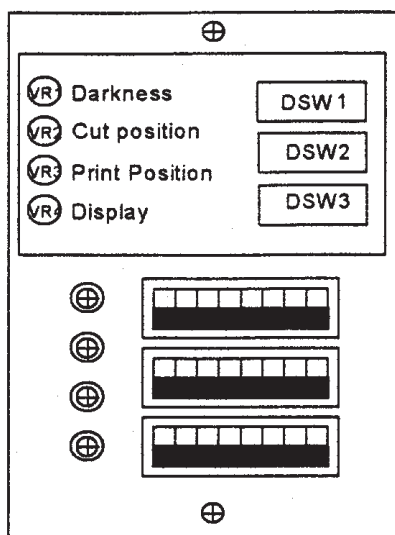
- Close the **Media Hold Down** and press the **START/STOP** key.
- The printer will automatically feed the media into the printer and position it correctly.

## SECTION 3. CONFIGURATION

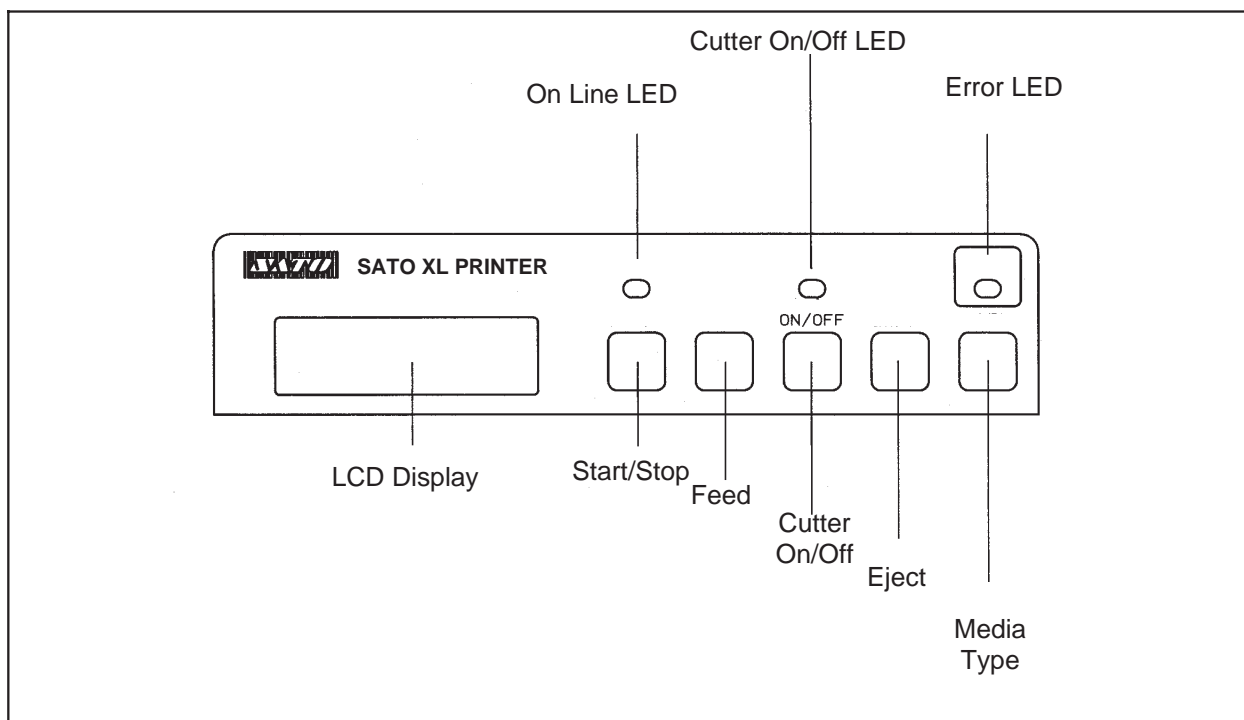
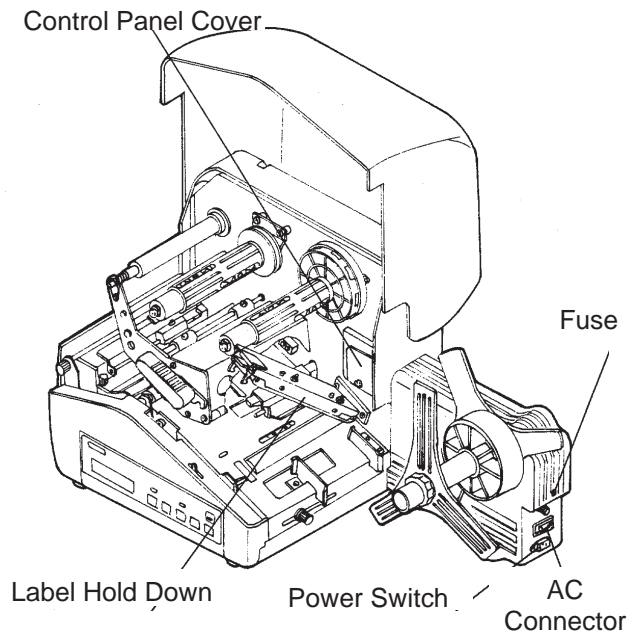
### INTRODUCTION

The configuration settings for the XL Series printers are set in two ways. The first is via three DIP switches (DSW1, DSW2 and DSW3) located under the cover. The other is using the Operator Panel LCD Display.

#### CONTROL PANEL



#### Control Panel Cover



## PRINTER DIP SWITCH CONFIGURATION

### DIP Switch Panels

There are three DIP switches (DSW1, DSW2 and DSW3) located underneath an access panel inside the printer. These switches can be used to set:

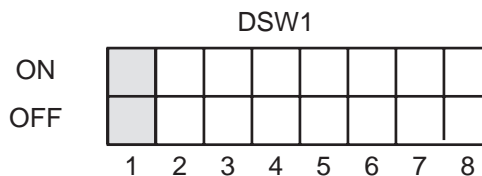
- RS232C transmit/receive parameters
- Thermal transfer or direct thermal mode
- Head check mode
- Hex dump mode
- Receive buffer size
- Operation mode

Each switch is an eight section “toggle” switch. The ON position is always to the top (up). To set the switches, first power the unit Off, then position the DIP switches. Finally, after placing the switches in the desired positions, power the printer back on. The switch settings are read by the printer electronics during the power up sequence. They will not become effective until the power is cycled.

### RS232 Transmit/Receive Setting

**Data Bit Selection (DSW1-1)** - This switch sets the printer to receive either 7 or 8 bit data bits for each byte transmitted.

DSW1-1	SETTING
Off	8 data bits
On	7 data bits



**Parity Selection (DSW1-2, DSW1-3)** - These switches select the type of parity used for error detection.

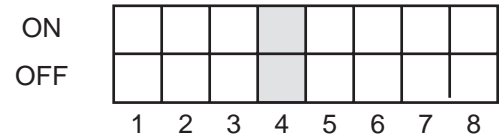
DSW1-2	DSW1-3	SETTING
Off	Off	No Parity
Off	On	Even
On	Off	Odd
On	On	Not Used





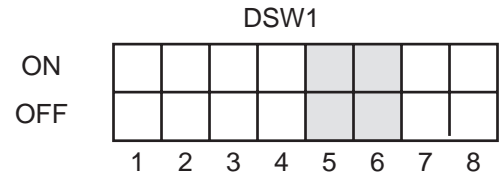
**Stop Bit Selection (DSW1-4)** - Selects the number of stop bits to end each byte transmission.

DSW1-4	SETTING
Off	1 Stop Bit
On	2 Stop Bits



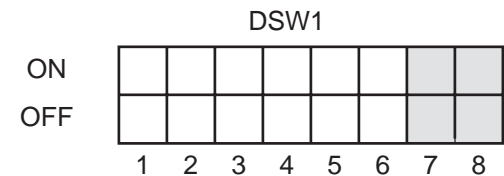
**Baud Rate Selection (DSW1-5, DSW1-6)** - Selects the data rate (bps) for the RS232 port.

DSW1-5	DSW1-6	SETTING
Off	Off	9600
Off	On	19200
On	Off	4800
On	On	2400



**Protocol Selection (DSW1-7, DSW1-8)** - Selects the flow control and status reporting protocols. See Section 6: Interface Specifications for more information.

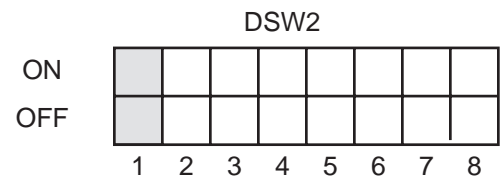
DSW1-7	DSW1-8	SETTING
Off	Off	Rdy/Bsy
Off	On	X-On/X-Off
On	Off	Bi-Com
On	On	Not Used



## Printer Set Up

**Print Mode Selection (DSW2-1)** - Selects between direct thermal printing on thermally sensitive paper and thermal transfer printing using a ribbon.

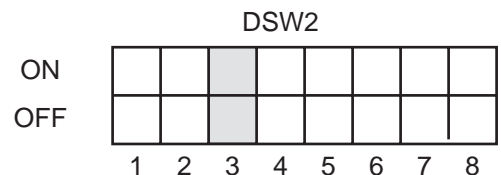
DSW2-1	SETTING
Off	Therm Xfr
On	Direct Therm



**Reserved (DSW2-2)** - Reserved for future use

**Head Check Selection (DSW2-3)** - When selected, the printer will check for head elements that are electrically malfunctioning.

DSW2-3	SETTING
Off	Disabled
On	Enabled



**Reserved (DSW2-4)** - Reserved for future use.

**Receive Buffer Selection(DSW2-5)** - Selects the operating mode of the receive buffer. See Section 6: Interface Specifications for more information.

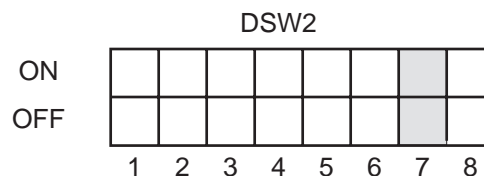
DSW2-5	SETTING
Off	Single Job
On	Multi Job



**Reserved (DSW2-6)** - Reserved for future use.

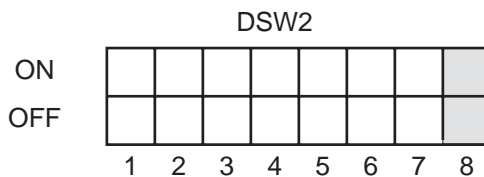
**Protocol Code Selection (DSW2-7)** - Selects the command codes used for protocol control. Refer to page E-1for more information.

DSW2-7	SETTING
Off	Standard
On	Non-Std



**Pitch Size Check (DSW2-8)** - Checks the length on the installed media against the size loaded via software (<ESC>A1 Command, page 5-46).

DSW2-8	SETTING
Off	Disabled
On	Enabled



**Reserved (DSW3)** - Reserved for future use.

*Note: The Centronics (Parallel) communications port is always enabled regardless of the settings for the RS232 port. There are no settings for Centronics! Both the Centronics and RS232 ports are active at all times. Care should be taken to ensure that data is not transmitted to both ports simultaneously as the received message will be corrupted.*

## Default Settings

Switch Selections - All switches are placed in the Off position (default) for shipping. This will result in the following operating configuration:

<b>Communications</b>	8 data bits, no parity, 1 Stop bit, 9600 Baud
<b>Protocol:</b>	Ready/Busy, Standard Protocol Codes
<b>Mode:</b>	Thermal Transfer
<b>Head Check:</b>	Disabled
<b>Receive Buffer:</b>	Single Job
<b>Pitch Check:</b>	Sensor Used

Software Default Settings - The printer stores the software settings upon receipt and uses them until they are again changed by receipt of a command containing a new setting. These settings are stored in non-volatile RAM and are not affected by powering the printer off. The printer may be reset to use the default software settings by depressing the **FEED** and **START/STOP** keys simultaneously while powering the printer on. This will result in the following default configuration:

	<b>XL400</b>	<b>XL410</b>
<b>Print Darkness</b>	2	2
<b>Print Speed</b>	6 inches per second	5 inches per second
<b>Print Reference</b>	Vertical = 001 Horizontal = 001	Vertical = 001 Horizontal = 001
<b>Media type</b>	Center hole Tag	Center Hole Tag
<b>Cutter</b>	Enabled	Enabled
<b>Zero</b>	Slash	Slash

Once the default operation is completed, a “SATO DEFAULT COMPLETED” message will be displayed on the LCD panel or a single “beep” will be heard if the printer does not have an LCD panel. The printer should be powered off while this message is being displayed (or after the “beep” is heard. This saves the default settings in the EEPROM where they will be automatically loaded the next time the printer is powered on.

***SATO DEFAULT  
COMPLETED***

## PRINTER ADJUSTMENTS

---

The LCD Panel on the XL400 and XL410 is used by the operator to manually enter printer configuration settings. Many of the settings can also be controlled via software commands and in the case of conflict between software and control panel settings, the printer will always use the last valid setting. If you load a label job that includes software settings and then enter a new setting via the Operation Panel, the manually set values will be used by the printer. If you set the values manually and then download a job with software settings, the software settings will be used.

### NORMAL MODE

When the printer is powered on, the ON-LINE LED will be illuminated and the readout should display the following message:



The image shows a rectangular LCD display with a black border. The top line displays the text "ON LINE" in a monospaced font. The bottom line displays two sets of six zeros, "000000" on the left and "000000" on the right, separated by a wide space.

The LCD Panel will display the ON LINE status on the top line of the display and the bottom line will contain the label quantity status. The ON LINE message will be changed to OFF LINE whenever the printer is switched OFF LINE by depressing the **START/STOP** key. *As soon as a print job is received, the left quantity message will indicate the number of labels to be printed and the right quantity message the number of labels printed since power up. As soon as the label job begins to print, the display will indicate the number of labels remaining in the print job that remain to be printed. As each label in the print job is printed, the quantity to be printed (left) will decrement and the quantity printed (right) will increment.*

When the printer is first taken offline by pressing the **START/STOP** key once. The ON LINE LED will go off and the display will change to:



The image shows a rectangular LCD display with a black border. The top line displays the text "CENTER HOLE TAG" in a monospaced font. The bottom line displays two sets of six zeros, "000000" on the left and "000000" on the right, separated by a wide space.

<b>POWER ON</b>	
Normal MODE	<i>ON LINE</i>
<b>POWER</b>	<i>000000 000000</i>
Print Test Labels	<i>USER TEST PRINT</i>
<b>POWER + FEED</b>	
User Mode	<i>USER MODE</i>
<b>POWER + START/STOP</b>	
Load SATO Default Settings	<i>SATO DEFAULT COMPLETED</i>
<b>POWER + FEED + START/STOP</b>	
Download User Defined Protocol Codes	<i>USER DOWNLOAD</i>
<b>POWER + START/STOP + DSW2-7=ON</b>	
Print Service Label	<i>SERVICE PRINT</i>
<b>POWER+MEDIA TYPE + FEED</b>	<i>SMALL LARGE</i>
Sensor Setup	<i>SERVICE MODE</i>
<b>POWER + START/STOP + MEDIA TYPE</b>	<i>SENSOR SETUP</i>

## USER MODE

To enter the USER mode, power the printer on while pressing the **START/STOP** key. After the printer beeps, release the **START/STOP** key.

A rectangular LCD display showing the text "USER MODE" in a monospaced, uppercase font.

Pressing the **FEED** key will result in the printer now displaying the first USER mode adjustment (Print Darkness).

### Print Darkness Setting

There are three Darkness (or heat range) settings on the XL400/410 (1, 2 and 3). The higher numbers represent darker settings. The current setting is indicated by an underline under one of the range settings. To change the setting:

A rectangular LCD display showing the text "PRINT DARKNESS" in a monospaced, uppercase font. Below the text, the numbers "1", "2", and "3" are displayed. The number "2" is underlined.

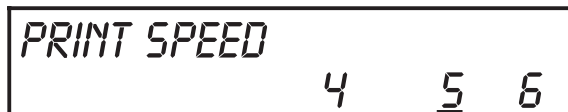
1. Use the **START/STOP** key to step the underline cursor to the desired setting.
2. Once the correct setting is underlined, press the **FEED** key to advance to the next adjustment.

*Note: This setting can be overridden by software commands (see Print Darkness page 5-49).*

After setting the heat range with this command, finer adjustments can be made using the PRINT potentiometer adjustment on the Adjustment panel. See page 4-1 for additional information on how to make this adjustment.

### Print Speed Adjustment

There are three SPEED settings on the XL410 (4 ips, 5 ips and 6 ips) and four on the XL400 (5 ips, 6 ips, 7 ips and 8 ips). They are listed on the bottom line of the display. The current setting is indicated by an underline cursor under one of the speed settings. To change the setting:



1. Use the **START/STOP** key to step the underline cursor to the desired speed setting.
2. Once the correct setting is underlined, press the **FEED** key to advance to the next adjustment.

*Note: This command can be overridden by software command (see Print Speed, page 5-53).*

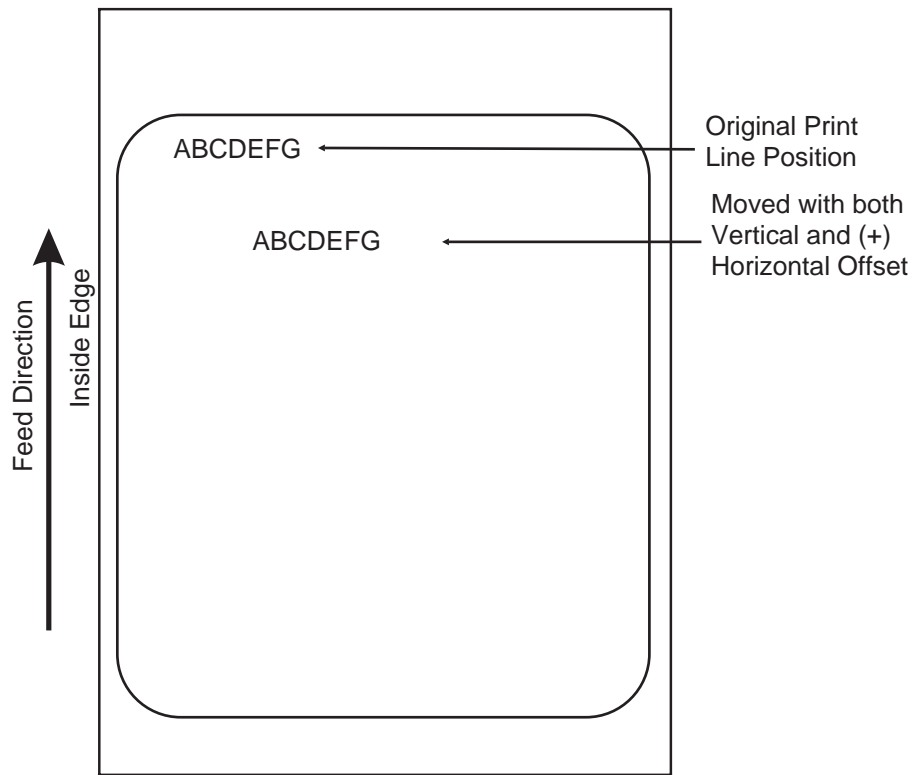
See Section 4: *CLEANING AND MAINTENANCE*, for additional information on how to make this adjustment for optimum print quality.

### VH Offset

The Vertical and Horizontal offset allows you to move the label image both horizontally and vertically to position a label format correctly on a label. This allows you to use smaller label formats on media which is larger than the original format called for without having to individually correct each H and V field positions in the command stream. It is the same effect as using the <ESC>A3 Base Reference Point command (page 5-17).



1. Use the **START/STOP** key to select the vertical direction ("+" or "-").
2. Once the correct direction is displayed, press the **FEED** key to accept the setting advance to the vertical setting adjustment.
3. The underline cursor is now positioned under the least significant digit of the V offset setting. The vertical offset will increase each time the **START/STOP** key is pressed. If the **START/STOP** key is pressed and held down, the value will count up rapidly.
4. Once the correct vertical offset is displayed, press the **FEED** key to accept the setting and advance to the horizontal setting adjustment.
5. Use the **START/STOP** key to select the horizontal direction ("+" or "-").
6. Once the correct direction is displayed, press the **FEED** key to accept the setting advance to the horizontal setting adjustment.



7. The underline cursor is now positioned under the least significant digit of the H offset setting. The horizontal offset will increase each time the **START/STOP** key is pressed. If the **START/STOP** key is pressed and held down, the value will count up rapidly.
8. Once the correct setting is displayed, press the **FEED** key to accept the setting advance to the next adjustment.

### Zero Slash Setting

This setting determines if a zero is printed with a slash or without a slash. This setting can also be controlled via software commands. When YES is selected, the XU, XS, XM, XB, XL and vector fonts will have a slash through the center of the zero character.



1. Use the **START/STOP** key to step the underline cursor to either the YES or NO selection.
2. Once the correct setting is underlined, pressing the **FEED** key will cycle back to the

### Exit

You exit from the USER MODE by removing power from the printer. At this time the values selected will be stored in non-volatile memory.



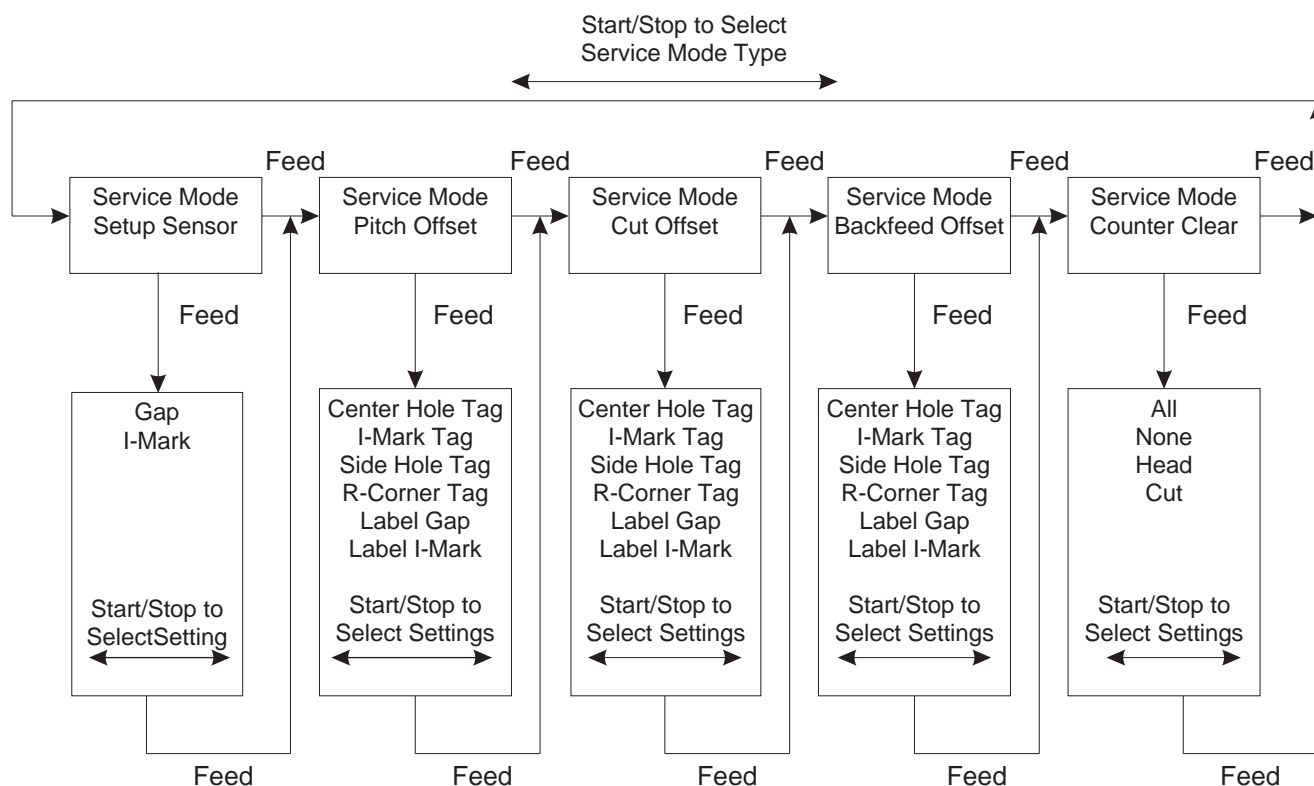
## SERVICE MODE

A Service Mode is provided to make adjustments that require only occasional changes. Since they affect the basic operation of the printer, the procedure for entering this mode is designed to prevent someone from accidentally changing the settings.

To enter the Service Mode, the printer is powered on while pressing the **START/STOP** simultaneously with the **MEDIA TYPE** key while powering the printer on. The printer will “beep” one time and display the first configuration selection on the LCD panel. You select the type of adjustment by pressing the **START/STOP** key. Each time the **START/STOP** key is pressed, the Service Mode display will be cycled to the next selection. The type of adjustments that can be made in the Service Mode are:

- Sensor Setup
- Pitch Offset
- Cut Offset
- Backfeed Offset
- Clear Counter

From the Service Mode type display, the settings are accessed in sequence by pressing the **FEED** key. Once you have cycled through all the adjustments for the Service Mode type, pressing the **FEED** key will sequence you to the next Service Mode type.



Setup Sensor



The XL Series printers determine the location of the leading edge of the label or tag by measuring the difference between light levels when it sees either a media edge or a black I-Mark. This adjustment allows you to manually set the threshold voltage level, between the maximum and minimum light levels. The type of sensor is automatically selected by the **MEDIA TYPE** setting (*Note: GAP is also used for tags*). The LCD will display either “GAP” or “I-Mark” on the top line along with the current setting. If the value entered is “0.0V”, then the printer will automatically calculate the setting when the first label is fed after the printer is powered on or the head is closed. There are some instances where the automatically calculated value must be adjusted to ensure reliable label feeding, such as when the backing opacity or the reflectance of the I-Mark varies significantly within a roll of labels or between label rolls. In these instances the value should be set using the following procedures.



**GAP** - When setting the “gap” threshold, the voltage must be measured with nothing (or nothing but the backing if labels are used) in the sensor and then again with a labels in the sensor. The smaller value is added to the larger and the result multiplied by 0.5. This is the starting point to be used. The formula for this is:

$$(\text{High Voltage Level} + \text{Low Voltage Level}) \times 0.5 = \text{Start Value}$$

1. Insert a tag/label into the sensor (see page 2-11 for location of the sensors) and close the Media Hold Down. Record the voltage shown on the top line of the LCD panel. This line should have the message “GAP” on the top line. Make sure the tag/label is all the way under the sensor.
2. If labels are used, strip the label from the backing and insert the backing strip under the sensor. If tags are used, remove the tag from the sensor. Close the Media Hold Down. Record the voltage shown on the top line of the LCD panel. The voltage ranges measured should be within the following ranges:

Tag or Label with Backing	No Tag or Label Backing Only
2.0V to 3.5V	Less than 1.0V

If the measured values are outside this range, you may have trouble in finding a value that will work properly under all conditions. If this is the case, a higher quality label may be needed to get adequate performance.

3. Calculate the starting point voltage using the formula.
4. Use the **START/STOP** key to step the counter to the desired setting. The display will increment one step for each time the **Start/Stop** key is pressed. If the **START/STOP** key is held pressed for more than two seconds, it will automatically go into the fast scroll mode. The reading will advance to a setting of 4.9 (the maximum voltage) after which it will automatically wrap and start at “0.0” again. If a value of “0.0” is set, the printer will automatically set the level half way between the two measured voltages each time the printer is powered on with labels loaded.
5. Repeat this procedure using values slightly higher or lower until the optimum performance is obtained. If you cannot find a setting between the high and low readings that gives adequate performance, then the label stock has too much variation in its opacity and a better quality stock should be used.
6. Once the setting is correct, pressing the **FEED** key will advance to the next display.

**I-Mark** - When setting the “I-Mark” threshold, the voltage must be measured with nothing but the label or tag under the sensor and then again with the printed I-Mark under the sensor. The smaller value is added to the larger and the result multiplied by 0.5 . This is the starting point to be used. The formula for this is:

$$(\text{High Voltage Level} + \text{Low Voltage Level}) \times 0.5 = \text{Start Value}$$

1. Insert a label or tag into the sensor (see *Section 4: Cleaning and Maintenance* for location of the sensors) and close the Media Hold Down. Make sure the printed I-Mark is *not* under the sensor. Record the voltage shown on the top line of the LCD panel. This line should have the message “I-Mark” on the top line.
2. Now pull the label or tag forward until the I-Mark is positioned under the sensor (the voltage reading should be at its highest point). Record the voltage shown on the top line of the LCD panel. The voltage ranges measured should be within the following ranges:

Label or Tag Only	I- Mark
Less than 1.0V	2.5V to 3.5V

If the measured values are outside this range, you may have trouble in finding a value that will work properly under all conditions. If this is the case, a higher quality label may be needed to get adequate performance.

3. Calculate the starting point voltage using the formula.

4. Use the **START/STOP** key to step the counter to the desired setting. The display will increment one step for each time the **START/STOP** key is pressed. If the **START/STOP** key is held pressed for more than two seconds, it will automatically go into the fast scroll mode. The reading will advance to a setting of 4.9 (the maximum voltage) after which it will automatically wrap and start at "0.0" again. If a value of "0.0" is set, the printer will automatically set the level each time the printer is powered on with labels/tags loaded or the head is closed.
5. Repeat this procedure using values slightly higher or lower until the value that gives adequate performance is found. If adequate performance cannot be obtained, then the label stock or printed I-Mark has too much variation in its reflectance and a better quality stock should be used.
6. Once the setting is correct, pressing the **FEED** key will advance to the next display.

### Pitch Offset

The Pitch is the distance from the leading edge of a label or tag to leading edge of the next label or tag. It is used to position the first print line of the label or tag under the print head. This position can be adjusted relative to the "000" reference line (see page 3-26) +/- 99 dots in increments of 1 dot using the following procedure (1 dot = .005" for the XL400 and .0033" for the XL412). Once the position is set, it can be adjusted +/- 3.75 mm using the PRINT POSITION potentiometer on the Control panel (see page 3-19).

*PITCH OFFSET*

*CENTER HOLE TAG     ± 99*

1. Press the **FEED** key to enter the desired Service Mode type.
2. Use the **START/STOP** key to select the type of media to be used.
3. Once the correct media type is shown in the display message, pressing the **FEED** key will advance to the Pitch Direction adjustment.
4. Use the **START/STOP** key to step the underline cursor to either the positive (+) or negative (-) selection. A positive selection increases the label pitch (or label length) while a negative selection decreases the label pitch.
5. Once the correct direction setting is underlined, pressing the **FEED** key will advance to the Pitch Offset adjustment.
6. Use the **START/STOP** key to step the counter to the desired position. The display will increment one step for each time the **START/STOP** key is pressed. If the **START/STOP** key is held pressed for more than two seconds, it will automatically go into the fast scroll mode. The reading will advance to a setting of 99 dots after which it will automatically wrap and start at "00" again. The Pitch Direction set in the previous step will be displayed in front of the Offset setting.
7. You may wish to check your settings by printing a label after making the adjustment.

- Once the setting is correct, pressing the **FEED** key will advance to the Cut Offset display.

### Cut Offset

The Cut Offset is the distance from the reference line (see page 3-20) of a label or tag to the desired cut position. The cut position of the label or tag can be adjusted relative to the reference line +/- 99 dots in increments of 1 dot using the following procedure (1 dot = .005" for the XL400 and .0033" for the XL412). Once the position is set, it can be adjusted +/- 3.75mm using the CUT POSITION potentiometer on the Control panel (see page 3-20).



CUT OFFSET  
CENTER HOLE                      ± 99

- Press the **FEED** key to enter the desired Service Mode type.
- Use the **START/STOP** key to select the type of media to be used.
- Once the correct media type is shown in the display message, pressing the **FEED** key will advance to the Cut Offset direction adjustment.
- Use the **START/STOP** key to step the underline cursor to either the positive (+) or negative (-) selection. A positive selection moves the cut position towards the top of the tag while a negative selection moves the cut position toward the bottom of the tag.
- Once the correct direction setting is underlined, pressing the **FEED** key will advance to the Cut Offset adjustment.
- Use the **START/STOP** key to step the counter to the desired position. The display will increment one step for each time the **START/STOP** key is pressed. If the **START/STOP** key is held pressed for more than two seconds, it will automatically go into the fast scroll mode. The reading will advance to a setting of 99 dots after which it will automatically wrap and start at "00" again. The Cut Offset Direction set in the previous step will be displayed in front of the Cut Offset setting.

### Backfeed Offset

The Backfeed Offset is the distance the label or tag is to be retracted after it is cut. It aligns the print and cut position of the first tag after tags have been ejected from the printer. The backfeed distance can be adjusted relative to the reference line +/- 12 dots (+/- 18 dots for the XL410) in increments of 1 dot using the following procedure (1 dot = .005" for the XL400 and .0033" for the XL410). A minus value retracts the tag less and a positive value pulls the tag further back into the printer. If a value greater than 12 (or 18) is entered, an error will occur.



BACKFEED OFFSET  
CENTER HOLE                      ± 10

- Press the **FEED** key to enter the desired Service Mode type.

2. Use the **START/STOP** key to select the type of media to be used.
3. Once the correct media type is shown in the display message, pressing the **FEED** key will advance to the Backfeed Offset direction adjustment.
4. Use the **START/STOP** key to step the underline cursor to either the positive (+) or negative (-) selection.
5. Once the correct direction setting is underlined, pressing the **FEED** key will advance to the Backfeed Offset adjustment.
6. Use the **START/STOP** key to step the counter to the desired position. The display will increment one step for each time the **START/STOP** key is pressed. If the **START/STOP** key is held pressed for more than two seconds, it will automatically go into the fast scroll mode. The reading will advance to a setting of 99 dots after which it will automatically wrap and start at "00" again. The Backfeed Offset Direction set in the previous step will be displayed in front of the Backfeed Offset setting.

### Counter Clear

The Counter Clear Service Mode is used to reset the internal printer counters to zero. This allows the user to keep track of the number of centimeters of label material that has passed through the printer, how many labels have been dispensed or how many labels have been cut.



COUNTER CLEAR  
NON

The counters are identified in the display as:

NON:	None (default)
ALL:	Clears all counters
HEAD:	Clears Head Counter
CUT:	Clears Cutter Counter

1. Press the **FEED** key to enter the desired Service Mode.
2. Use the **START/STOP** key to step the underline cursor to the counter(s) to be reset. The default position is None (NON) of the counters. Use the **START/STOP** key to advance the underline cursor to the desired position.
3. Once the correct setting is underlined, pressing the **FEED** key will clear the selected counter and advance the display back to the SETUP SENSOR display.

### Exit

To exit the Service Mode, remove power from the printer and the settings will be stored in non-volatile memory.

### USER TEST PRINT

This option allows you to print a Test Label. It is recommended that you print a Test Label after you have changed any of the settings in the User Mode. The test label allows you to verify that you indeed did make the desired changes. To enter the User Test Print Mode, apply power to the printer while simultaneously pressing the **FEED** key. The printer will “beep” once and display the following message on the LCD panel:



USER TEST PRINT

1. Pressing the **START/STOP** key will cause the printer to start printing test labels.
2. If you wish to pause the printer after it starts printing labels, press the **START/STOP** key to place it Off Line. Pressing the **START/STOP** key again will place the printer back On Line and the printer will resume printing test labels.
3. If you wish to stop the test label print, pause the printer and then turn power off without placing it On Line.

### SERVICE TEST PRINT

This option allows you to print a Service Test Label. It is recommended that you print a test label after you have changed any of the settings in the Service Mode. The Test Label allows you to verify that you indeed made the desired changes. To enter the Service Test Print Mode, apply power to the printer while simultaneously pressing the **FEED** and **MEDIA TYPE** keys. The printer will “beep” once and display the following message on the LCD panel:



SERVICE PRINT  
SMALL                  LARGE

1. You can select either a Small or Large label using the **START/STOP** key. The Large selection assumes you have labels at least 3.1 inches wide loaded in the printer. If your labels are smaller, you must select Small as the head can be easily damaged if nothing is under the print area to dissipate the heat from the print head.
2. If Large is selected, pressing the **FEED** key will cause a complete Service Test label to be printed. If Small was selected, you will get the following screen:



PRINT SIZE  
04 CM

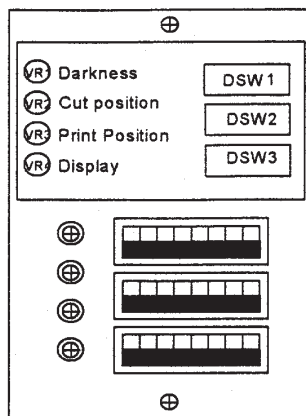
3. Use the **START/STOP** key to select the correct size label. Each time the **START/STOP** key is pressed, the indicated label size will increase by 1 cm. The maximum size is 10 cm.

4. Pressing the **FEED** key will start the Small Service Print Test label print mode. The printer can be paused by pressing the **FEED** key again.
5. To exit the Service Print Test Mode, pause the printer using the **FEED** key and then remove power.



## POTENTIOMETER ADJUSTMENTS

There are four potentiometer adjustments located on the Control panel underneath a protective cover at the rear of the printer. They are accessible by loosening the screw and removing the cover.



### Print Position (Pitch Offset)

After the pitch has been set with the LCD panel, it is sometimes desirable to make minor adjustments. This can be done using the **PRINT POSITION** potentiometer on the control panel. This potentiometer is set at the factory so that it has a range of +/- 3.75 mm. The midpoint setting should have no effect on the print position. Turning the potentiometer all the way counterclockwise should move the print position 3.75 mm towards the leading edge of the tag or label. Turning it all the way clockwise should move the print position away from the leading edge 3.75 mm. This adjustment is best made while printing the actual tags or labels.

Adjust the **PRINT POSITION** potentiometer on the front panel until the first print position is at the desired location on the label. If the potentiometer does not have enough range, then you will have to change the pitch setting using the LCD panel display. (see page 3-14)

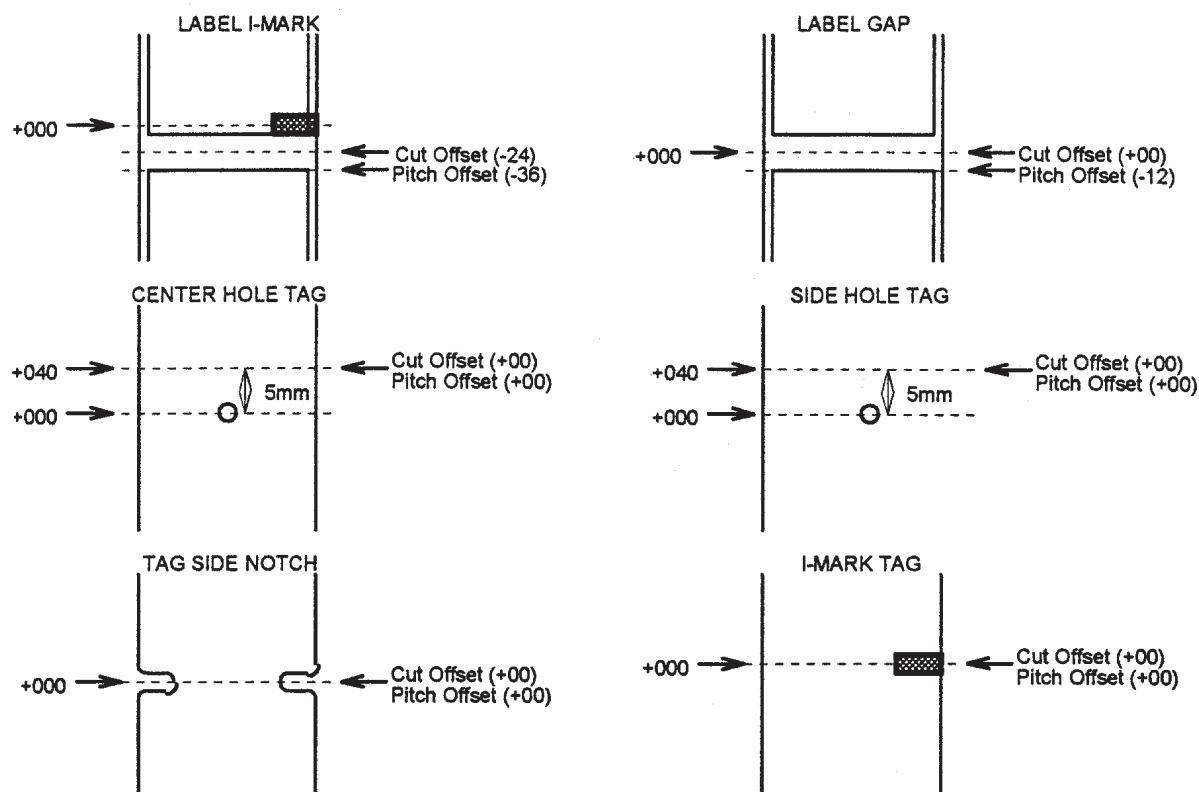
Adjusting the **PRINT POSITION** potentiometer will not affect the stop position of the label and the cut/tear-off position, it only affects the print position.

## Cut Position

When the printer is in the Cut mode (cutter enabled), the Cut Offset is set using the LCD Service Mode to correctly position the label for cutting. Once the correct Cut Offset is obtained, it may be necessary to adjust the position slightly.

This is done with the CUT POSITION potentiometer on the front panel. When turned all the way clockwise the cut position is moved down the tag 3.75mm and when turned all the way counterclockwise, the cut position is moved 3.75mm toward the top of the tag.

1. Turn the printer on.
2. Press the **START/STOP** key to place the printer in the OFF LINE status.
3. Press the **FEED** key to feed out a blank label.
4. Adjust the position using the Cut Position potentiometer on the Control panel and feed another label by depressing the **FEED** key.
5. When the adjustment is correct, turn the printer off.



**Default Offset Settings, XL400**

**Display**

This potentiometer is used to adjust the contrast of the LCD display for optimum viewing under various lighting conditions.

**Print Darkness**

There are three Print Darkness settings that can be set either via the LCD panel or with software commands. The Print Darkness potentiometer allows you to fine tune the darkness. Turning the potentiometer all the way counterclockwise will decrease the amount of heat (lighter print) and turning it all the way Clockwise will increase the amount of heat (darker print).

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# SECTION 4.

## CLEANING AND MAINTENANCE

### INTRODUCTION

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This section provides information on user maintenance for the XL Series printers. The following information is covered in this section:

- Adjusting the Print Quality
- Cleaning the Print Head, Platen and Rollers

### PROCEDURES

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#### ADJUSTING THE PRINT QUALITY

The XL printers are equipped with two different methods of adjusting the quality of the print: print darkness and speed. When adjusting the printer for optimum print quality, a bar code verifier system should be used. The human eye is a poor judge of the relative widths of the bars in a symbol, a characteristic that is extremely important for good bar code quality.

##### **Darkness (Print)**

This adjustment allows the user to control (within a specified range) the amount of power that is used to activate the individual print head heat elements. It is important to find a proper print darkness level based on your particular label and ribbon combination. The printed images should not be too light nor should the ink from the ribbon “bleed.” The edges of each image should be crisp and well defined.

**LCD Panel** - The Print Darkness can be set using the front panel LCD panel (see page 3-8) or by downloading the setting using the Print Darkness software command (see page 5-49). There are three ranges, 1 (Low), 2 (Medium) and 3 (High). Once the range has been selected, the DARKNESS potentiometer on the Control panel can be used to make finer adjustments.

**DARKNESS Potentiometer** - The fine adjustment for Print Darkness is the Darkness potentiometer on the operator panel. It provides a continuous range of adjustment, allowing you to make precise changes. Use a small cross-point screwdriver, turning clockwise for darker print and counterclockwise for lighter print. See *Section 3: Configuration* for instructions on performing potentiometer adjustments.

*NOTE: The PRINT potentiometer adjustment will affect the darkness in all of the command code speed ranges, i.e. if the PRINT potentiometer is adjusted for lighter print, the darkness will be lighter in all speed ranges selected by the command code.*

## **Print Speed**

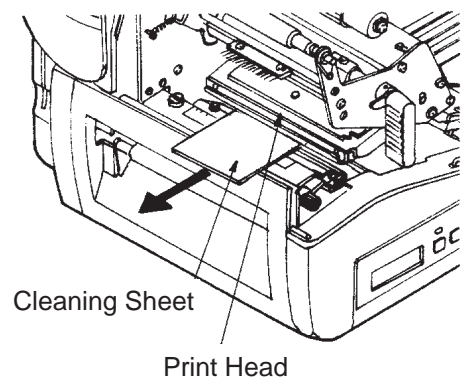
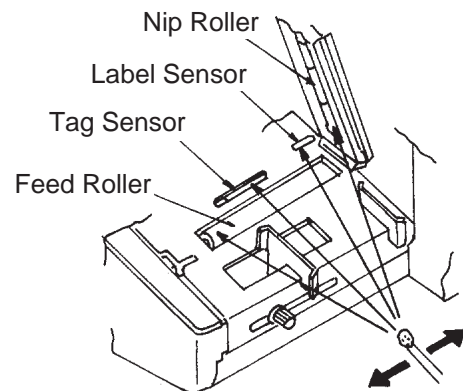
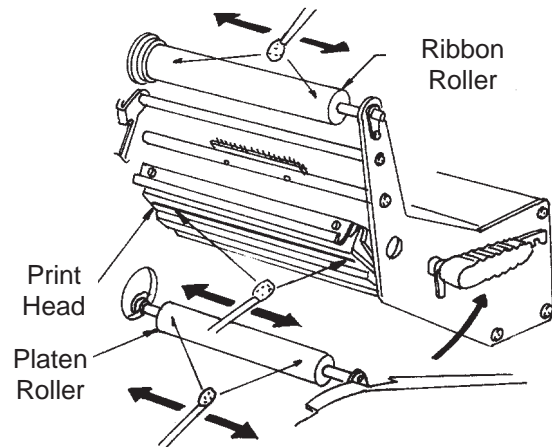
The other method of controlling print quality is by controlling the speed at which the label is printed. This adjustment is made on an individual label basis using either the Print Speed command code or the LCD display panel. For more details on this command, see page 5-53 in *Section 5: Programming*. Changing the print speed allows the user to control the amount of time allowed for print element cooling before the media is stepped to the next print position. It is especially critical when printing “ladder” bar codes (bar codes printed with the bars parallel to the print line). When printing a “ladder” bar code, it is important to allow the head to cool sufficiently before stepping to the next position. If it does not have sufficient time to cool, the bar will be “smeared” on the trailing edge.

The Print Speed can be set to 5, 6, 7 or 8 inches per second for the XL400 or 4, 5 or 6 for the XL410 using the LCD panel (see page 3-9) or with the Print Speed command code (see page 5-53). The software command will override any setting entered using the LCD panel.

## CLEANING THE PRINT HEAD, PLATEN, ROLLERS AND SENSORS

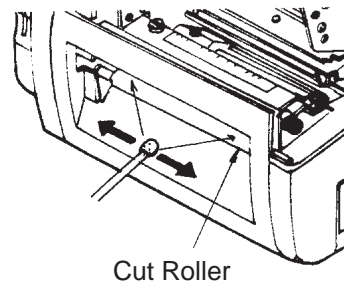
**Supplies needed:** SATO SA070 Cleaning Kit

1. Power the printer Off.
2. Open the print head by rotating the green Head release lever counterclockwise.
3. Moisten a cotton swab with SATO Thermal Print Head and Platen Cleaner.
4. Carefully rub the cotton swab over the length of the print head and along and around the Platen and Ribbon Rollers.
5. Open the Media Hold Down by lifting up on the green plate marked "Push".
6. Moisten a cotton swab with SATO Thermal Print Head and Platen Cleaner.
7. Use the swab to clean the Nip Roller, Feed Roller, Label Sensor and Tag Sensor.
8. Place the Cleaning Sheet under the Print Head (dull side up) and close the Print Head.
9. Slowly pull the Cleaning Sheet out of the printer.



10. Moisten a cotton swab with SATO Thermal Print Head and Platen Cleaner.

11. Carefully clean the entire surface of the Cut Roller. Rotate the roller to expose the complete surface while cleaning.

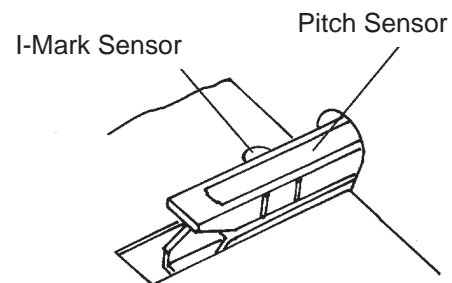
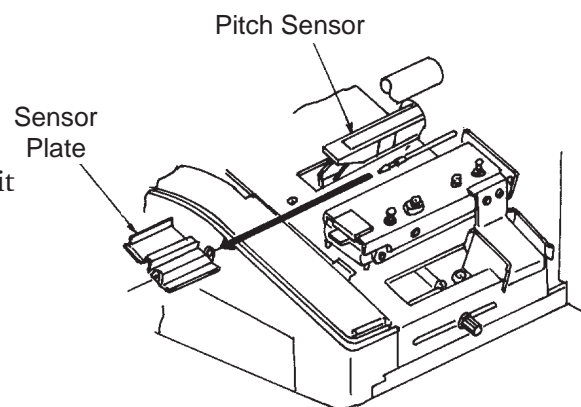


12. Remove the Sensor Plate by pressing down on the detent latch located inside the Sensor Plate mounting

13. Moisten a cotton swab with SATO Thermal Print Head and Platen Cleaner.

14. Clean the Pitch and I-Mark sensors.

4. Reinstall the Sensor Plate by sliding it back on the shaft.





# SECTION 5.

## PROGRAMMING

### INTRODUCTION

---

This section presents the commands that are used with the SATO XL Series printers to produce labels with logos, bar codes and alphanumeric data. All of the XL commands use the same syntax. Some commands reference a physical point on the label using horizontal and vertical dot reference numbers. The allowable range for these references is dependent upon the particular printer to accommodate different print widths and resolutions. These differences are noted in tables under the commands affected.

The following information is presented in this section:

- The SATO XL Programming Language
- Selecting Protocol Control Codes
- Using Basic
- The Print Area
- Command Codes

### THE SATO XL PROGRAMMING LANGUAGE

---

A programming language for a printer is a familiar concept to most programmers. It is a group of commands that are designed to use the internal intelligence of the printer. The commands, which are referred to as XL Command Codes, contain non-printable ASCII characters (such as <STX>, <ETX>, <ESC>) and printable characters. These commands must be assembled into an organized block of code to be sent as one data stream to the printer, which in turn interprets the command codes and generates the desired label output. The programmer is free to use any programming language available to send the desired data to the SATO XL Series printer.

The command codes used by the SATO XL Series Printers are based upon “Escape” (1B hexadecimal) sequences. Typically there are four types of command sequences:

<ESC>{Command}

These commands generally tell the printer to perform a specific action, like “clear the memory.”

<ESC>{Command} {Data}

Commands with this format tell the printer to perform a specific action which is dependent upon the following data, like “print X labels”, where the value for X is contained in the data.

<ESC>{Command} {Parameter}

These commands set the operational parameters of the printer, like “set the print speed to 3.”

<ESC> {Command} {Parameter} {Data}

Some commands can contain both Parameter and Data elements, such as “print a Code 39 symbol containing the data”.

## SELECTING PROTOCOL CONTROL CODES

Protocol codes are the special control characters that prepare the printer to receive instructions. For example, the <ESC> character tells the printer that a command code will follow and the <ENQ> character asks for the printer status.

There are two pre-defined different sets of Protocol Control codes to choose from. Each set is made up of six special characters. The Standard Protocol Control codes are non-printable characters, and the Non-Standard Protocol Control codes are printable characters. The Non-Standard set may be useful on host computers using protocol converters or in an application where non-printable ASCII characters cannot be sent from the host. This manual uses the Standard Protocol Control codes for all of the examples. Alternately, the user may define and download a set of custom Protocol Control Codes (see Appendix E).

The Protocol Control codes are selected by a DIP switch DSW2-7 on the Control panel (see *Section 3: Printer DIP Switch Configuration*, page 3-2)

CONTROL CHARACTER	STANDARD DSW2-7 OFF	NON-STANDARD DSW2-7 ON	DESCRIPTION
STX	02 Hex	7B Hex = {	Start of Data
ETX	03 Hex	7D Hex = }	End of Data
ESC	1B Hex	5E Hex = ^	Command code to follow
ENQ	05 Hex	40 Hex = @	Get printer status, Bi-Com mode
CAN	18 Hex	21 Hex = !	Cancel print job, Bi-Com mode

## USING BASIC

It may be useful to test your XL printer using a BASIC program on a PC. You may also write your actual production programs in BASIC. Whatever the reason, if you will be working in BASIC, some of the following hints may help you get started:

1. Set the WIDTH of the output device to 255 characters to avoid automatically sending <CR> and <LF> characters after every line. The command string should be continuous and uninterrupted by <CR> and/or <LF> commands. The examples given in this manual are printed on separate lines because they will not fit on one line and do not contain any <CR> and/or <LF> characters. If these characters are needed, they are explicitly noted by the inclusion of <CR> and <LF> notations.

2. If you are using the printer's RS232 interface, it is necessary to set the COM port on the PC such that the CTS and DSR signals will be ignored. Send your OPEN "COM" statement in the following way:

```
OPEN "COM1:9600,E,8,1,CS,DS" AS #1
```

This sets the RS232 communication parameters of the host PC's COM1 port for 9600 baud, Even parity, 8 Data bits, 1 Stop bit and directing the port to ignore the **CTS** and **DSR** control signals.

3. You may want to minimize keystrokes and program size by assigning the <ESC> character to a string variable since this character is used quite often.

The following two examples in BASIC show a typical example using these hints. Both of these examples use the Standard Protocol codes.

Printing with the Parallel Port:

5 REM XL400 Parallel Example	Identifies the program as a XL400 parallel port print label. The "REM" prevents this data from being sent to the printer and displays it only on the screen.
10 E\$=CHR\$(27)	Sets the "E\$" string as an <ESC> character
20 WIDTH "LPT1:",255	Sets the width of the output to 255 characters
30 LPRINT E\$;"A";	Sends an "<ESC>A" command code to the LPT1 parallel port
40 LPRINT E\$;"H400";E\$;"V100";E\$;"XL1SATO";	Sends the data "SATO" to be to be placed 400 dots horizontally and 100 dots vertically on the label and printed in the "XL" font.
50 LPRINT E\$;"Q1";	Instructs the printer to print one label.
60 LPRINT E\$;"Z";	Tells the printer that the last command has been sent. The printer can now create and print the job.

Printing with the RS232 Port:

5 REM XL400 RS232 Example	Identifies the program as a XL400 RS232 port print label. The "REM" prevents this data from being sent to the printer and displays it only on the screen.
10 E\$=CHR\$(27)	Sets the "E\$" string as an <ESC> character.
20 OPEN "COM1:9600,N,8,1,CS,DS" AS #1	Opens the COM1 port for output and sets the parameters as 9600 baud, No parity, 8 Data bits, 1 Stop bit and instructs the port to ignore the CTS and DSR control signals.

```
30 PRINT #1,CHR$(2);
```

Sends an <STX> (ASCII Code a decimal "2") to the printer instructing it to prepare to receive a message.

```
50 PRINT #1,E$;"A";
```

Sends an "<ESC>A" command code to Print Port #1 opened by statement 20 above.

```
60 PRINT #1, E$;"H400";E$;"V100";E$;"XL1SATO";
```

Sends the data "SATO" to be placed 400 dots horizontally and 100 dots vertically on the label and printed in the "XL" autosmoothed font.

```
50 PRINT #1, E$;"Q1";
```

Instructs the printer to print a quantity of one label.

```
60 PRINT #1, E$;"Z";
```

Tells the printer that the last command has been sent. The printer can now create and print the job.

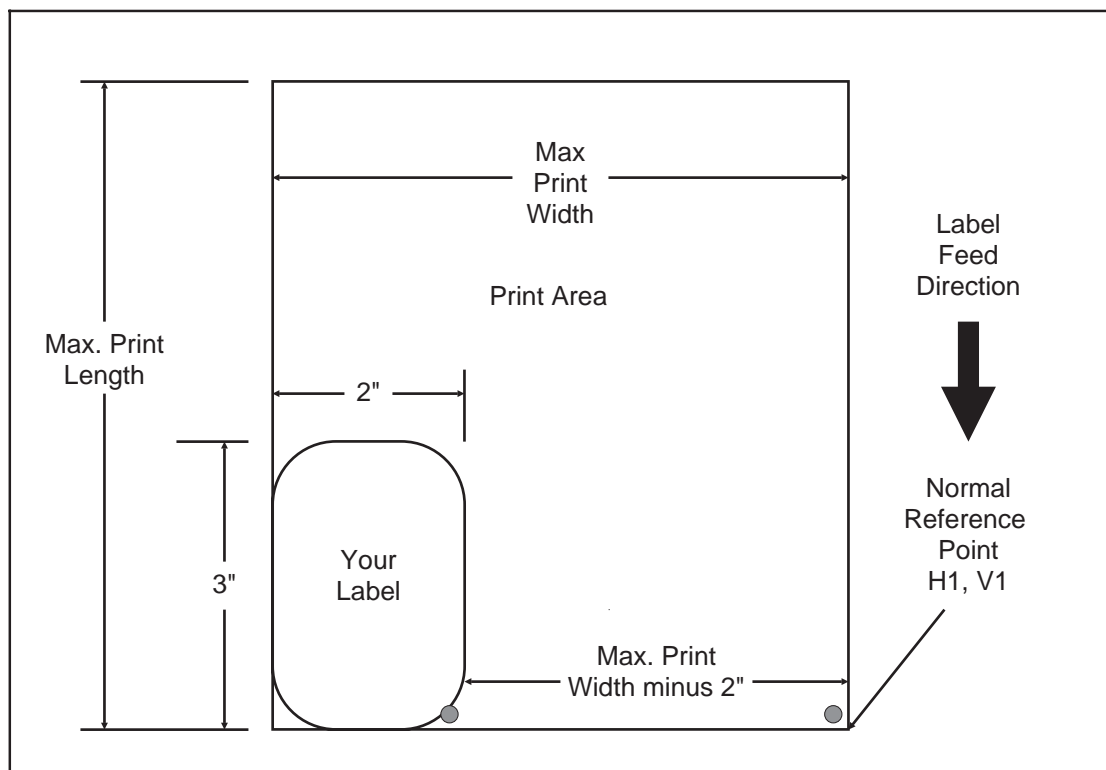
```
70 PRINT #1,CHR$(3);
```

Sends an <ETX> (ASCII Code decimal "3") to the printer telling it that this is the end of the message.

## THE PRINT AREA

The maximum print area for the various XL Series printers is listed in Table 5-1 on page 5-5. Most of your label applications will not require labels that fill the entire print area, therefore it is important to understand how to work with labels that do not use the entire print area. The goal is to help you avoid printing where no label exists, which may lead to print head damage, not to mention frustration when you cannot see the printed output.

The diagram below illustrates the maximum print area and a sample 2 inch wide by 3 inch long label placed within this area. As can be seen, your label will be oriented



against the inside left edge of the printer as viewed from the front of the printer. The normal reference point is located at the H1, V1 position of the print area in the normal print orientation (no rotation).

**Table 5.1, Print Area**

	<b>XL400</b>	<b>XL410</b>
Resolution	203 dpi 8 dpmm	305 dpi 12 dpmm
Max Print Width	800 dots 3.9 in. 100 mm	1200 dots 3.9 in. 100 mm
Max Label Width	5.0 in. 128 mm	5.0 in. 128 mm
Std Print Length	1920 dots 9.5 in. 240 mm	2880 dots 9.5 in. 240 mm
Expanded Print Length Using Memory Card <sup>(2)</sup>		
128 Kbyte	1168 dots 5.7 in. 146 mm	743 dots 2.4 in. 62 mm
512 Kbyte	4768 dots 23.5 in. 596mm	2977 dots 9.7 in. 248 mm
1 Mbyte	9360 dots <sup>(1)</sup> 46 in. 1170 mm	5956 dots 19.5 in. 496 mm
2 Mbyte	9999 dots <sup>(1)</sup> 49.2 in. 1249 mm	9999 dots <sup>(1)</sup> 32.8 in. 833 mm

*(1). Limited by number of digits in command field.*

*(2). When a Memory Card is used to expand the print length, the card capacity is used instead of the internal memory, not in addition to the internal memory.*

There are two methods available to make sure your printed output will appear correctly on your label. They are as follows:

1. Send the Base Reference Point command as part of your data to the printer to set a new base reference point for your label.

Calculate the distance (in dots) from the normal base reference point to the closest edge of the label. For a 12 dpmm XL410 printer, this would be:

$$\text{Label Width} = 2" \times 25.4 \text{ mm/in} \times 12 \text{ dpmm} = 610 \text{ dots}$$

For an 8 dpmm XL400 printer, this would be:

$$\text{Label Width} = 2" \times 25.4 \text{ mm/in} \times 8 \text{ dpmm} = 406 \text{ dots}$$

The new Base Reference Point then becomes:

$$\text{New Base Reference Point} = \text{Maximum Print Width} - \text{Label Width}$$

For a XL410, the new Base Reference Point is

$$\text{New Base Reference Point} = 1200\text{dots} - 610 \text{ dots} = 590\text{dots}$$

2. Use the normal base reference point from the print area and use the horizontal position for each field to properly locate it on the label.

Calculate the distance (in dots) from the normal base reference point to the closest edge of the label.

For a 12 dpmm printer, this would be:

$$\text{Label Width} = 2" \times 25.4 \text{ mm/in} \times 12 \text{ dpmm} = 610 \text{ dots}$$

and for an 8 dpmm printer:

$$\text{Label Width} = 2" \times 25.4 \text{ mm/in} \times 8 \text{ dpmm} = 406 \text{ dots}$$

$$\text{New Base Reference Point} = \text{Maximum Print Width} - \text{Label Width}$$

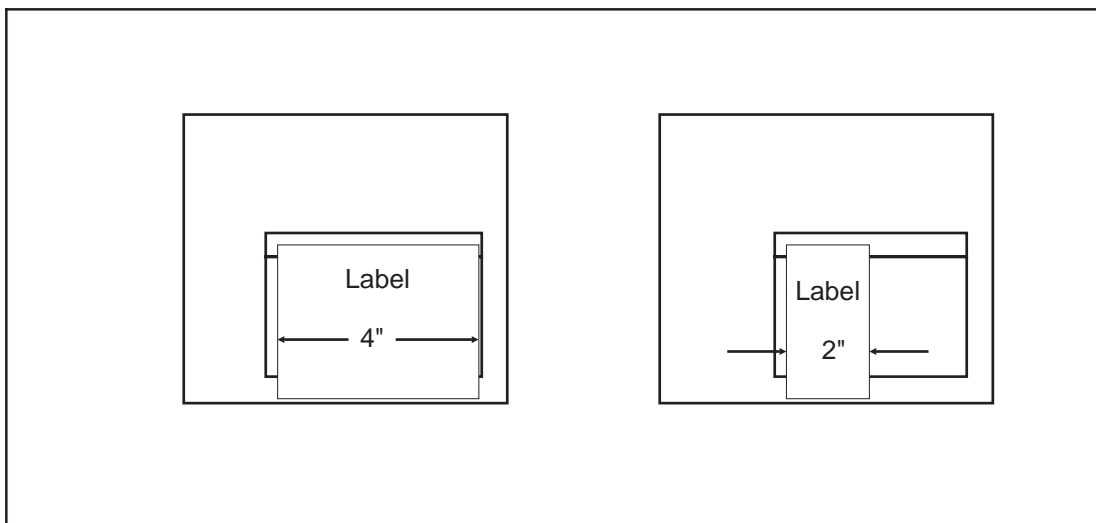
Each **<ESC>H** command would have the value "590" added to it to correctly position each field.

The Command Code subsection contains a sample label output for each command code. These samples reflect how the printed information would appear on a five inch wide label. If you want to test any of the sample label outputs and are using labels less than five inches in width, we suggest that you add the Base Reference Point command to the data stream in order for the images to print on your labels.

You must be careful not to print off the label surface as the label provides a heat sink for the print head elements. Doing so will cause irreparable damage to the head. This damage is not covered under the print head warranty. The addition of the Base Reference Point command to the sample data stream may help to adjust the print for your labels. See the following two examples or refer to the Base Reference Point command description.

For example, the following illustrates a sample data stream for a XL410 printer and the resulting label assuming a 4.0 inch wide label:

```
<ESC>A
<ESC>H0050<ESC>V0100<ESC>L0303<ESC>XMSATO
<ESC>H0050<ESC>V0200<ESC>B103100*SATO*
<ESC>H0070<ESC>V0310<ESC>L0101<ESC>XUSATO
<ESC>Q1
<ESC>Z
```

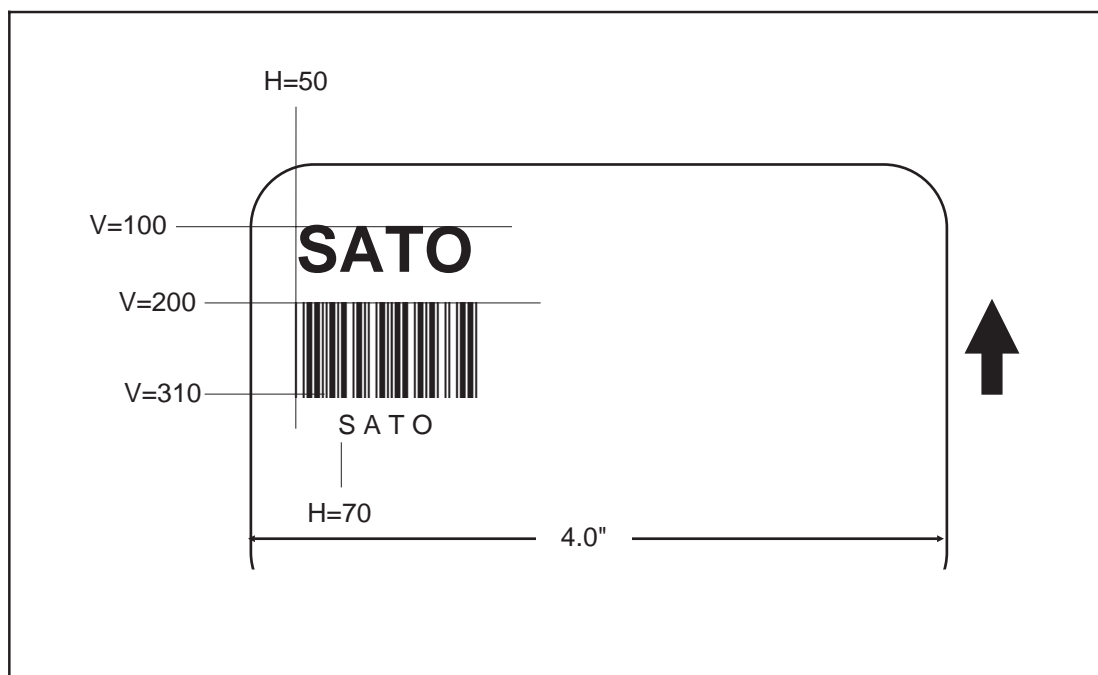


If you are using a 2 inch wide label, the entire image may not appear on your label. By adding the following Base Reference Point command to the second line of the data stream, the base reference point will be changed, causing the image to be shifted over toward the inside of the printer where it can be printed on the narrower label.

```
<ESC>A
<ESC>A3HV0590
<ESC>H0050<ESC>V0100<ESC>L0303<ESC>XMSATO
<ESC>H0050<ESC>V0200<ESC>B103100*SATO*
<ESC>H0170<ESC>V0310<ESC>L0101<ESC>XUSATO
<ESC>Q1
<ESC>Z
```

The image is moved horizontally to the right 2.0 inches (590 dots) so that it can be printed on a 2 inch wide label.

For more information, see the Base Reference Point command description.





## ROTATED FIELDS

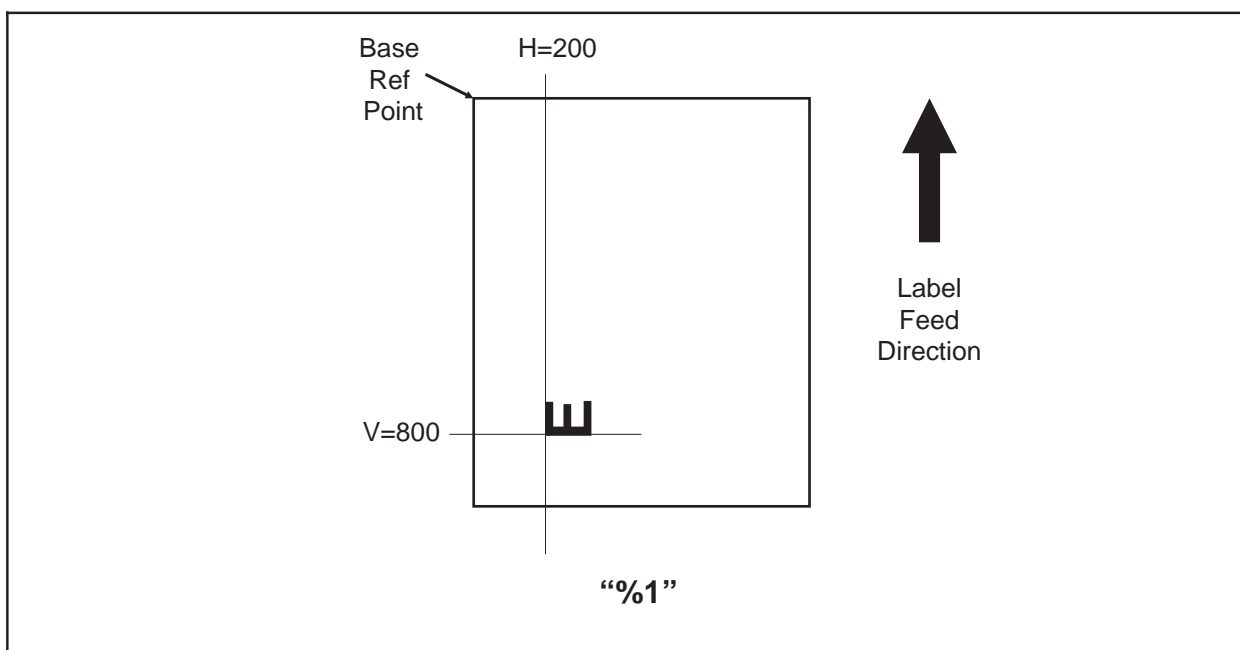
The XL Series printers can rotate each print field in 90° increments using the Rotate command.

- `<ESC>%` - The field rotates, but the base reference point for the field remains the same.

The following data stream will rotate the print field but will not change the base reference point of the field:

```
<ESC>A<ESC>%1<ESC>V800<ESC>H200<ESC>L0202<ESC>XB1E<ESC>Q1<ESC>Z
```





## COMMAND DEFAULT SETTINGS

There are some types of commands that must have a value specified before a label can be printed. If the data stream does not contain these commands, a “default” value is assumed. The commands and the corresponding default values are:

COMMAND	DEFAULT	NOTE
Print Rotation	0°	(1)
Vertical Reference Point	0	(1)
Horizontal Reference Point	0	(1)
Character Pitch	2	(1)
Base Reference Point	H=1, V=1	(2)
Character Expansion	1	(1)
Print Darkness	2	(1)
Print Speed XL400	6 ips	(2)
Print Speed XL410	4 ips	(2)
Offset		(3)

### NOTES:

- (1) The settings for these commands will revert to the default value when the printer receives an **<ESC>Z** or an **<ESC>\***.
- (2) The values transmitted with these commands will remain in effect until a new command is received.
- (3) The default value for offset depends upon the type of media selected.

	Side Notch Tag Label I-Mark Label Gap	Center Hole Tag Side Hole Tag	I-Mark Tag
XL400	0.00	+040	4.5mm
XL410	0.00	+060	4.5mm

## COMMAND CODES

---

This section contains all the XL Series printer Command Codes. The commands must be sent to the printer in an organized fashion in order for the label(s) to print.

The purpose of this section is to:

1. Explain the different commands and provide examples of their usage.
2. To provide a detailed reference for programming the XL Series Printers.

Each command begins on a separate page with its own heading. A uniform layout is used to help you find key information about each command. For each Command Code in this section, there will be a sample data input stream to the printer and the expected print output. By studying the examples, you can learn how to use the particular command within a whole block of printer code. Pay particular attention to the “Special Notes” with each command to learn other important information.

The subject commands are highlighted in bold letters in the Reference Sheets. There are two parts of most, but not all, commands. The first is the command character which immediately follows the **<ESC>** code. It is always an upper case alpha or a special character (such as an “&” or a “%”). It is never a lower case alpha character. If the command requires additional variable information, it is represented by a group of lower case alpha characters immediately following the command character. For example, if an **aaaabb** is listed following the basic command, the printer will look for six characters immediately following the command. The first four would represent the value of **aaaa** and the next two the value of **bb**.

The maximum number of characters defined in a parameter is represented by the number of characters shown in the command structure. For example, a command followed by an **aaaa** can have up to four characters. In general, commands with only one parameter following the command can be entered without the leading zeroes. However, certain commands require the exact number of matching characters. A command with two parameters listed following the command code without a comma delimiter, such as **aaaabbbb** require the exact number of digits to be entered. If the value of **aaaa** is “800” and the value of **bbbb** is “300”, then the parameters must be entered as “08000300”. It is recommended that you make it a practice to always enter leading zeros to prevent any mistakes.

*NOTE: These examples assume the use of the Standard Protocol Command Codes, a parallel interface and a four inch wide label in a XL400 printer. The labels for all other printers will be similar, but, because of different resolutions may be scaled differently.*

An alphabetical listing of the command codes is contained in Appendix A: Command Code Quick Reference.

# Bar Codes

**Command Structure**    1:3 narrow/wide bar ratio: <ESC>**Babbcccd**  
                                  2:5 narrow/wide ratio:    <ESC>**BDabbcccd**  
                                  1:2 narrow/wide bar ratio: <ESC>**Dabbcccd**

a     =    Bar Code Symbol

- 0   Codabar
- 1   Code 39
- 2   Interleaved 2 of 5 (I 2/5)
- 3   UPC-A / EAN-13
- 4   EAN-8
- 5   reserved
- 6   reserved
- 7   reserved
- 8   reserved
- 9   reserved
- A   reserved
- B   reserved
- C   reserved
- D   reserved
- E   UPC-E
- F   Bookland
- G   Code 128
- I   UCC 128

bb    =    Number of dots (01-12) for narrow bar and narrow space

ccc   =    Bar height in dots (001-600)

d     =    UCC 128 only. Not used for other bar code types

- 0   No human readable text
- 1   Human readable at top
- 2   Human readable at bottom

Example:    <ESC>**BD103200**

Placement:    Immediately preceding data to be encoded

Default:        None

## Command Function

To print bar code images on a label. With this command, there are nine standard bar code symbologies available to be printed and three two dimensional symbols (see Two Dimensional bar code symbols starting on page 5-89. Each of the bar codes are unique, and it is important to know the differences. See Appendix B for specific information on using each individual bar code symbol.

### Special Notes

1. UPC and EAN bar codes are not affected by the different types of narrow to wide ratios. Instead, the <ESC>D command adds descender bars to these codes where needed to meet UPC specifications. The <ESC>BD command places descender bars in the symbol.
2. The Code 128 and UCC 128 bar codes are not affected by the narrow to wide ratios.
3. The Codabar and Code 39 bar codes are affected by the Character Pitch command. This command must be placed before the Bar Code command.
4. See Appendix B for more specific instructions and detailed information regarding individual bar code symbols.
5. Because of their unique characteristics, two-dimensional symbols are covered separately (see page 5-89).
6. For UCC128, the FNC1 code is automatically inserted and the Mod 10 and Mod 103 check digits are automatically calculated.

# Bar Codes, Expansion

## Command Structure <ESC>BWaabb

aa = Expansion factor by which the width of all bars and spaces will be increased (01-12)

bbb = Bar height by dot (004-600 dots)

Example: <ESC>BW02100

Placement: Immediately follows the <ESC>BT command and precedes data to be encoded.

Default: None

## Command Function

This command works together with the <ESC>BT command to specify an expansion factor and the bar code height for the particular symbol being printed.

## Input to Printer:

```
<ESC>A
<ESC>H0050<ESC>V0050<ESC>BD103100*XL400*
<ESC>H0050<ESC>V0050<ESC>BT101030103<ESC>BW04100*1234*
<ESC>Q1<ESC>Z
```

## Printer Output:



## Special Notes

1. This command must be preceded by the Variable Ratio Bar Codes <ESC>BT command (see Page 5-14).
2. The following bar codes will be affected by the Character Pitch command: Codabar and Code 39.

# Bar Codes, Variable Ratio

## Command Structure <ESC>BTabbccdde

a = Bar Code Symbol:  
 0 Codabar  
 1 Code 39  
 2 Interleaved 2 of 5

bb = Narrow space in dots (01-99)  
 cc = Wide space in dots (01-99)  
 dd = Narrow bar in dots (01-99)  
 ee = Wide bar in dots (01-99)

Example: <ESC>BT101030103

Placement: Following print position commands and preceding  
 <ESC>BW

Default: Current setting

**Command Function** To print a bar code with a ratio other than those specified through the standard bar code commands (B,BD, and D). This is done through individual control of each of the bar code elements (bars, spaces) as shown above. Remember that this command only applies to the three bar code types shown.

**Input to Printer:** <ESC>A  
 <ESC>H0050<ESC>V0050<ESC>BT101030103<ESC>BW03100\*1234\*  
 <ESC>Q1  
 <ESC>Z

**Printer Output:**



**Special Notes**

1. This command must be immediately followed by the <ESC>BW Bar Code Expansion command (see Page 5-13).
2. You may use only one variable ratio bar code per label.
3. If the data specified in this command is incorrect, the command is ignored and the ratio used will be based on the previous setting.
4. See Appendix B for more specific instructions and details regarding individual bar code symbols.

---

# Batch Separator

---

**Command Structure**    <ESC>la

a     =   1   Batch Marker- Prints a black mark on the edge of the first tag of the print job.

b     =   1   Batch Separator - Cuts the first tag in a print job 2 mm longer and the following tag 2 mm shorter.

Example:        See Above

Placement:      Before or after job data stream

Default:         None

**Command Function**    To separate tag batches in the stacker.

**Printer Input**

```
<ESC>A<ESC>V0100<ESC>H0300<ESC>XMJob1<ESC>Q5<ESC>Z
<ESC>A<ESC>I1<ESC>Z
<ESC>A<ESC>V0100<ESC>H0300<ESC>WB1JOB2<ESC>Q5<ESC>I1<ESC>Z
```

**Printer Output**

1. If a Batch Separator tag is specified, the first 2 tags of the print job are used. If these 2 tags are not to be used, you must increase your print quantity by 2 tags to get the desired number of usable tags.
2. If the Batch Separator Tag command is used in a separate print job, you must specify a quantity of at least 2 tags or the command will be ignored.



# Base Reference Point

## Command Structure <ESC>A3H-aaaaVbbbb

- = This character is optional. When present, it specifies that the horizontal offset is in the negative direction. If it is left out, the offset direction is positive.

aaaa = Horizontal Print Offset (see Note 5 for field range)

bbbb = Vertical Print Offset (see Note 5 for field range)

Example: <ESC>A3H100V0050

Placement: Preceding all images that are based on the new base reference point

Default: Current V and H offset setting in the printer configuration

## Command Function

To establish a new base reference point for the current label. The base reference point is the top left corner or “origin” from where all print position commands are based.

This command may be very helpful when using labels less than four inches wide to place images on the printable label surface. It may also be used to move images past preprinted fields on a label.

## Input to Printer:

```
<ESC>A<ESC>L0202
<ESC>H0025<ESC>V0025<ESC>XBNORMAL REFERENCE POINT
<ESC>A3H0300V0075
<ESC>H0100<ESC>V0050<ESC>XBNEW REFERENCE POINT
<ESC>Q1<ESC>Z
```

## Printer Output:



**NORMAL REFERENCE POINT**

**NEW REFERENCE POINT**

**Special Notes**

1. Use of this command will set the Vertical/Horizontal Offset setting of the printer configuration until a new Base Reference Point command is issued or the setting is changed from the operator panel. See Section 3: Printer Configuration.
2. This command may be used more than once in a print job.
3. An alternative to using this command is to make changes to your current Horizontal and Vertical Print Position commands (see Page 5-50).

**Example:**

Let's say the current base reference point is H=1, V=1 and you wish to move all the fields on your label downward vertically by 150 dots. You could either (1) add the Base Reference Point command or (2) change all the vertical position commands by an additional 150 dots.

4. For a more detailed example of the Base Reference Point command, see "Print Area" in this section (Page 5-4).
5. The allowable field ranges for this command depend upon the setting of DSW2-2 and are:

	<b>XL410</b>	<b>XL410</b>
Horizontal aaaa	0001 to 960	0001 to 1200
Vertical bbbb	0001 to 1440	0001 to 2880

# Characters, Custom-Designed

## Command Structure

Store Command: **<ESC>T**abcc****  
 Recall Command: **<ESC>K**ab90cc****

a     =     1   16x16 matrix  
           2   24x24 matrix

b     =     Specifies the character encoding method for the data stream  
           H   Hexadecimal characters  
           B   Binary characters

cc    =     Memory location to store/recall the character. Valid memory locations are 21 to 52 (counting in Hex) or “!” to “R” in Binary

(data) =     Data to describe the character

Example:   **<ESC>T**1H3F****  
              **<ESC>K**1H903F****  
              See Appendix C for a more detailed explanation

Placement: The Store command is typically sent in its own data stream to the printer, between the Start/Stop commands. The Recall command is sent in a secondary data stream to print the character, and follows any necessary position or size commands.

Default:   None

## Command Function

To allow for the creation, storage, and printing of custom characters, such as special fonts or logos. Up to 50 individual characters may be stored in the custom character volatile memory.

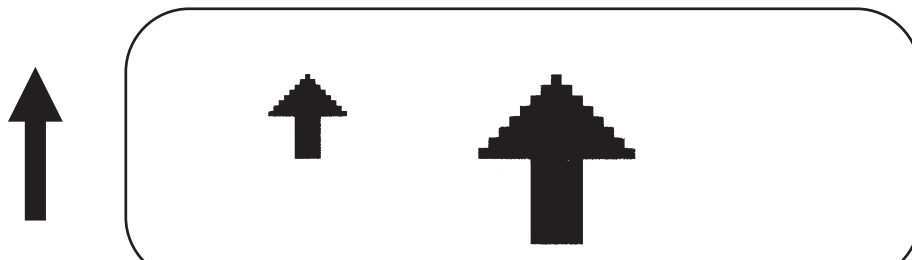
## Printer Input

See Appendix C for a detailed explanation.

**<ESC>A**  
**<ESC>T**1H3F****  
 0100038007C00FE01FF03FF87FFCFFFE07C007C007C007C007C007C0  
**<ESC>Z**

**<ESC>A**  
**<ESC>H150<ESC>V100<ESC>L0505<ESC>K**1H903F****  
**<ESC>H350<ESC>V100<ESC>L1010<ESC>K**1H903F****  
**<ESC>Q1<ESC>Z**

## Printer Output



## Special Notes

1. When printing the custom character using the Recall command, the character is affected by the following commands:

Character Expansion (see Page 5-21)

Character Pitch (see Page 5-23)

Line Feed (see Page 5-44)

Rotate, Base Reference Point Fixed (see Page 5-59)

2. The characters are stored in volatile memory and must be reloaded if the printer power is lost.
3. Do not use ASCII <CR> or <LF> characters (carriage return or line feed) as line delimiters within the graphic data or the actual image will not be printed as specified.

# Character Expansion

## Command Structure <ESC>Laabb

aa = Multiple to expand horizontally (01-12)

bb = Multiple to expand vertically (01-12)

Example: <ESC>L0305

Placement: Preceding the data to be expanded

Default: <ESC>L0101

## Command Function

To expand characters independently in both the horizontal and vertical directions. The command allows you to enlarge the base size of each font (except the vector font) up to 12 times in either direction. Expanded characters are typically used for added emphasis or for long distance readability.

## Input to Printer

```
<ESC>A
<ESC>A<ESC>H0100<ESC>V0100<ESC>XMSATO
<ESC>H0100<ESC>V0200<ESC>L0402<ESC>XMSATO
<ESC>H0100<ESC>V0300<ESC>L0204<ESC>XMSATO
<ESC>Q1<ESC>Z
```

## Printer Output



## Special Notes

This command will expand the following fonts:

1. Fonts XU, XS, XM, OA & OB (see Page 5-28) and fonts XB and XL (see Page 5-32).
2. This command will also affect the following commands:  
Character Pitch (see Page 5-23)  
Characters, Custom-Designed (see Page 5-19)
3. The Character Expansion value is in effect for the current print job until a new expansion command is specified.
4. The Line and Box command, if used within the data stream, may return all subsequent text to the default expansion of 1 x 1. Therefore, either send the Character Expansion command before all printed data, or send Line and Box commands last, preceding the <ESC>Q Quantity command.

# Character Pitch

**Command Structure**    <ESC>**P**aa

aa    =    Number of dots between characters (00-99)

Example: <ESC>P03

Placement:    Preceding the text to be printed

Default:        <ESC>**P02**

**Command Function**    To designate the amount of spacing (in dots) between characters. This command provides a means of altering character spacing for label constraints or to enhance readability.

**Input to Printer:**    <ESC>A  
                              <ESC>H0025<ESC>V0025<ESC>L0202<ESC>XB1SATO  
                              <ESC>H0025<ESC>V0125<ESC>L0202<ESC>**P20**<ESC>XB1SATO  
                              <ESC>H0025<ESC>V0225<ESC>L0202<ESC>**P40**<ESC>XB1SATO  
                              <ESC>Q1<ESC>Z

**Printer Output:**



## Special Notes

1. This command is affected by the <ESC>L Character Expansion command (see Page 5-21). The character pitch is actually the product of the current horizontal expansion multiple and the designated pitch value.

Example:

<ESC>L0304

<ESC>P03

Pitch = (03) x (03) = 9 dots

2. To avoid confusion, you may want to include the <ESC>L Character Expansion command and this command together in your program.
3. This command affects fonts XU, XS, XM, XCS, XCL, OA & OB (see Page 5-28, fonts XB and XL (see Page 5-32), and the vector font (see Page 5-30).
4. Character Pitch will always revert to the default value unless it is specified before each new font command in the data stream.
5. This command also affects Codabar and Code 39 bar codes.



# Clear Print Job(s) & Memory

## Command Structure <ESC>\*a

a = If the “a” parameter is not included with this command and the printer is in the multi-buffer mode, this command clears all print jobs in the printer memory, including the current print job.

a = If “a” is included with this command, it specifies the internal memory section to be cleared  
 T To clear the custom character memory  
 & To clear the form overlay memory  
 X To clear all internal memory

Example: <ESC>\*  
 <ESC>\*X

Placement: This command should be sent to the printer as an independent data stream.

Default: None

**Command Function** To clear individual memory or buffer areas of the printer.

**Input to Printer:** <ESC>A  
 <ESC>\*  
 <ESC>Z

**Printer Output:** There is no printer output as a result of this command. The current print job in the buffer will be terminated and all other print jobs in the buffer cleared.

- Special Note**
1. See Memory Card Functions for variations of this command used to clear data from the memory card (Page 5-71).
  2. It is not necessary to clear the printer's memory between each print job.
  3. The primary purpose of this command is to clear all print jobs in the multi-buffer mode. The “a” parameter can be used in either the multi-buffer or single job mode to clear specific parts of the memory.
  4. When the “a” parameter is used, the section of memory specified will not be cleared until the label is printed.

# Copy Image Area

**Command Structure**     <ESC>**WDHaaaaVbbbbXccccYdddd**

aaaa =     Horizontal position of the top left corner of the area to be copied

bbbb =     Vertical position of the top left corner of the area to be copied

cccc =     Horizontal length of the image area to be copied

dddd =     Vertical length of the image area to be copied

Example:     <ESC>**WDH0100V0050X0600Y0400**

Placement:     Anywhere within the data stream, after specifying the location of the duplicate image.

Default:     None

**Command Function**     To copy an image from one location to another on the same label. This may be useful for duplicating individual fields or entire sections of the label with only one command.

**Input to Printer:**     <ESC>A  
                                  <ESC>H0050<ESC>V0050<ESC>E010<ESC>XM  
                                  SATOSATOSATOSATOSATOSATOSATO  
                                  SATOSATOSATOSATOSATOSATOSATO  
                                  SATOSATOSATOSATOSATOSATOSATO  
                                  SATOSATOSATOSATOSATOSATOSATO  
                                  <ESC>H0180<ESC>V0250<ESC>WDH0130V0050X0400Y0200  
                                  <ESC>Q1<ESC>Z

**Printer Output:**



**SATOSATOSATOSATOSATOSATOSATO  
 SATOSATOSATOSATOSATOSATOSATO  
 SATOSATOSATOSATOSATOSATOSATO  
 SATOSATOSATOSATOSATOSATOSATO**

**SATOSATOSATOSATOSATO  
 SATOSATOSATOSATOSATO  
 SATOSATOSATOSATOSATO  
 SATOSATOSATOSATOSATO**

**Special Notes**

1. Use the Print Position commands (V and H) to locate the new area for the duplicate image (see Page 5-50).
2. Position of the new target area must not be inside the original image.
3. If you use the Rotate command, V, H, X and Y axes will be reversed.
4. If the reference area of the target image exceeds the print area, it will not be printed.
5. The allowable ranges for these fields are as follows:

	<b>XL400</b>	<b>XL410</b>
Horizontal aaaa cccc	0001 to 0800	0001 to 1200
Vertical bbbb dddd	0001 to 1920	0001 to 2880

# Fonts OA, OB, XU, XS & XM

**Command Structure**

Font XU: <ESC>**XU**  
Font XS: <ESC>**XS**  
Font XM: <ESC>**XM**  
Font OA: <ESC>**OA**  
Font OB: <ESC>**OB**

Example: See above

Placement: Preceding the data to be printed

Default: None

**Command Function**

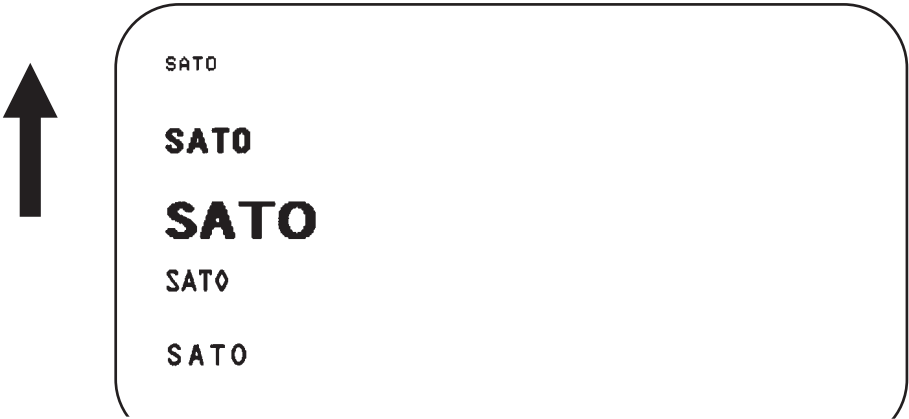
To print text images on a label. These are eight of the built-in fonts available on the printer. All matrices include descenders.

NON-PROPORTIONAL		PROPORTIONAL	
OA	OCR-A font (see Note 7 for matrix)	XU	5W x 9H dot matrix
OB	OCR-B font (see Note 7 for matrix)	XS	17W x 17H dot matrix
		XM	24W x 24H dot matrix

**Input to Printer**

<ESC>A  
<ESC>H0100<ESC>V0100<ESC>L0202<ESC>**XUSATO**  
<ESC>**H0100<ESC>V0175<ESC>L0202<ESC>XSSATO**  
<ESC>H0100<ESC>V0250<ESC>L0202<ESC>**XMSATO**  
<ESC>H0100<ESC>V0325<ESC>L0101<ESC>**OASATO**  
<ESC>**H0100<ESC>V0400<ESC>L0101<ESC>OBSATO**  
<ESC>Q1<ESC>Z

**Printer Output**



- Special Notes**
1. Characters may be enlarged through the use of the Character Expansion command (see Page 5-21).
  2. Character spacing may be altered through the use of the Character Pitch command (see Page 5-23). The default is 2 dots between

characters. It is recommended to use a spacing of 5 dots for OCR-A and 1 dot for OCR-B.

3. You may also create custom characters or fonts. See the <ESC>T Custom-Designed Characters command (Page 5-19).
4. A font must be defined for each field to be printed. There is no default font.
5. The proportionally spaced fonts XU, XS, XM, XL and XA can be printed with fixed spacing using the <ESC>PS Proportional Space command.
6. The matrices for the OA and OB fonts are scaled so that they will remain a constant size according to the OCR-A and OCR-B specifications when printed on different resolution printers.

	<b>XL400</b>	<b>XL410</b>
OA Font	15 dots W x 22 dots H	22 dots W x 33 dots H
OB Font	20 dots W x 24 dots H	30 dots W x 36 dots H

# Font, Vector

<b>Command Structure</b>	Specify Vector Font:	<code>&lt;ESC&gt;\$a,b,c,d</code>
	Data for Vector Font:	<code>&lt;ESC&gt;\$=(data)</code>
	a =	A Helvetica Bold (proportional spacing) B Helvetica Bold (fixed spacing)
	b =	Font width (50-999)
	c =	Font height (50-999 dots)
	d =	Font variation (0-9) as follows:
		0 Standard
		1 Standard open (outlined)
		2 Gray (mesh) pattern 1
		3 Gray (mesh) pattern 2
		4 Gray (mesh) pattern 3
		5 Standard open, shadow 1
		6 Standard open, shadow 2
		7 Standard mirror image
		8 Italic
		9 Italic open, shadow

Example: `<ESC>$A,100,200,0<ESC>$=123456`

Placement: Immediately preceding data to be printed.

Default: None

<b>Command Function</b>	To specify printing of the unique SATO vector font. The vector font allows large characters to be printed with smooth, round edges. Each character is made of a number of vectors (or lines), and will require slightly more printer compiling time.
-------------------------	--

<b>Input to Printer</b>	<pre> &lt;ESC&gt;A &lt;ESC&gt;H0100&lt;ESC&gt;V0100&lt;ESC&gt;\$A,100,100,0&lt;ESC&gt;\$=SATO AMERICA &lt;ESC&gt;H0100&lt;ESC&gt;V0200&lt;ESC&gt;\$=VECTOR FONT &lt;ESC&gt;\$A,200,300,8&lt;ESC&gt;H0100&lt;ESC&gt;V0350&lt;ESC&gt;\$=SATO &lt;ESC&gt;Q1&lt;ESC&gt;Z </pre>
-------------------------	---

**Printer Output****Special Notes**

1. The Pitch command can be used with Vector fonts.
2. If the font size designation is out of the specified range, a default value of 50 is used.
4. The font width and height values include ascenders, descenders and other space.
5. A font must be defined for each field to be printed. There is no default font.

# Fonts XB & XL

## Command Structure

Font XB: <ESC>**XB**aFont XL: <ESC>**XL**a

a     =     0   Disables auto-smoothing of font  
               1   Enables auto-smoothing of font (see notes below)

Example:     <ESC>**XB1123456**

Placement:   Preceding the data to be printed

Default:       None

## Command Function

To print text images on a label. These are the two auto-smoothing fonts available on the printer.

XB       48W x 48H dot matrix

XL       48W x 48H dot matrix

## Input to Printer:

```
ESC>A
<ESC>H0001<ESC>V0100<ESC>XB0SATO
<ESC>H0001<ESC>V0185<ESC>XB1SATO
<ESC>H0001<ESC>V0270<ESC>XL0SATO
<ESC>H0001<ESC>V0355<ESC>XL1SATO
<ESC>Q1<ESC>Z
```

## Printer Output:

**SATO****SATO****SATO****SATO**

## Special Notes

1. Auto-smoothing (when enabled) is only effective if the character expansion rate is at least (3) times in each direction.
2. Characters may be enlarged through the use of the <ESC>L Character Expansion command (see Page 5-21).

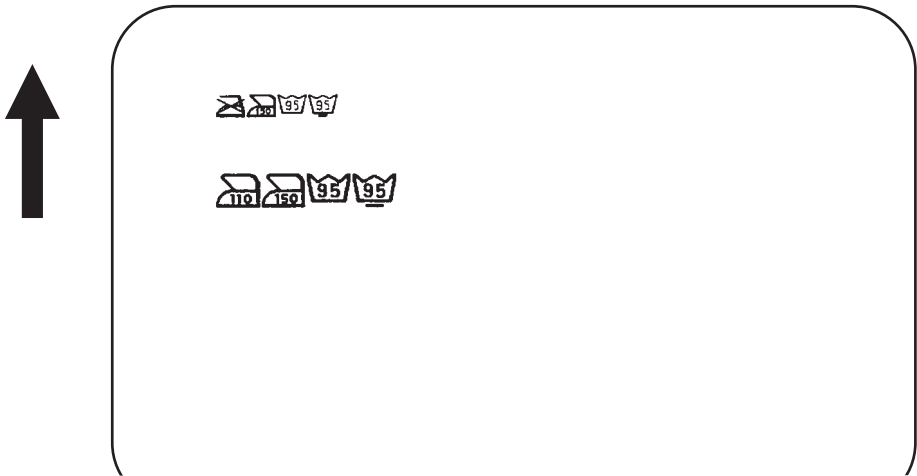


3. Character spacing may be altered through the use of the <ESC>A Character Pitch command (see Page 5-23).
4. A font must be defined for each field to be printed. There is no default font.

# Fonts XCS and XCL Care Symbols

Command Structure	Font XCS: <ESC> <b>XCS</b> ,{data}
	Font XCL: <ESC> <b>XCL</b> ,{data}
	{data} = ASCII code for Care Symbols
	Example: <ESC> <b>XCS</b> ,0123ABC
	Placement: Preceding the data to be printed
Command Function	Default: None
	To print Care Symbols images on a label. These are the four auto-smoothing fonts available on the printer.
	XCS 24W x 24H dot matrix
	XCL 36W x 36H dot matrix
Input to Printer:	<ESC>A <ESC>H0100<ESC>V0100<ESC> <b>XCS</b> ,01AB <ESC>H0100<ESC>V0185<ESC> <b>XCL</b> ,01AB <ESC>Q1<ESC>Z

Printer Output



Special Notes	1. There are 34 Care Symbols in this font, in the ranges 03H to 08H, 14H to F4H, 05H to 85H and A5H. See Appendix F for font tables.
---------------	--

---

# Form Feed

---

<b>Command Structure</b>	<ESC>A(space)<ESC>Z
	Example:      See above
	Placement:    Separate data stream sent to printer
	Default:       None
<b>Command Function</b>	To feed a blank tag or label, which is the equivalent of a “form feed”
<b>Input to Printer</b>	<ESC>A(space) <ESC>Z
<b>Printer Output</b>	Blank label or tag

---

# Form Overlay, Recall

---

<b>Command Structure</b>	<code>&lt;ESC&gt;/</code>
Example:	See above
Placement:	Must be preceded by all other data and placed just before the Print Quantity command ( <code>&lt;ESC&gt;Q</code> )
Default:	None

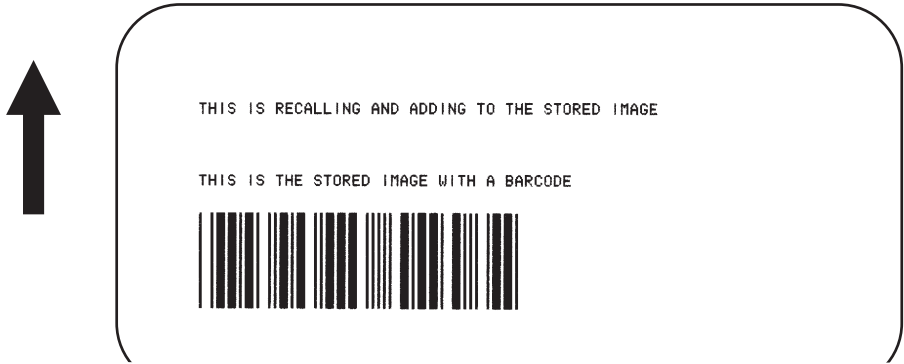
**Command Function** To recall the label image from the form overlay memory for printing. This command recalls a stored image from the overlay memory. Additional or different data can be printed with the recalled image.

**Input to Printer**

```
<ESC>A
<ESC>H0100<ESC>V0125
<ESC>XSTHIS IS THE STORED IMAGE WITH A BARCODE
<ESC>H0100<ESC>V0165<ESC>B103100*12345*
<ESC>&<ESC>Z

<ESC>A<ESC>H0100<ESC>V0050
<ESC>XSTHIS IS RECALLING AND ADDING TO THE STORED IMAGE<ESC>/
<ESC>Q1<ESC>Z
```

**Printer Output**



- Special Notes**
1. The overlay is stored using the `<ESC>&` Form Overlay Store command (see Page 5-37).

---

# Form Overlay, Store

---

<b>Command Structure</b>	<p data-bbox="570 340 690 373">&lt;ESC&gt;&amp;</p> <p data-bbox="570 411 902 445">Example:      See above</p> <p data-bbox="570 480 1511 548">Placement:    Must be preceded by all other data and placed just before the Stop command (&lt;ESC&gt;Z)</p> <p data-bbox="570 583 833 615">Default:       None</p>
<b>Command Function</b>	To store a label image in the volatile form overlay memory. Only one label image may be stored in this memory area at a time.
<b>Input to Printer</b>	<pre data-bbox="570 751 1219 924">&lt;ESC&gt;A &lt;ESC&gt;H0001&lt;ESC&gt;V0125 &lt;ESC&gt;XSTHIS IS THE STORED IMAGE WITH A BARCODE &lt;ESC&gt;H0001&lt;ESC&gt;V0165&lt;ESC&gt;B103100*12345* &lt;ESC&gt;&amp; &lt;ESC&gt;Z</pre>
<b>Printer Output</b>	There is no output from this command. It stores the label image in the overlay buffer.
<b>Special Notes</b>	<ol data-bbox="570 1062 1450 1367" style="list-style-type: none"> <li data-bbox="570 1062 1450 1129">1. Remember that this storage is volatile. Therefore, if the printer loses power, the overlay must be sent again.</li> <li data-bbox="570 1165 1450 1232">2. The overlay is recalled using the &lt;ESC&gt;/ Form Overlay Recall command (see Page 5-36).</li> <li data-bbox="570 1268 1450 1367">3. Form overlays do not have to be recompiled each time they are called to be printed and therefore may result in much faster print output.</li> </ol>

# Graphics, Custom

## Command Structure <ESC>G**abbbccc**(data)

- a = Specifies format of data stream to follow  
 B Binary format  
 H Hexadecimal format
- bbb = Number of horizontal 8 x 8 blocks (see Note 7 for allowable range).
- ccc = Number of vertical 8 x 8 blocks (see Note for allowable range).
- (data)= Hex data to describe the graphic image
- Example: <ESC>GH006006  
 See Appendix C for a detailed example
- Placement: May be placed anywhere within the data stream after the necessary position commands.
- Default: None

**Command Function** To create and print custom graphics (logos, pictures, etc.) on a label. The graphic image may be printed along with other printed data to enhance label appearance or eliminate the need for preprinted label stock. Using a dot-addressable matrix, design the graphic image in 8 dot by 8 dot blocks, then send it in a binary format to the printer.

## Printer Input

```
<ESC>A
<ESC>H0100<ESC>V0100<ESC>GH006006
FFFFFFFFFFFFFFFFFFFFC00000000003
C00000000003C000FFFFFFFF3C00080000013
C00080000013C0009FFFFF13C00080000013
C00080000013C0009FFFFF13C00080000013
C00080000013C000FFFFFFFF3C000000000003
C00000000003C00000000003C00000000003
C00000000003C00000000003C00003C00003
C00007E00003C0000FF00003C0000FF00003
C0000FF00003C0000FF00003C00007E00003
C00003C00003C00003C00003C00003C00003
C00003C00003C00003C00003C00003C00003
C00003C00003C00003C00003C00003C00003
C00003C00003C00001800003C00000000003
C00000000003FFFFFFFFFFFFFFFFFFFFFFFF
<ESC>H0300<ESC>V0100<ESC>XSPLEASE PLACE YOUR DISK
<ESC>H0300<ESC>V0150<ESC>XSIN A SAFE PLACE
<ESC>Q1<ESC>Z
```

See Appendix C for a details on the data format.

**Printer Output****Special Notes**

1. Do not use ASCII <CR> or <LF> characters (carriage return or line feed) as line delimiters within the graphic data or the actual image will not be printed as specified.
2. A custom graphic cannot be enlarged by the <ESC>L Character Expansion command (Page 5-21).
3. A custom graphic is not affected by either of the Rotation commands. Therefore, always design and locate your graphic image to print in the appropriate orientation.
4. Use an optional Memory Card to expand the print length.
5. To store graphic images in an optional memory card, see the Memory Card Functions section.
6. The binary format reduces the transmission time by 50%.
7. The allowable number of blocks for this command are:

	<b>XL400</b>	<b>XL410</b>
Horizontal Blocks cccc	001 to 100	001 to 150
Vertical Blocks cccc	001 to 240	001 to 360

---

# Graphics, PCX

---

**Command Structure**     <ESC>**GP**aaaaa,(data)

aaaaa     =   Number of bytes to be downloaded

Example:     <ESC>**GP32000**, ... data...

Placement:     Anywhere within the job data stream

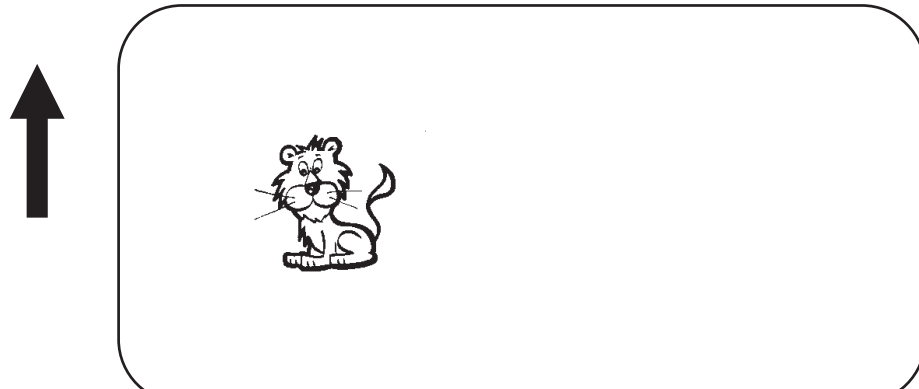
Default:     None

**Command Function**     To allow the creation and printing of graphic images using a PCX file format.

**Printer Input**     See Appendix Appendix C for a detailed example

```
<ESC>A
<ESC>V0150<ESC>H0100<ESC>GP03800,(...Data...)
<ESC>Q1
<ESC>Z
```

**Printer Output**



**Special Notes**

1. The maximum number of bytes that can be downloaded is 32K (compressed). The number specified by this command includes the PCX header information. The maximum size of the uncompressed PCX file is 64K. If the uncompressed file exceeds 64K, the graphic will not print.
2. Only black and white PCX files can be downloaded.
3. The image created by this command cannot be rotated.
4. The file size specified by this command is the DOS file size in bytes.



---

# Job ID Store

---

**Command Structure**     <ESC>**ID**aa

aa     =     Job ID assigned (01 to 99)

Example:     <ESC>**ID09**

Placement:     Immediately following the <ESC>A in the job data stream.

Default:     None

**Command Function**     To add an identification number to a job. The status of the job can then be determined using the ENQ command in the Bi-Com status mode (See Section 5: Interface Specifications for more information).

**Printer Input**     <ESC>A  
                          <ESC>**ID02**  
                          ... Job ...  
                          <ESC>Z

**Printer Output**     There is no printer output as a result of this command.

**Special Notes**     1. Works only in Bi-Com mode. The Job ID number must be stored before Bi-Com status mode can be used.

2. If more than one ID number is sent in a single job, i.e.

<ESC>A  
                  <ESC>ID01  
                  .....  
                  <ESC>ID02  
                  .....

the last number transmitted will be used.

2. It is effective only for the current print job.

# Lines and Boxes

Command Structure	Line	<ESC> <b>FWaabcccc</b>
	aa	= Width of horizontal line in dots (01-99)
	b	= Line orientation
		H Horizontal line
		V Vertical Line
	cccc	= Length of line in dots (see Note 2 for max length)
	Box:	<ESC> <b>FWaabbVccccHdddd</b>
	aa	= Width of horizontal side in dots (01-99)
	bb	= Width of vertical side in dots (01-99)
	cccc	= Length of vertical side in dots (see Note 2 for max length)
	dddd	= Length of horizontal side in dots (see Note 2 for max length)
	Example:	<ESC> <b>FW02H0200</b>
	Placement:	Following the necessary positioning commands
	Default:	None

**Command Function** To print horizontal lines, vertical lines, and boxes as images on the label.

**Input to Printer**

```
<ESC>A
<ESC>H0100<ESC>V0100<ESC>FW20H0200
<ESC>H0320<ESC>V0100<ESC>FW20V0200
<ESC>H0350<ESC>V0100<ESC>FW1010H0200V0200
<ESC>Q1<ESC>Z
```

**Printer Output**



## Special Notes

1. It is recommended that all lines and boxes be specified in the normal print direction.
2. The maximum allowable lengths for the different XL printers are as follows.

	<b>XL400</b>	<b>XL410</b>
Horizontal cccc	0001 to 0800	0001 to 1200
Vertical cccc	0001 to 1920	0001 to 2880

# Line Feed

## Command Structure

**<ESC>Eaaa**

aaa = Number of dots (001-999) between the bottom of the characters on one line to the top of the characters on the next line

Example: **<ESC>E010**

Placement: Preceding the text that will use the line feed function

Default: None

## Command Function

To print multiple lines of the same character size without specifying a new print position for each line. With the Line Feed command, specify the number of dots you want between each line. Then, send an ASCII <CR> at the end of each line of text. The printer automatically identifies the size of the last character, moves down the number of dots specified, and begins printing the next line.

## Input to Printer

```
<ESC>A
<ESC>E010<ESC>H0050<ESC>V0050<ESC>L0202<ESC>XS
THIS IS THE 1ST LINE
THIS IS THE 2ND LINE
THIS IS THE 3RD LINE
<ESC>Q1<ESC>Z
```

## Printer Output



```
THIS IS THE 1ST LINE
THIS IS THE 2ND LINE
THIS IS THE 3RD LINE
```

## Special Notes

1. This command can be used for text and for bar codes.
2. It is effective only for the current data stream.
3. When printing lines or boxes in the same data stream with the Line Feed command, the Lines and Boxes command should be specified last, preceding <ESC>Q Quantity command.

4. This command is invalid only if the value specified is zero.
5. The rotation command can be used with this command.
6. Following this command with a <CR> character will allow you to print with auto line feed. In this case, the print position will be determined from the value specified in the command and the H value set in the printer. However, if you specify several H values after this command, the print position will be determined by the H value last specified. You must redefine the font to be used after each H command.

---

# Media Size

---

**Command Structure**    <ESC>**A1aabbcc**

aa    =    Media Type  
          0T    Center Hole, Side Hole, R-Corner or I-Mark tag  
          0L    I-Mark or Gap label

bbb   =   Pitch Size in mm  
          025 - 120    Tag  
          019 - 120    Label  
          025 - 240    Tag  
          019 - 240    Label

cc    =    Media Width in mm  
          032 - 080    Tag  
          025 - 080    Label  
          032 - 100    Tag  
          025 - 100    Label

Example:    <ESC>**A1**OT060042

Placement:    Preceding the print job

Default:    None

**Command Function**    Checks if the Media Size specified in the job stream matches the media size detected by the printer. DSW2-8 must be ON for this command to work.

**Input to Printer**    <ESC>A  
          <ESC>**A1**OT038076  
          <ESC>Z  
          <ESC>A<ESC>V0100<ESC>H0400  
          <ESC>P2<ESC>L0202<ESC>XMABCD  
          <ESC>Q3<ESC>Z

**Printer Output**    There is no printer output as a result of this command.

**Special Notes**

1. A Media Size error will occur is the pitch and width sent by the command does not match that measured by the printer.
2. If a Media Error occurs, you must either load the correct size media or reset the printer by powering it Off.

---

## Off-Line/Pause

---

<b>Command Structure</b>	<code>&lt;ESC&gt;@,nnn...n</code>  nnn...n     =    Display message, up to 32 ASCII characters  Example:       See above  Placement:     In its own data stream  Default:        None
<b>Command Function</b>	To specify the printer to come to an off-line state. When used within a print job, the printer goes off-line after finishing the print job.
<b>Input to Printer</b>	<code>&lt;ESC&gt;A</code> <code>&lt;ESC&gt;@,Load Blue Tags - 1" W by 3" L</code> <code>&lt;ESC&gt;Z</code>
<b>Printer Output</b>	There is no printer output for this command. The printer is placed in the Off-Line mode as soon as the current print job is finished.
<b>Special Notes</b>	<ol style="list-style-type: none"><li>1. You must press the START/STOP key on the front panel to return the printer to an on-line status (see Control Panel in Section 3 of this manual).</li><li>2. Can be used before or after a print job.</li></ol>

---

## Print & Cut Offset

---

**Command Structure**    <ESC>#abbbb

a     =    Offset Direction  
         +    Feed Direction (plus offset)  
         -    Reverse Direction (minimum offset)  
bbbb =    Number of dots for offset (000 to 400)

Example:    <ESC>#+40

Placement:    In data stream for job

Default:       None

**Command Function**    To move the tag cut position.

**Printer Input**        <ESC>A  
                         <ESC>#+040  
                         <ESC>V0100<ESC>H0200<ESC>P2<ESC>L0202<ESC>WB1ABCD  
                         <ESC>Q3<ESC>Z

**Special Notes**        1. This command can be specified for every print job and keeps the specified value in memory as long as power is on.



# Print Darkness

## Command Structure <ESC>#Ea

a = Print darkness value  
(see Note 2 for allowable setting)

Example: <ESC>#E2

Placement: Must be placed immediately after <ESC>A and immediately before <ESC>Z in its own separate data stream

Default: See Note 2

## Command Function

To specify a new print darkness setting. This command allows software control of the darkness setting for unique media and ribbon combinations.

## Input to Printer

<ESC>A  
<ESC>#E2  
<ESC>Z

## Printer Output

There is no printer output for this command.

## Special Notes

1. This becomes the new setting in the printer configuration for all subsequent print jobs, unless changed. The setting is stored in non-volatile memory and is not affected by cycling power.
2. The allowable Print Darkness settings for each printer are as follows:

	XL400	XL410
Darkness Settings	1, <b>2</b> or 3	

Default values are shown in **bold** type.

# Print Position

<b>Command Structure</b>	Horizontal Position:	<ESC>Haaaa
	Vertical Position:	<ESC>Vbbbb
	aaaa =	Number of dots horizontally from the base reference point (1 to maximum) See Note 2.
	bbbb =	Number of dots vertically from the base reference point (1 to maximum) See Note 2.
	Example:	<ESC> <b>H0020</b> <ESC> <b>V0150</b>
	Placement:	Preceding any printed field description of lines/boxes, fonts, bar codes or graphics.
	Default:	<ESC>H0001 <ESC>V0001

<b>Command Function</b>	The Horizontal and Vertical commands specify the top left corner of a field or label, using the current base reference point as an origin. They also establish a reference point for subsequent fields until the next horizontal and/or vertical print position command is issued.
-------------------------	--

<b>Input to Printer</b>	<pre>&lt;ESC&gt;A &lt;ESC&gt;<b>H0025</b>&lt;ESC&gt;<b>V0050</b>&lt;ESC&gt;L0303&lt;ESC&gt;XMSATO &lt;ESC&gt;<b>H0100</b>&lt;ESC&gt;<b>V0150</b>&lt;ESC&gt;XMSATO &lt;ESC&gt;Q1&lt;ESC&gt;Z</pre>
-------------------------	---

## Printer Output



<b>Special Notes</b>	1. The print position of a field is affected by both the Rotate (<ESC>R and <ESC>A3) commands.
----------------------	--

2. For print lengths greater than 9.5 inches, an optional Memory Card must be used.

	<b>XL400</b>	<b>XL410</b>
Maximum Print Width <b>aaaa</b>	800 dots 3.9 in. 100 mm	1200 dots 3.9 in. 100 mm
Standard Print Length <b>bbbb</b>	1920 dots 9.5 in. 240 mm	2880 dots 9.5 in. 240 mm
Maximum Length with Memory Card <sup>(2)</sup>		
128 Kbyte <b>bbbb</b>	1168 dots 5.7 in. 146 mm	743 dots 2.4 in. 62 mm
512 Kbyte <b>bbbb</b>	4768 dots 23.5 in. 596 mm	2977 dots 9.7 in. 248mm
1 Mbyte <b>bbbb</b>	9360 dots 46 in. 1170 mm	5956 dots 19.5in. 496 mm
2 Mbyte <b>bbbb</b>	9999 dots <sup>(1)</sup> 49.2 in. 1249 mm	9999 dots <sup>(1)</sup> 32.8 in. 833 mm

(1) Limited by the number of digits in the command field.

(2) When a Memory Card is used to expand the print length, the card capacity is used instead of the internal memory, not in addition to the internal memory.

3. If any part of an image is placed past the maximum number of dots for standard length and or the capacity of the memory card, that part of the image will be lost.
4. If any part of an image is placed past maximum allowable dots across the label, that part of the image will be lost.
5. If you attempt to print where there is no paper, you may damage the print head.
6. For these commands, the leading zeroes do not have to be entered. The command V1 is equivalent to V0001.

# Print Quantity

<b>Command Structure</b>	<p>&lt;ESC&gt;Qaaaaaa</p> <p>aaaaaa = Total number of labels to print (1-999999)</p> <p>Example: &lt;ESC&gt;Q500</p> <p>Placement: Just preceding &lt;ESC&gt;Z. This command must be present in every print job.</p> <p>Default: None</p>
<b>Command Function</b>	To specify the total number of labels to print for a given print job.
<b>Input to Printer</b>	<p>&lt;ESC&gt;A</p> <p>&lt;ESC&gt;H0100&lt;ESC&gt;V0100&lt;ESC&gt;WB1XL400</p> <p>&lt;ESC&gt;Q3</p> <p>&lt;ESC&gt;Z</p>
<b>Printer Output</b>	Three labels containing the data "XL400" will be printed.
<b>Special Notes</b>	<ol style="list-style-type: none"> <li>1. To pause during a print job, you must press the START/STOP key on the Operator Panel.</li> <li>2. To cancel a print job, you must turn off the printer, or you may send the &lt;CAN&gt; code if using the Bi-Com mode. Multi-Buffer jobs can be cleared with the &lt;ESC&gt;* Clear Print Job and Memory command (see Page 5-25).</li> <li>3. When used with the &lt;ESC&gt;F Sequential Numbering command (see Page 5-61), the Print Quantity value should be equal to the total number of labels to be printed.</li> <li>4. If you do not specify a Print Quantity, the printer will not print a label.</li> <li>5. For this command, leading zeroes do not have to be entered. The command Q1 is equivalent to Q000001.</li> </ol>

# Print Speed

Command Structure	<p>&lt;ESC&gt;<b>CS</b>a</p> <p>a = Designates the speed selection See Note 2 for allowable settingsExample:</p> <p>Example &lt;ESC&gt;<b>CS</b>6</p> <p>Placement: Must be placed immediately after &lt;ESC&gt;A and immediately before &lt;ESC&gt;Z in its own separate data stream</p> <p>Default: As previously set in the printer configuration</p>
Command Function	To specify a unique print speed through software for a particular label. This allows flexibility in finding the best performance and quality for the particular label format, media, and ribbon. All subsequent labels will print at this speed unless the speed is changed with this command or through the Operator Panel.
Input to Printer	<ESC>A <ESC> <b>CS</b> 6 <ESC>Z
Printer Output	There is no printer output for this command. It sets the print speed of the printer.
Special Notes	<p>1. This becomes the new setting in the printer configuration for all subsequent print jobs, unless changed. The setting is stored in non-volatile memory and is not affected by cycling the power.</p> <p>2. The allowable Print Speed settings are as follows:</p>

	XL400	XL410
Print Speed Settings	5 = 5 ips 6 = 6 ips 7 = 7ips 8 = 8 ips	4 = 4 ips 5 = 5 ips 6 = 6ips

Default values are shown in **bold** type.

---

## Repeat Label

---

**Command Structure**     <ESC>C

Example:     See above

Placement:     Must be placed immediately after <ESC>A and  
immediately before <ESC>Z in its own separate data stream

Default:     None

**Command Function**     To print duplicate of the last label printed

**Input to Printer**     <ESC>A  
                              <ESC>C  
                              <ESC>Z

**Printer Output**     A duplicate of the previous label will be printed.

**Special Notes**     1. This command will have no effect if the power to the printer was  
                              cycled off and back on since printing the previous label.

# Replace Data (Partial Edit)

**Command Structure**     <ESC>**0** (<ESC>zero)

Example:     See above

Placement:     Must follow <ESC>A and precede all other print data

Default:     None

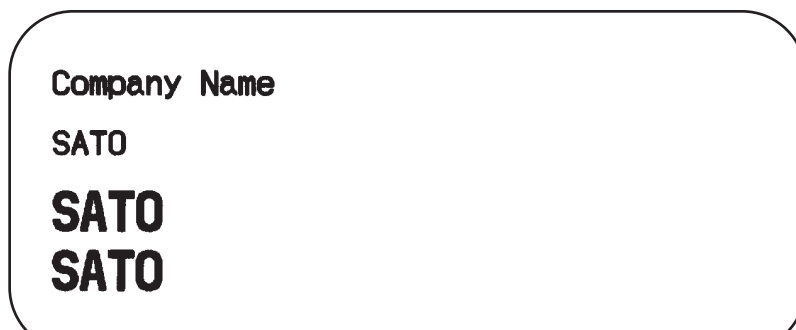
**Command Function**     To replace a specified area of the previous label with new data. This command will cause the previous label to print along with any changes specified within the current data stream.

**Input to Printer**

```
<ESC>A
<ESC>H0025<ESC>V0020<ESC>XB0Company Name
<ESC>H0025<ESC>V0085<ESC>XB1SATO
<ESC>H0025<ESC>V0150<ESC>XL0SATO
<ESC>H0025<ESC>V0215<ESC>XL1SATO
<ESC>Q1<ESC>Z
```

```
<ESC>A
<ESC>0<ESC>H0025<ESC>V0020<ESC>XB0SATO
<ESC>Q1<ESC>Z
```

**Printer Output**



**Special Notes**

1. Specify the exact same parameters for the image to be replaced as were specified in the original data stream, including rotation, expansion, pitch, etc. This will ensure that the new data will exactly replace the old image. If the replacement data contains fewer characters than the old data, then the characters not replaced will still be printed.
2. This command will not function if the power has been cycled off and back on since the last label was printed.
3. Proportional Pitch text cannot be used with this command.



# Reverse Image

**Command Structure**    <ESC>(aaaa,bbbb

a     =    Horizontal length in dots of reverse image area

b     =    Vertical height in dots of reverse image area.

See Note 6 for field ranges

Example:        <ESC>(100,50

Placement:    This command must be preceded by all other data and be placed just before <ESC>Q

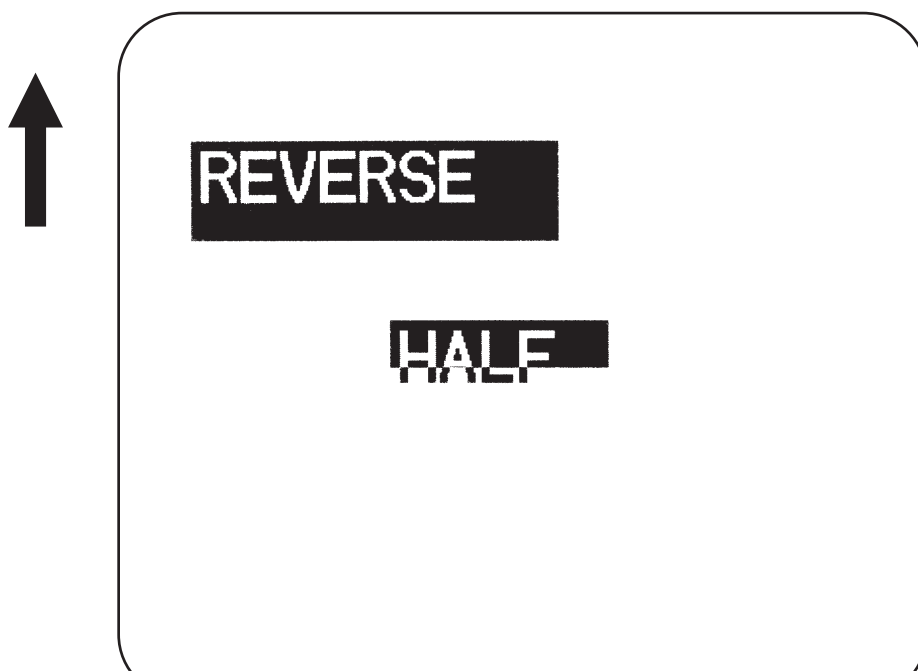
Default:        None

**Command Function**    To reverse an image area from black to white and vice versa. Use the Print Position commands (<ESC>H and <ESC>V) to locate the top left corner of the reverse image area.

**Input to Printer**

```
<ESC>A
<ESC>H0050<ESC>V0120<ESC>L0202<ESC>XB1REVERSE
<ESC>H0250<ESC>V0300<ESC>L0202<ESC>XB1HALF
<ESC>H0040<ESC>V0110<ESC>(370,100
<ESC>H0240<ESC>V0290<ESC>(220,47
<ESC>Q1<ESC>Z
```

**Printer Output**



**Special Notes**

1. A reverse image area is affected by the rotate commands. Therefore, always assume the printer is in the normal print orientation when designing and sending the Reverse Image command.
2. If using reverse images with the form overlay, place this command before the Form Overlay command in the data stream.
3. If the Rotate commands are used with this command, the V and H parameters are reversed.
4. If the height and width to be reversed contain other than alphanumeric data, the area is not printed.
5. If the values specified exceed the maximum ranges, the reverse image is not created.
6. The maximum allowable settings are as follows:

	<b>XL400</b>	<b>XL410</b>
Horizontal aaaa	0001 to 0800	0001 to 1200
Vertical bbbb	0001 to 1920	0001 to 2880

# Rotate, Fixed Base Reference Point

**Command Structure**     <ESC>%a

a     =     0   Sets print to normal direction  
               1   Sets print to 90°CCW  
               2   Sets print to 180° rotated (upside down)  
               3   Sets print to 270° CCW

Example:     <ESC>%3

Placement:   Preceding any printed data to be rotated

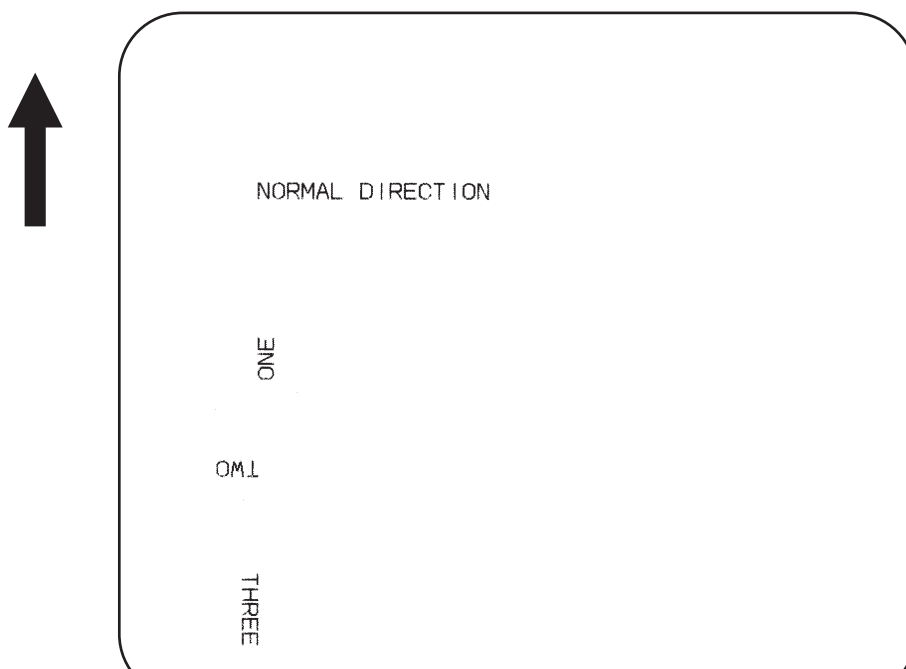
Default:     <ESC>%0

**Command Function**     To rotate the print direction in 90° increments without changing the location of the base reference point. The diagram below illustrates the use of the <ESC>% Rotate command. Note that the entire print area is shown, but your label will probably not be as large as the entire area.

**Input to Printer**

```
<ESC>A
<ESC>%0<ESC>L202<ESC>H0200<ESC>V0100<ESC>XMNORMAL DIRECTION
<ESC>%1<ESC>H0200<ESC>V0300<ESC>XMONE
<ESC>%2<ESC>H0200<ESC>V0400<ESC>XMTWO
<ESC>%3<ESC>H0200<ESC>V0500<ESC>XMTHREE
<ESC>Q1<ESC>Z
```

**Printer Output**



**Special Notes**

1. The specified values are valid until another Rotate (<ESC>%) command is received.
2. Receipt of a Stop Print (<ESC>Z) command will reset the setting to the default value.

# Sequential Numbering

**Command Structure**     <ESC>**F**aaaaabcccc,dd,ee

aaaa =     Number of times to repeat the same data (0001-9999)

b     =     Plus or minus symbol (+ for increments; - for decrements)

cccc =     Value of step for sequence (0001-9999)

,dd =     Number of digits for sequential numbering (01-99). The first incrementing character position starts after the positions exempted from sequential numbering as specified in ee. If these digits are left out, the default is 8.

,ee =     Number of digits free from sequential numbering (00-99) starting with the right most position. If these digits are left out, the default is 0.

Example:     <ESC>**F001-001,04,03**

Decrementing

004321321

Free from Decrementing

In this example, the right most (least significant) three digits would not decrement and the next four would decrement.

Placement:     Preceding the starting value to be incremented or decremented.

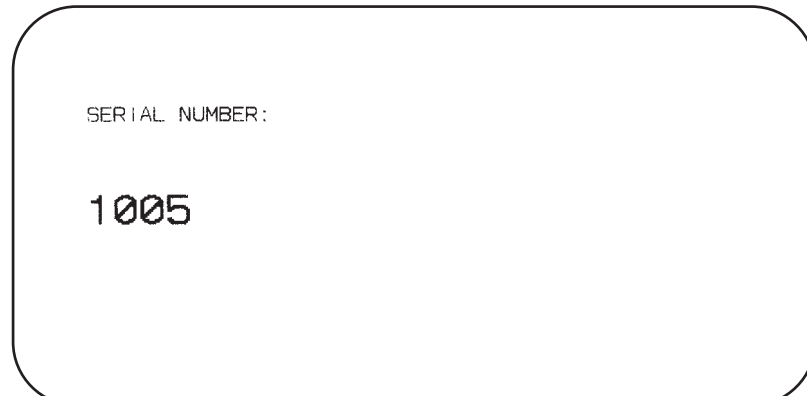
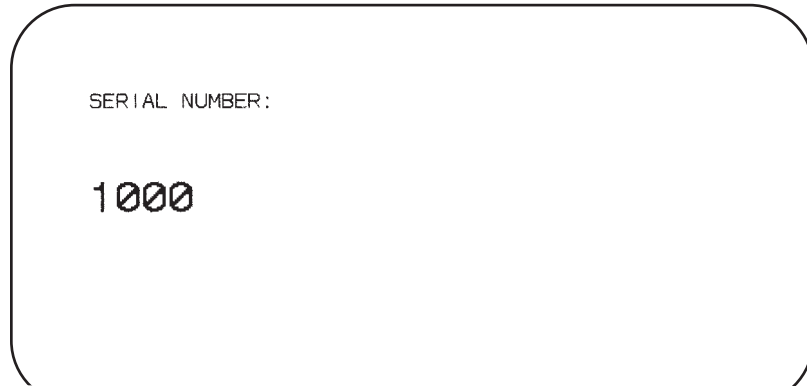
Default:     None

**Command Function**     To allow the ability to print sequential fields (text, bar codes) where all incrementing is done within the printer. Up to eight different sequential fields can be specified per label. Sequencing is effective for up to 99-digit numeric data within each field.

**Input to Printer**

```
<ESC>A<ESC>H0100<ESC>V0100<ESC>XM SERIAL NUMBER:
<ESC>H0100<ESC>V0200<ESC>F001+005
<ESC>L0202<ESC>XM1000
<ESC>Q2<ESC>Z
```

## Printer Output



## Special Notes

1. The value specified for Print Quantity (see Page 5-52) should be equal to the number of different sequential values desired multiplied by the number of repeats specified.

### Example:

To print 2 sets each of the numbers 1001-1025 on separate labels, we need 50 total labels. The commands would be as follows:

```
<ESC>A  
<ESC>H0100<ESC>V0100<ESC>F002+001<ESC>XM1001  
<ESC>Q50  
<ESC>Z
```

2. It is necessary to specify the print position for each sequential field on a label.
3. Up to eight different sequential fields can be specified per label.
4. This command ignores alpha characters in the sequential number field.
5. This command can not be used with the following commands:  
Copy Image, Page 5-26  
Reverse Image, Page 5-57  
Line Feed, Page 5-44

---

## Start/Stop Label

---

<b>Command Structure</b>	Start Command: <ESC>A Stop Command: <ESC>Z  Example: See above  Placement: <ESC>A must precede data <ESC>Z must follow data  Default: None
<b>Command Function</b>	For all print jobs, the Start command must precede the data, and the Stop command must follow. The print job will not run properly if these are not in place.
<b>Input to Printer</b>	<ESC>A <ESC>H0125<ESC>V0100<ESC>XB1SATO <ESC>H0130<ESC>V0200<ESC>B103150*XL400* <ESC>H0200<ESC>V0360<ESC>L0202<ESC>XS*XL400* <ESC>Q1<ESC>Z
<b>Printer Output</b>	There is not output for these commands they are not accompanied by other label printing commands. However, these commands must precede and follow each print job sent to the printer.

---

# Tag Feed

---

<b>Command Structure</b>	<b>&lt;ESC&gt;EJ</b>  Example:      See above  Placement:    Following the print job  Default:       None
<b>Command Function</b>	Feed the already printed tags or labels out of the printer.
<b>Input to Printer</b>	<ESC>A <ESC> <b>EJ</b> <ESC>Q1<ESC>Z
<b>Printer Output</b>	If cutter is enabled, the printer feeds and cuts each printed label. If the cutter is disabled, the printer feeds all printed labels out and cuts the last one.
<b>Special Notes</b>	1. Same as pressing the EJECT key on the Front Panel to purge a print job from the throat of the printer.



## **Calendar Option Commands**

---

The following commands in this section require the Calendar Option.

# Calendar Increment

**Command Structure**    <ESC>**WP**abbb

a     =    Y   Years  
              M   Months  
              D   Days  
              h   Hours  
 bbb =    Numeric data: Years (1-9), Months (01-99),  
              Days (001-999), Hours (001-999)

Example:    <ESC>**WPM03**

Placement:    Anywhere within the data stream

Default:        None

**Command Function**    To add a value to the printer's current date and/or time, which may then be printed on the label. This command does not change the printer's internal clock setting.

**Input to Printer:**    <ESC>A  
                          <ESC>H0100<ESC>V100<ESC>XB1Current Date:  
                          <ESC>WAMM/DD/YY  
                          <ESC>**WPM06**  
                          <ESC>H0100<ESC>V0200<ESC>XB1Expiration Date:  
                          <ESC>WAMM/DD/YY  
                          <ESC>Q1<ESC>Z

**Printer Output:**



**Current Date: 01/01/95**

**Expiration Date: 07/01/95**

**Special Notes:**

1. This command requires the Calendar Option. See your SATO representative for more details
2. Once the year increments past "99" it will wrap back to "00".
3. This command can only be used once per data stream.
4. The printer's internal clock may be set through the Calendar Set command (see Page 5-70).
5. If a print quantity of more than one label per job is used, the same time and date will be on each label of the entire print job.

# Calendar Print

**Command Structure**    <ESC>**WA**(elements)

(elements) =    YY   Year  
                   MM   Month  
                   DD   Day  
                   hh   Hour  
                   mm   Minute

Example:        <ESC>**WAMM/DD/YY hh:mm**

Placement:     Anywhere within the data stream

Default:        None

**Command Function**    To specify the printing of a date and/or time field from the printer's internal clock. This may be used to date/time stamp your labels.

**Input to Printer:**    <ESC>A  
                              <ESC>H0100<ESC>V0100<ESC>XB1The current date is:  
                              <ESC>XB1<ESC>**WAMM/DD/YY**  
                              <ESC>H0100<ESC>V0200<ESC>XB1The current time is:  
                              <ESC>XB1<ESC>**WAhh:mm**  
                              <ESC>Q1<ESC>Z

**Printer Output:**



**The current date is: 01/01/95**

**The current time is: 00:00**

**Special Notes:**

1. This function requires the Calendar Option. See your SATO representative for details.
2. The date and time elements may be placed in any order for printing.
3. Use a slash (/) to separate date elements and a colon (:) to separate time elements.
4. The font for the date/time elements must be specified before this command.
6. The printer's internal clock may be set through the Calendar Set command (see Page 5-70).
7. This command can be used up to six times per job.
8. The Copy or Reverse Image commands cannot be used with this command.
9. Up to 16 characters can be used with this command.

# Calendar Set

**Command Structure**     <ESC>**WTaabbccdde**

aa    =    Year (01-99)  
bb    =    Month (01-12)  
cc    =    Day (01-31)  
dd    =    Hour (00-23)  
ee    =    Minute (00-59)

Example:     <ESC>**WT9101311200**

Placement:    This command must be sent in an independent data stream.

Default:        None

**Command Function**     To set the time and date of the printer's internal clock.

**Input to Printer:**     <ESC>A  
                               <ESC>**WT9312251300**  
                               <ESC>Z

**Printer Output**         There is no printer output for this command. It sets the current date to December 25, 1993 and the current time to 1:00 PM in the printer.

**Special Notes**         This command requires the Calendar Option. See your SATO representative for details.

## Memory Card Option Commands

---

These commands require the Memory Card Option.

*Note: Before a Memory Card can be used for the first time, it must be initialized using the <ESC>BJF command (see page 5-84). If it is not initialized, the printer will not recognize the card and respond as if no card was installed.*

# Memory Card Function

## Clear Card Memory

**Command Structure**    <ESC>\*a,bb

a     =    Memory card section to be cleared  
           G    To clear SATO graphic files from memory card  
           P    To clear PCX graphic files  
           F    To clear formats from the memory card  
           O    To clear TrueType fonts  
 bb    =    Memory Card storage area to be cleared  
           01 to 99 for Graphics, PCX or Formats  
           00 to 09 for TrueType fonts

Example:    <ESC>\*G,01

Placement:    This command should be sent to the printer immediately following the <ESC>CC Slot Select command.

Default:       None

**Command Function**    To clear individual memory areas in the Memory Card.

**Input to Printer**       <ESC>A  
                              <ESC>CC1<ESC>\*O,09  
                              <ESC>Z

**Printer Output**        There is no printer output as a result of this command.

**Special Notes**

1. To clear everything in the memory card, use the <ESC>BJF Memory Card Initialize command (see page 5-84).
2. This command is ignored if there is no data to be cleared.
3. This command is ignored if a memory card is not installed in the printer.



# Memory Card Function

## Expand Memory Area

**Command Structure**     <ESC>EXa

a     =     Memory Designation  
          0     Use Printer Memory  
          1     Use Slot 1  
          2     Use Slot 2

Example:     <ESC>EX1

Placement:     In its own data stream immediately after powering on.

Default:     None

**Command Function**     This command expands the memory available to image labels by using the Memory Card.

**Input to Printer**     <ESC>A  
                              <ESC>EX2  
                              <ESC>Z

**Printer Output**     There is no printer output as a result of this command.

**Special Notes**

1. You must have the optional Memory Card to use this command. Call your local SATO representative for details.
2. When the printer is turned off, the the Memory Card is reset to normal operation.
3. If the Memory Card specified already contains data, it cannot be used for memory expansion.
4. The printer will reserve the specified Memory Card for expanded memory until it is turned off or receives another <ESC>EX Expand Memory Area command.
5. Use care with Line and Box commands as excessively long lines can damage the print head.
6. The maximum vertical position that can be specified by the <ESC>V vertical position command is shown in the table below:

	<b>XL400</b>	<b>XL410</b>
Standard Print Length	1920 dots 9.5 in. 240 mm	2880 dots 9.5 in. 240 mm
Maximum Length with Memory Card <sup>(2)</sup>		
128 Kbyte	1168 dots 5.7 in. 146 mm	743 dots 2.4 in. 62 mm
512 Kbyte	4768 dots 23.5 in. 596 mm	2977 dots 9.7 in. 248 mm
1 Mbyte	9360 dots 46 in. 1170 mm	5956 dots 19.5 in. 496 mm
2 Mbyte	9999 dots <sup>(1)</sup> 49.2 in. 1249 mm	9999 dots <sup>(1)</sup> 32.8 in. 833 mm

(1) Limited by the number of digits in the command field.

(2) When a Memory Card is used to expand the print length, the card capacity is used instead of the internal memory, not in addition to the internal memory.

7. If a job contains elements out of the memory range, it is ignored.
8. This command cannot be used with the <ESC>AX and <ESC>AR Expanded Print Length commands or the <ESC>R Rotate, Moving Base Reference Point command.

# Memory Card Function

## Fonts, TrueType Recall

**Command Structure**    <ESC>BJRabbccddeeeff...f

a     =    Font ID (0 thru 9)  
bb    =    Horizontal Expansion (01 thru 12)  
cc    =    Vertical Expansion (01 thru 12)  
dd    =    Character Pitch (01 thru 99)  
eeee =    Number of characters to be printed using the font  
f f f f =   Data to be printed

**Example:**    <ESC>BJR1020201000004SATO

**Placement:**    Immediately following the <ESC>CC Slot Select command.

**Default:**        None

**Command Function**    This command recalls previously stored TrueType fonts from a Memory Card.

**Printer Input**        <ESC>A  
<ESC>V0100<ESC>H0100<ESC>CC1<ESC>BJR1020201000004SATO  
<ESC>Q1<ESC>Z

**Printer Output**



**SATO**

### Special Notes

1. This command requires the Memory Card option. See your SATO representative for details.

# Memory Card Function

## Fonts, TrueType Store

<b>Command Structure</b>	Begin Download   <ESC> <b>BJ</b> ( aa...abb..b Download           <ESC> <b>BJD</b> ccccccddddee...e End Download       <ESC> <b>BJ</b> )
	aa..a =     40 byte font description bb..b =     10 byte date information ccccc=     Memory offset (hexadecimal) dddd =     Number of data bytes to be stored (0001-2000) ee...e=     Font data to be downloaded
	Example:     <ESC> <b>BJ</b> { <b>50 byte header</b> } <ESC> <b>BJD</b> { <b>5 byte hex memory offset</b> }{data} <ESC> <b>BJ</b> )
	Placement:   Immediately following the <ESC>CC Slot Select command.
	Default:       None
<b>Command Function</b>	This command allows TrueType fonts to be stored in a Memory Card.
<b>Printer Input</b>	The download data stream is very complex and it is recommended that the TrueType Download utility program be used instead of manually creating the required command and data stream.
<b>Printer Output</b>	There is no printer output as a result of this command. See <ESC>BJR TrueType Font Recall command.
<b>Special Notes</b>	<ol style="list-style-type: none"> <li>1. This command requires the Memory Card option. See your SATO representative for details.</li> <li>2. The SATO TrueType Download utility program can be used to automate the download process from a computer running Windows 3.1 or above. A copy of this utility program is included as a part of the Memory Card Option.</li> </ol>

# Memory Card Function

## Format/Field Recall

**Command Structure**     <ESC>YR,aa <ESC>/D,bb,cc...c

aa     =     Format number to be recalled (01-99)

bb     =     Field number to be recalled (01-99)

cc...c=     Data to be placed in recalled field.

Example:     <ESC>YR,01<ESC>/D,01,99

Placement:     Immediately after <ESC>CC Slot Select command

Default:     None

**Command Function**     To recall a field from a stored format and place new data in the field.

**Printer Input**

<ESC>A

<ESC>CC1

<ESC>YR,02<ESC>/D,01,TWO FIELDS OF<ESC>/D,02,VARIABLE DATA

<ESC>Q1<ESC>Z

**Printer Output**



**TWO FIELDS OF  
VARIABLE DATA**

**Special Notes**

1. This command requires the Memory Card option. See your SATO representative for details.
2. Only one format can be recalled at a time. However, multiple fields may be recalled from the same format.
3. The number of data characters contained in the "cc...c" field cannot exceed the value designated in the <ESC>/N Field Store command. If it does, the data will be truncated to fit the field length defined in the Field Store Command.

# Memory Card Function

## Format/Field Store

**Command Structure**    <ESC>YS,aa<ESC>/N,bb,cc{.....}

aa    =    Format number to be stored (01-99)  
bb    =    Field number to be stored (01-99)  
cc    =    Length of field to be stored (01-99)  
{.....} =    Command stream describing the field to be stored.

Example:    <ESC>YS,01<ESC>/N,01,05

Placement:    Immediately after <ESC>CC Slot Select command.

Default:    None

**Command Function**    To store a format field description in the memory card.

**Printer Input**    <ESC>A  
<ESC>CC1  
<ESC>YS,02<ESC>/N,01,13<ESC>V0100<ESC>H0100<ESC>XB1  
<ESC>/N,02,13<ESC>V0200<ESC>H0200<ESC>XB1  
<ESC>Z

**Printer Output**    There is no printer output as a result of this command. See  
<ESC>YR Format/Field Recall command.

**Special Notes**

1. This command requires the Memory Card option. See your SATO representative for details.
2. Each job should be sent individually. If more than one job is sent in a data stream, only the first one will be accepted and the remainder ignored.

3. The following commands cannot be stored in a format:

<ESC>CS	Print Speed	<ESC>C	Repeat Label
<ESC>#	Cut & Print Label	<ESC>Q	Print Quantity
<ESC>/D	Recall Field	<ESC>EX	Expanded Label Storage
<ESC>T	Custom Characters	<ESC>&	Store Form Overlay
<ESC>@	Off Line	<ESC>#E	Print Darkness
<ESC>BJ	TrueType Fonts	<ESC>ID	Store Job ID
<ESC>G	Store Custom Graphics	<ESC>*	Clear Memory & Buffer
<ESC>BT	Variable Ratio Bar Codes	<ESC>PI	Store PCX Graphics
<ESC>0	Partial Edit		

---

# Memory Card Function

## Graphics, Custom Recall

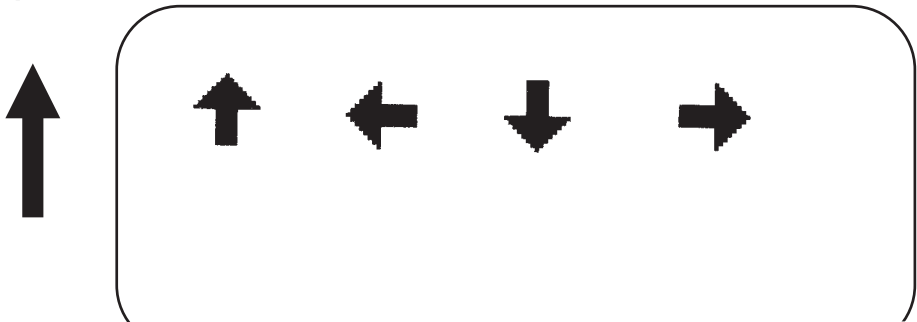
---

<b>Command Structure</b>	<b>&lt;ESC&gt;GRaaa</b>  aaa = Graphics storage number (001-999)  Example: <b>&lt;ESC&gt;GR111</b>  Placement: The Recall command is sent in a secondary data stream to print the graphic, and follows any necessary position or size commands.  Default: None
--------------------------	--

**Command Function** Use the Recall command any time you want to print a graphic image on a label along with other printed data.

<b>Printer Input</b>	Non Rotated Graphic <ESC>A<ESC>CC1 <ESC>V0100<ESC>H0080<ESC>L0505 <ESC> <b>GR001</b> <ESC>Q1<ESC>Z	Graphic Rotated 90° <ESC>A<ESC>CC1<ESC>%1 <ESC>V0180<ESC>H0250<ESC>L0505 <ESC> <b>GR001</b> <ESC>Q1<ESC>Z
	Graphic Rotated 180° <ESC>A<ESC>CC1<ESC>%2 <ESC>V0180<ESC>H0500<ESC>L0505 <ESC> <b>GR001</b> <ESC>Q1<ESC>Z	Graphic Rotated 270° <ESC>A<ESC>CC1<ESC>%3 <ESC>V0100<ESC>H0700<ESC>L0505 <ESC> <b>GR001</b> <ESC>Q1<ESC>Z

**Printer Output**



- Special Notes**
1. The graphic image to be stored cannot be rotated before it is stored. It can be rotated when it is recalled.
  2. Graphic images cannot be stored as part of a label format.
  3. See the <ESC>GI Custom Graphic Store command.

# Memory Card Function Graphics, Custom Store

### Command Structure

**<ESC>Glabbbcccd{data}**

a	=	Specifies character format of the data
		H Hex data
		B Binary data
bbb	=	Number of horizontal 8 x 8 blocks (001-248)
ccc	=	Number of vertical 8 x 8 blocks (001-267)
ddd	=	Graphics storage number (001-999)
{data}	=	Hex or binary data to describe the graphic image

Example: See Appendix C for detailed information on creating Hex and Binary graphic files.

Placement: Immediately following the <ESC>CC Slot Select command.

Default: None

## Command Function

To provide similar functionality to the <ESC>G Custom Graphic command (see Page 5-38, but allows for the graphic image to be stored in a Memory Card. Use the Store command to send the graphic data to the printer, which is held in the optional memory card, even if printer power is lost.

## Printer Input

```
<ESC>A  
<ESC>CC1<ESC>GIH002002001  
0100038007C00FE01FF03FF87FFCFFFE07C007C007C007C007C007C007C0  
<ESC>Z
```

Note: See Appendix C for detailed explanation on how to format a graphics data stream.

## Printer Output

There is no printer output as a result of this command. See <ESC>GR Recall Custom Graphics command.

## Special Notes

1. You must have the optional Memory Card to use this command. Call your SATO representative for details.
2. The maximum storage capacity is 999 graphics, up to the capacity of the memory card used.
3. If a data transmission error occurs, the printer will beep and the "ERROR" LED will come on. You must then retransmit the image. See Appendix D for information on Memory Card error reporting.
4. Each graphic to be stored must be sent in its own data stream.



Example of correct data stream:

```
<ESC>A
<ESC>GIHaaabbb001(DATA)
<ESC>Z
<ESC>A
<ESC>GIHaaabbb002(DATA)
<ESC>Z
```

Example of incorrect data stream:

```
<ESC>A
<ESC>GIHaaabbb001(DATA)
<ESC>GIHaaabbb002(DATA)
<ESC>Z
```

5. Do not use ASCII <CR> or <LF> characters (carriage return or line feed) as line delimiters within the graphic data or the actual image will not be printed as specified.
6. The graphics storage number (ddd) must be specified with this command.
7. The allowable vertical and horizontal settings are:

	<b>XL400</b>	<b>XL410</b>
Horizontal Blocks cccc	001 to 100	001 to 150
Vertical Blocks cccc	001 to 240	001 to 360

# Memory Card Function

## Graphics, PCX Recall

**Command Structure**    <ESC>PYaaa

aa    =    Storage area number (001 thru 099)

Example:    <ESC>PY001

Placement:    This command must be placed within its own data stream specifying the placement of the graphic.

Default:    None

**Command Function**    To recall for printing a graphic file previously stored in a PCX format in the Memory Card.

### Printer Input

Normal Rotation

<ESC>A<ESC>CC1

<ESC>V0100<ESC>H00025<ESC>PY001

<ESC>Q1<ESC>Z

Rotate Base Reference Point

<ESC>A<ESC>CC1<ESC>%1

<ESC>V0330<ESC>H0180<ESC>PY001

<ESC>Q1<ESC>Z

2nd Rotation, Base Reference Point

<ESC>A<ESC>CC1<ESC>%2

<ESC>V0330<ESC>H0600<ESC>PY001

<ESC>Q1<ESC>Z

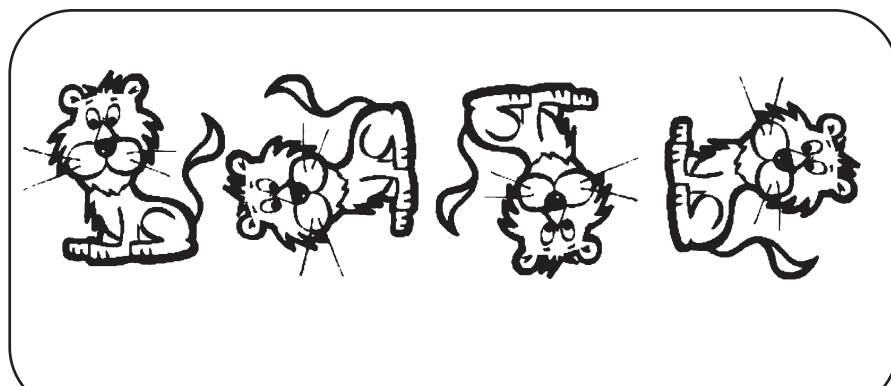
3rd Rotation, Base Reference Point

<ESC>A<ESC>CC1<ESC>%3

<ESC>V0100<ESC>H0800<ESC>PY001

<ESC>Q1<ESC>Z

### Printer Output



### Special Notes:

1. This command requires Memory Card option. See your SATO representative for details.
2. See the <ESC>PI Store PCX Graphics command.

# Memory Card Function

## Graphics, PCX Store

**Command Structure**     <ESC>PIaaa,bbbb,{data}

aaa            =    Storage area number (001 thru 999)

bbbb          =    Size of PCX file in bytes

{data}        =    Data

Example:       <ESC>PI001,32000,{data}

Placement:    This command must be placed within its own data stream

Default:        None

**Command Function**     To store for later printing a PCX graphic file in the Memory Card.

### Printer Input

BASIC Program to Download a PCX file to Memory Card #1, Location #1

```
OPEN "C:\WIZARD\GRAPHICS\LION.PCX" FOR INPUT AS #2
DA$ = INPUT$(3800,#2)
C$ = CHR$(27)
WIDTH "LPT1:",255
LPRINT C$;"A";C$;"CC1";
LPRINT C$;"PI001,03800,";DA$
LPRINT C$;"Z";
CLOSE #2
```

### Printer Output

There is no printer output as a result of this command. See <ESC>PY PCX Graphics Recall command.

### Special Notes:

1. This command requires Memory Card option. See your SATO representative for details.
2. Graphics cannot be stored as part of a format.
3. Only black and white PCX files can be stored.
4. The file size specified by this command is the DOS file size in bytes.

# Memory Card Function

## Initialize

**Command Structure**    <ESC>BJFaaaaaaaaa

aaaaaaaa = Eight character alphanumeric user ID

Example:            <ESC>BJFsatocard

Placement:        Immediately following the <ESC>CC Slot Select command.

Default:            None

**Command Function**    This clears all of the data from Memory Card in the specified slot and prepares the card to accept data.

**Input to Printer**        <ESC>A  
                                  <ESC>CC2<ESC>BJFsatocard  
                                  <ESC>Z

**Printer Output**         There is no printer output as a result of this command.

**Special Notes**

1. You must have the optional memory card to use this command. Call your local SATO representative for information.
2. All Memory Cards must be initialized before they can be used for the first time.
3. Care should be exercised when using this command as it destroys any data previously written to the card. It will clear all data from the card and assign the new ID ("satocard" in the above example).
4. If the Memory Card is write protected, a Memory Card R/W Error will occur.

---

# Memory Card Function

## Slot Select

---

<b>Command Structure</b>	<b>&lt;ESC&gt;CCa</b> a = Memory Card Slot designation 1 Slot 1 2 Slot 2  Example: <ESC>CC1  Placement: Immediately following the <ESC>A Start Code.  Default: Last selected Memory Card Slot.
<b>Command Function</b>	Selects the card slot to be used for following Memory Card commands.
<b>Printer Input</b>	<ESC>A <ESC>CC1 {commands} <ESC>Z
<b>Printer Output</b>	There is no printer output as a result of this command.
<b>Special Notes</b>	1. This command requires the Memory Card option. See your SATO representative for more information.

# Memory Card Function Status

**Command Structure**    <ESC>BJS

Example:    <ESC>BJS

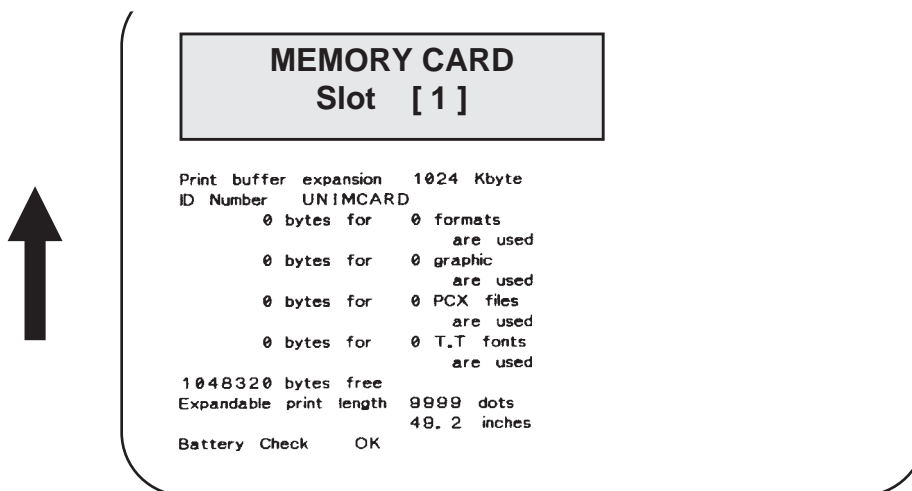
Placement:    After the <ESC>CC Slot Select command.

Default:    None

**Command Function**    Causes the printer to print the card status.

**Printer Input**    <ESC>A  
                          <ESC>CC1<ESC>BJS  
                          <ESC>Z

**Printer Output**



**Special Notes**

1. This command requires the Memory Card option. See your SATO representative for more information
2. The following information is provided on the status label:

Line 1: Memory size of the card in Kbytes  
 Line 2: The ID number assigned with the <ESC>BJF command  
 Line 3: Number of formats stored and bytes used  
 Line 4: Number of graphics stored and bytes used  
 Line 5: Number of PCX files and bytes used  
 Line 6: Number of TT fonts stored and bytes used  
 Line 7: Remaining free memory  
 Line 8: Max expandable print length using the card  
 Line 9: Battery check results

# Custom Protocol Command Codes Download

## Command Structure <ESC>LD,a,b,c,d,e,f,g,h,i

- a = Replacement character for STX in ASCII or hex format
- b = Replacement character for ETX in ASCII or hex format
- c = Replacement character for ESC in ASCII or hex format
- d = Replacement character for ENQ in ASCII or hex format
- e = Replacement character for CAN in ASCII or hex format
- f = Replacement character for NULL in ASCII or hex format
- g = Replacement character for OFFLINE in ASCII or hex format
- h = Auto-Online. Printer powers up in the On Line mode.  
0 = Yes  
1 = No
- i = Zero Slash. Places a slash through the "0" character.  
0 = Yes  
1 = No

**Example:** <ESC>LD,{,},%,#,&,\* ,~,0,0

**Placement:** Immediately following the <ESC>A Start command and in an independent data stream.

**Default:** Standard Protocol command Codes

**Command Function** Allows the user to defines custom Protocol Command codes.

**Printer Input**  
 <ESC>A  
 <ESC>LD,{,},%,#,&,\* ,~,0,0  
 <ESC>Z

**Printer Output** A Protocol Command code status label will be printed as a result of the a successful download of a custom set of Protocol Command codes.



```

STX = 7B   ETX = 7D   ESC = 25
ENQ = 23   CAN = 26   NULL = 2A
OFFLINE = 7E
AUTO ONLINE =      YES
ZERO SLASH =       YES

```

Press the "FEED" key to activate the User  
Default or power the printer off to ignore  
them.

### Special Notes

1. Commas must be used to separate the parameters. If a parameter is omitted between two commas, the default Non-Standard Protocol Command codes for that parameter will be used. See Appendix E.
2. This command must be sent as an independent data stream immediately following the <ESC>A Start code and immediately preceding the <ESC>Z Stop code. No other commands can be included in the data stream.
3. If more or less than nine commas are included in the command, the entire command sequence will be ignored. The command must contain exactly nine commas.
4. If two characters are specified for a parameter, it will be interpreted as a hex value. For example:

Command Parameter	Resulting Command Code
2B	+
+	+

If a combination of characters are outside the hexadecimal range, the entire command sequence will be ignored.

5. Downloading Auto Online and Zero Slash settings will overwrite the values selected using the LCD panel. If these settings are changed using the LCD panel, they will overwrite any previously downloaded settings.



## Two-Dimensional Symbols

---

The following commands are used to create the two-dimensional symbologies supported by the XL Series printers.

# Two-Dimensional Bar Codes

## Data Matrix, Data Format

**Command Structure**    <ESC>**BX***aa**bb**cc**dd**eee**fff**ghh*

- aa*    =    Format ID. 01-06 or 11-16. The values 07 and 17 will not be accepted by the printer.
- bb*    =    Error correction level. 00 ,01, or 04-14. The values 02, 03 or values of 15 or greater will be processed as a 00.
- cc*    =    Horizontal cell size. 03 - 12 dots/cell.
- dd*    =    Vertical cell size. 03 - 12 dots/cell.
- eee*   =    Number of cells in one line. Must use 000 to optimize.
- fff*   =    Number of cell lines. Must use 000 to optimize.
- g*     =    Mirror Image
  - 0    =    Normal Print
  - 1    =    Reverse Print
- hh*    =    Guide Cell Thickness. 01-15. 01 indicates normal type.

Example:    <ESC>**BX030805050000000001**

Placement:    Immediately preceding data to be encoded

Default:        None

**Command Function**    To designate the format for a Data Matrix two-dimensional bar code image on a label.

**Printer Input**        <ESC>A  
 <ESC>%0<ESC>V0100<ESC>H0100<ESC>**BX050510100000000001**  
 <ESC>DCDATA MATRIX DATA MATRIX  
 <ESC>Q1<ESC>Z

**Printer Output**        There is no printer output as a result of this command. See the <ESC>DC Print Data command for printer output.

- Special Notes**
1. If any of the parameters entered are outside the valid range, a symbol will not be printed when the <ESC>DC Print Data command is sent to the printer.
  2. The number of cells per line (*eee*) and the number of cell lines (*fff*) should be specified as all zeroes, allowing the printer to automatically calculate the optimum configuration for the symbol.
  3. The Reference Point for the Data Matrix symbol is the upper-left corner. If an <ESC>R Rotate command is used to rotate the symbol, it will rotate in the counter-clockwise direction.

4. The Format ID specified for “aa” is defined by the following table.  
The printer only supports the Format ID’s defined in the table.

ID NUMBER	CHARACTER SET	ENCODING SCHEME
<b>16 Bit CRC</b>		
01	Numeric, Space	Base 11
02	Upper Case Alpha, Space	Base 27
03	Upper Case Alpha, Space, Comma, Period, Slash, Minus	Base 41
04	Upper Case Alphanumeric, Space	Base 37
05	ASCII 7-bit, Full Keyboard (20 <sub>H</sub> -7F <sub>H</sub> )	ASCII
06	ISO 8-bit, International (20 <sub>H</sub> -FF <sub>H</sub> )	8-Bit
<b>32 Bit CRC</b>		
11	Numeric, Space	Base 11
12	Upper Case Alpha, Space	Base 27
13	Upper Case Alpha, Space, Comma, Period, Slash, Minus	Base 41
14	Upper Case Alphanumeric, Space	Base 37
15	ASCII 7-bit, Full Keyboard (20 <sub>H</sub> -7F <sub>H</sub> )	ASCII
16	ISO 8-bit, International (20 <sub>H</sub> -FF <sub>H</sub> )	8-Bit

5. The maximum number of data characters that can be specified for either the 16-Bit or 32-Bit CRC modes is 500.

---

# Two-Dimensional Bar Codes

## Data Matrix, Print Data

---

**Command Structure**    <ESC>**DCxx...x**

xx...x=      Data, maximum of 500 characters

Example:      <ESC>**DC00006000**

Placement:    Immediately following the <ESC>BC Data Format designation command or the <ESC>FX Sequential Numbering command.

Default:      None

**Command Function**    To print a Data Matrix two-dimensional bar code image on a label.

**Printer Input**            <ESC>A  
<ESC>%0<ESC>V0100<ESC>H0100<ESC>BX05051010000000001  
<ESC>**DCDATA MATRIX DATA MATRIX**  
<ESC>Q1<ESC>Z

**Printer Output**



**Special Notes**

1. The maximum amount of data that can be printed with this command is 500 characters.
2. If an <ESC>BX Data Format designation command contains any parameters out of the valid range, no symbol will be printed when this command is sent.

# Two-Dimensional Bar Codes

## Data Matrix, Sequential Numbering

### Command Structure <ESC>FXaaabcccddeee

aaa = Number of duplicate labels to be printed (001 -999)

b = Increment or Decrement

+ = Increment

- = Decrement

ccc = Increment/Decrement Steps (001 - 999)

ddd = Sequential numbering start position (001 - 999)  
Referenced to left side.

eee = Incremented data length measured from start position  
(001 - 999)

Placement: Immediately following the <ESC>BX Data Format  
designation command and preceding the <ESC>DC  
Print Data Command.

Default: None

**Command Function** To print sequential numbered Data Matrix symbols.

### Printer Input

```
<ESC>A
<ESC>V0100<ESC>H0100
<ESC>BX030810100000000001
<ESC>FX002+001005003<ESC>DC000060000
<ESC>Q4<ESC>Z
```

### Printer Output

Label Set #1





1. The maximum number of <ESC>FX Sequential Numbering commands that can be used in one job is eight.
2. In the example above four total labels will be printed (<ESC>FX002+005003<ESC>DC00006000), the sequential

printed, the first set of two labels with the value “00006000” and the next two label set with the value “00006010”.

	Label Set #1		Label Set #2
1st Label	00006000	3rd Label	00006010
2nd Label	00006000	4th Label	00006010

3. The <ESC>Q Label Quantity command must be set for the total number of labels to be printed. In the above example, the value for the <ESC>Q command should be 2 sets x 2 labels/set = 4. If, in the above example, it was set to a value of “1”, only the first label would be printed.

# Two-Dimensional Bar Codes

## Maxicode

**Command Structure**     <ESC>BUaaa,bbb,cccccc,dddd,ee...e

aaa        =    Service class, numeric only (001-999)  
 bbb        =    Country code, numeric only (001-999)  
 cccccc    =    ZIP code, alphanumeric (000000-999999)  
 dddd       =    Extended ZIP code, numeric only (0001-9999)  
 ee...e    =    Low priority message, alphanumeric, 84 digits.

Example:     <ESC>BU001,010,123456,6018

Placement:    Immediately preceding data to be encoded

Default:        None

**Command Function**     To print a Maxicode two-dimensional bar code image on a label. See Appendix B for specific information on using each individual bar code symbol.

**Command Function**     To print a UPS Maxicode symbol.

```
<ESC>A<ESC>V0100<ESC>H0100
<ESC>BU001,840,000000,0841,7006672
])><Rs>
01<Gs>96
1Z12345675
<Gs>UPSN<Gs>12345E<Gs>089
<Gs><Gs>1/1<Gs>10.1<Gs>Y
<Gs><Gs><Gs>UT
<Rs><Eot>
!!!!!!!!!!!!!!!!!!!!!!!!!!!!
<ESC>Q1<ESC>Z
```

**Printer Output**



**Special Notes**

1. The Secondary Message field (ee...e) must contain exactly 84 characters. If a smaller message is specified, the field must be padded with “exclamation point” character(s).
2. <Rs> represents Hex 1E, <Gs> represents Hex 1D, <Eot> represents Hex 04, <ESC> represents Hex 1B and <Sp> represents Hex 20.



# Two-Dimensional Bar Codes

## PDF417

### Command Structure <ESC>BKaaabbbcddeeffffnn...n

- aa = Minimum module dimension (03-09 dots). Will not print if values of 01, 02 or greater than 10 are specified.
- bb = Minimum module pitch dimension (04-24 dots). Will not print if values of 01, 02, 03 or greater than 25 are specified.
- c = Security (error detection) Level (1-8).
- dd = Code words per line (01-30). If 00 is specified for both dd and ee, the printer automatically optimizes the number of rows per symbol.
- ee = Rows per symbol (00 or 03-40). If 00 is specified for both dd and ee, the printer automatically optimizes the number of rows per symbol.
- ffff = Number of characters to be encoded (0001-2700).
- nn..n = Data to be printed.

Example <ESC>BK03044000000021

Placement: Immediately preceding data to be encoded

Default: None

**Command Function** To print a PDF417 two-dimensional bar code image on a label.

### Printer Input

```
<ESC>A
<ESC>V0100<ESC>H0100<ESC>BK0607400000021PDF417 PDF417 PDF417
<ESC>Q1<ESC>Z
```

### Printer Output



## Special Notes

1. When the code words per line and the number of rows per symbol (“dd” and “ee”) are set to all zeroes, the printer will calculate the optimum configuration.
2. If the product of the values entered for “dd” and “ee” are not equal to or less than the value of “fff” (i.e., “fff” equal to or greater than “dd” x “ee”), an error will occur and the symbol will not be printed. It is recommended that these values each be set to “000” and the printer be allowed to automatically calculate the optimum values.
3. The values for “dd” and “ee” need to be made larger if the security level is increased.
4. The maximum data length is 2700 characters, but may be less depending upon:
  - the minimum module dimension (“aa”)
  - the security level specified by “c”.
  - the number of data characters
5. The Reference Point of the PDF417 symbol is the upper-left corner.
6. The <ESC>F Sequential Numbering command cannot be used with this command.
7. The <ESC>E Line Feed command cannot be used with this command.
8. The Macro and Truncated PDF417 symbols are not supported.
9. The values 00<sub>H</sub> thru 1F<sub>H</sub> can be specified as print data.
10. This command can be stored in a format.
11. The <ESC>R Rotate command can be used.
12. The print height of the symbol will vary depending upon the data specified; numeric only, alpha only or alphanumeric.

# SECTION 6.

## INTERFACE SPECIFICATIONS

### INTRODUCTION

---

This section presents the interface specifications for the XL Series printers. These specifications include detailed information on how to properly interface your printer with your host system.

The following information is presented in this section:

- Interface Types
- Using the Receive Buffer
- RS232C Serial Interface
  - General Specifications
  - Electrical Specifications
  - Pin Assignments
  - Ready/Busy Flow Control
  - X-On/X-Off Flow Control
  - Bi-Directional Communications Protocol
- Centronics Parallel Interface
- Accessory (EXT) Connector

### INTERFACE TYPES

---

In order to provide flexibility in communicating with a variety of host computer systems all XL printers can be configured for operation with either parallel or serial data transfers. Both the XL400 and the XL410 come standard with two interface types.

The Centronics Parallel interface will probably be the most useful in communicating with IBM PCs and compatibles. The RS232C Serial interface allows connectivity to a number of other hosts. For instructions on how to properly configure your XL printer for either of these interface types, see *Section 3. Configuration* for instructions.

*NOTE: Both the Centronics and RS232C interfaces are active at the same time on the XL printers, i.e. data can be received on either one, however no provision is made for port contention. If data is transmitted to both ports simultaneously, it will cause the data in the receive buffer to be corrupted.*

## THE RECEIVE BUFFER

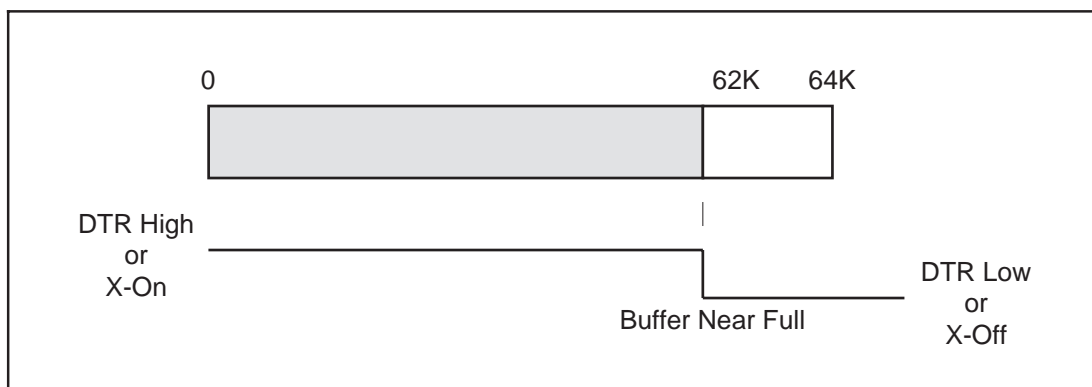
The XL printers have the ability to receive a data stream from the host in one of two ways. The receive buffer may be configured to accept one print job at a time or multiple print jobs. The single job print buffer is generally used by software programs that wish to maintain control of the job print queue so that it can move a high priority job in front of ones of lesser importance. The multiple job buffer, on the other hand prints all jobs in the order they are received by the printer, and the order of printing cannot be changed.

### Single Job Buffer

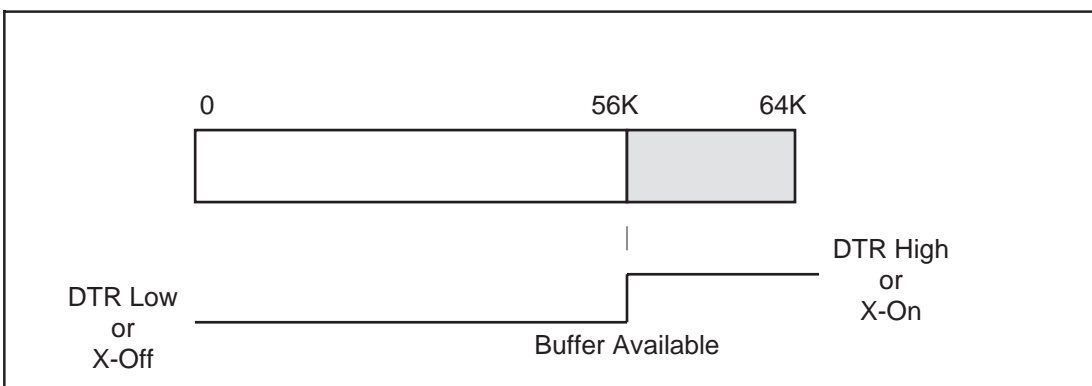
The printer receives and prints one job at a time. Each job must not exceed 64K bytes.

### Multi Job Buffer

The printer is able to continuously receive print jobs, compiling and printing other jobs at the same time. It acts much like a “print buffer” to maximize the performance of the host and the printer.



When using the RS232 Serial interface, the Multi Job Buffer uses either the **Ready/Busy** with **DTR** (pin 20) or **X-On/X-Off** flow control protocols. See these sections for more details. With an empty receiving buffer, the status of **DTR** is “high” (or an **X-On** status if using **X-On/X-Off**), meaning the printer is ready to receive data. When the receive buffer is holding 62K bytes of data (2K bytes from being full), **DTR** will go “low” (or an **X-Off** is sent) indicating the printer can no longer receive data. This condition is called “Buffer Near Full” (see figure below).



The receiving buffer will not be able to receive more data again until a “Buffer Available” condition occurs. This takes place when the receiving buffer has emptied so that only 56K bytes of data are being held (8K bytes from being full). At this time, **DTR** will go “high” or an **X-On** is sent to tell the host that it can again receive data.

All printer error conditions (i.e., label out, ribbon out) will cause the printer to go busy (**DTR** “low” or **X-Off**) until the problem is corrected and the printer is placed on-line. The printer will also be busy if taken off-line from the front panel.

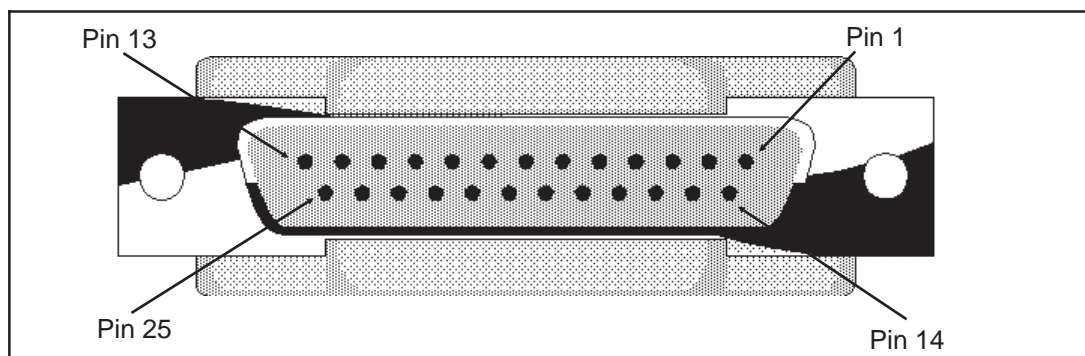
## RS232C SERIAL INTERFACE

### GENERAL SPECIFICATIONS

<b>Asynchronous ASCII</b>	Half-duplex communication
	Ready/Busy Hardware Flow Control Pin 20, DTR Control Pin 4, RTS Error Condition
	X-On/X-Off Software Flow Control
	Bi-Directional Communication (ENQ/Response)
<b>Data Transmission Rate</b>	2400, 4800, 9600 and 19200 bps
<b>Character Format</b>	1 Start Bit (fixed)
	7 or 8 data bits (selectable)
	Odd, Even or No Parity (selectable)
	1 or 2 Stop bits (selectable)

### ELECTRICAL SPECIFICATIONS

<b>Connector</b>	DB-25S (Female)
------------------	-----------------



<b>Cable</b>	DB-25P (Male), 50 ft maximum length. For cable configuration, refer to Cable Requirements appropriate to the RS232C protocol chosen.
<b>Signal Levels</b>	High = +5V to +12V Low = -5V to -12V

## PIN ASSIGNMENTS

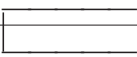
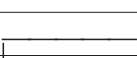
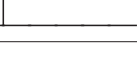
### RS232C Interface Signals

PIN	DIRECTION	SIGNAL DEFINITION
1	Reference	FG (Frame Ground)
2	To Host	TD (Transmit Data) - Data from the printer to the host computer. Sends X-On/X-Off characters or status data (Bi-Directional protocol).
3	To Printer	RD (Receive Data) - Data to the printer from the host computer.
4	To Host	RTS (Request to Send) - Used with Ready/Busy flow control to indicate an error condition. RTS is high and remains high unless the print head is open (in this case, RTS would return to the high state after the print head is closed and the printer is placed back on-line) or an error condition occurs during printing (e.g., ribbon out, label out).
5	To Printer	CTS (Clear to Send) - When this line is high, the printer assumes that data is ready to be transmitted. The printer will not receive data when this line is low. If this line is not being used, it should be tied high (to pin 4).
6	To Printer	DSR (Data Set Ready) - When this line is high, the printer will be ready to receive data. This line must be high before data is transmitted. If this line is not being used, it should be tied high (to pin 20).
7	Reference	SG (Signal Ground)
20	To Host	DTR (Data Terminal Ready) - This signal applies to Ready/Busy flow control. The printer is ready to receive data when this pin is high. It goes low when the printer is off-line, either manually or due to an error condition, and while printing in the Single Job Buffer mode. It will also go low when the data in the buffer reaches the Buffer Near Full level.

## READY/BUSY FLOW CONTROL

Ready/Busy is the hardware flow control for the serial interface on the XL printers. By raising/lowering the voltage level on Pin 20 of the RS232 port, the printer notifies the host when it is ready to receive data. Pin 4 (**RTS**) and pin 20 (**DTR**) are the important signals on the printer for this method of flow control. The host must be capable of supporting this flow control method for it to function properly.

### Cable Requirements

HOST	INTERCONNECTION	PRINTER
FG	←————→	1 FG (Frame Ground)
TD	————→	3 RD (Receive Data)
		4 RTS (Request to Send)
		5 CTS (Clear to Send)
		6 DSR (Data Set Ready)
*	←————→	20 DTR (Data Terminal Ready)
SG	←————→	7 SG (Signal Ground)

### Data Streams

Once the flow control method has been chosen for the RS232C interface, the data stream must be sent in a specific manner. The **STX** and **ETX** control characters must frame the data stream.

<STX> <ESC>A .. Job#1 .. <ESC>Z<ETX> <STX> <ESC>A .. Job#n .. <ESC>Z<ETX>

*NOTE: All characters, including STX, ESC and ETX are in ASCII.*

### X-On/X-Off FLOW CONTROL

**X-On/X-Off** flow control must be used whenever hardware (Ready/Busy) flow control is not available or desirable. Instead of a voltage going high/low at pin 20, control characters representing “Printer Ready” (**X-On** = 11 hexadecimal) or “Printer Busy” (**X-Off** = 13 hexadecimal) are transmitted by the printer on pin 2 (Transmit Data) to the host. In order for this method of flow control to function correctly, the host must be capable of supporting it. **X-On/X-Off** operates in a manner similar to the function of pin 20 (**DTR**) as previously explained. When the printer is first powered on and goes on-line, an **X-On** is sent out. In the Single Job Buffer mode, when the printer receives a viable job, it transmits an **X-Off** and begins printing. When it is done printing, it transmits an **X-On**. In the Multi Job Buffer mode, the printer sends an **X-Off** when the “Buffer Near Full” level is reached and a **X-On** when the data level of the buffer drops below the “Buffer Available” mark. When the printer is taken off-line manually, it transmits an **X-Off** indicating it cannot accept data. When it is placed back on line manually, it sends an **X-On**, indicating it is again available for receipt of data. If an error occurs during printing (paper out, ribbon out), the printer sends nothing in the Single Job Buffer mode since the last character transmitted was an **X-Off**. When the error is cleared and the printer resumes printing, no **X-On** is sent until the current job is completed and the printer is once again ready to receive the next job. If it is in the Multi Job Buffer mode, it sends an **X-Off** as soon as an error condition is detected. When the error is cleared and the printer is placed back on-line, it transmits an **X-On** indicating it is again ready to accept data.

Upon power up if no error conditions are present, the printer will continually send **X-On** characters at five millisecond intervals until it receives a transmission from the host.

**Cable Requirements**

HOST	INTERCONNECTION	PRINTER
FG	←————→	1 FG (Frame Ground)
RD	←————→	2 TD (Transmit Data)
TD	————→	3 RD (Receive Data)
		4 RTS (Request to Send)
		5 CTS (Clear to Send)
		6 DSR (Data Set Ready)
		20 DTR (Data Terminal Ready)
SG	←————→	7 SG (Signal Ground)

**Data Streams**

The data streams for **X-On/X-Off** are constructed in the same way as they are for Ready/Busy flow control. The **STX** and **ETX** control characters must frame the data stream. (NOTE: All characters, including **STX**, **ESC** and **ETX** are in ASCII).

Example: <STX><ESC>A . . Job#1 . . <ESC>Z<ETX>

**BI-DIRECTIONAL COMMUNICATIONS**

This is a two-way communications protocol between the host computer and the printer, thus enabling the host to check printer status. When this protocol is selected, there is no busy signal from the printer (pin 20, **DTR**, is always high). The host must request the complete status from the printer, including ready/busy. Whenever the host requests printer status, it transmits an **ENQ** to the printer and the printer will respond with its status within five milliseconds. If printing, it will respond upon finishing the current label, then resume printing. In order for this protocol to work properly, pin 6 (**DTR**) and pin 5 (**CTS**) must be held high by the host. One way to ensure these pins are always in the correct state is to make no connection to them in the interface cable, or preferably, tie pin 20 (**DTR**) to pin 6 (**DSR**) and pin 4 (**RTS**) to pin 5 (**CTS**) at the printer end of the cable.

**Cable Requirements**

HOST	INTERCONNECTION	PRINTER
FG	←————→	1 FG (Frame Ground)
RD	←————→	2 TD (Transmit Data)
TD	————→	3 RD (Receive Data)
SG	←————→	7 SG (Signal Ground)



If a **CAN** (18 hexadecimal) is received by the printer, it will cancel the current print job and clear all data from the receive buffer.

### Status Response

The Bi-Com protocol is an advanced version of bi-directional communications where the printer can also report the number of labels remaining to be printed for the current print job. Upon receipt of an **ENQ** command, the printer responds with nine bytes of status information bounded by an **STX/ETX** pair. The Bi-Com protocol works only in the Multi Job Buffer mode. The status information is defined as follows:

<STX>{ 2 Byte ID}{1 Status Byte}{6 Byte Label Remaining}<ETX>

**ID** - This is a two byte number identifying the current print job ID. The print job ID is defined using the <**ESC**>**ID** Job ID command transmitted with the print job (see Job ID Store in the command listing for more information on how to use this command). The range is from 00 to 99.

**Status** - A single byte defining the current status of the printer (see the Status Byte Definition table on page 6-8).

**Label Remaining** - Six bytes defining the number of labels remaining in the current print job. The range is from 000000 to 999999 labels.

If an **ENQ** is received after the print job specified in the ID bytes has been completed, or there is no data in the buffer, the printer will respond with two “space” characters (20 hexadecimal) for the ID number and six “zero” characters (30 hexadecimal) in the Remaining Labels bytes.

If a **CAN** (18 hexadecimal) command is received, it will stop the print job and clear all data from the receive and print buffers. A delay of five milliseconds or more is required before any new data can be downloaded. The **CAN** command is effective immediately upon receipt, even if the printer is off-line or in an error condition. The printer will return an **ACK** (06 hexadecimal) if there is no printer error condition and a **NAK** (15 hexadecimal) if an error condition exists.

Upon receipt of a valid print job (<**ESC**>**A** . . . <**ESC**>**Z**), and **ACK** (06 hexadecimal) will be returned by the printer if there are no errors and a **NAK** (16 hexadecimal) if a printer error exists.

## Status Byte Definition, Bi-Com Protocol

ASCII	HEX	DEFINITION
<b>OFF-LINE</b>		
0	30	No Errors
1	31	Ribbon Near End
2	32	Buffer Near Full
3	33	Ribbon Near End and Buffer Near Full
<b>ON-LINE, WAITING FOR DATA</b>		
A	41	No Errors
B	42	Ribbon Near End
C	43	Buffer Near Full
D	44	Ribbon Near End and Buffer Near Full
<b>ON-LINE, PRINTING</b>		
G	47	No Errors
H	48	Ribbon Near End
I	49	Buffer Near Full
J	4A	Ribbon Near End and Buffer Near Full
<b>ON-LINE, WAITING TO DISPENSE A LABEL</b>		
M	4D	No Errors
N	4E	Ribbon Near End
O	4F	Buffer Near Full
P	50	Ribbon Near End and Buffer Near Full
<b>ON-LINE, COMPILING PRINT JOB</b>		
S	53	No Errors
T	54	Ribbon Near End
U	55	Buffer Near Full
V	56	Ribbon Near End and Buffer Near Full
<b>OFF-LINE, ERROR CONDITION</b>		
a	61	Receive Buffer Full
b	62	Head Open
c	63	Paper End
d	64	Ribbon End
e	65	Media Error
f	66	Sensor Error
g	67	Head Error
i	68	Memory Card Error
j	6A	Cutter Error
k	6B	Other Error Condition

## CENTRONICS PARALLEL INTERFACE

### ELECTRICAL SPECIFICATIONS

<b>Printer Connector</b>	AMP 57-40360 (DDK) or equivalent
<b>Cable Connector</b>	AMP 57-30360 (DDK) or equivalent
<b>Cable Length</b>	10 ft or less
<b>Signal Level</b>	High = +2.4V to +5.0V Low = 0V to -0.4V

### DATA STREAMS

Single Job Buffer: ***The Single Job Buffer mode is not available when using the Centronics interface.***

Multi Job Buffer: <ESC>A . . Job#1 . . <ESC>Z<ESC>A . . Job#n . . <ESC>Z

*Note that for parallel communications, the STX and ETX characters are not required .*

### Centronics Parallel Interface Pin Assignments

PIN	SIGNAL	DIRECTION	PIN	SIGNAL	DIRECTION
1	STROBE	To Printer	19	STROBE Return	Reference
2	DATA 1	To Printer	20	DATA 1 Return	Reference
3	DATA 2	To Printer	21	DATA 2 Return	Reference
4	DATA 3	To Printer	22	DATA 3 Return	Reference
5	DATA 4	To Printer	23	DATA 4 Return	Reference
6	DATA 5	To Printer	24	DATA 5 Return	Reference
7	DATA 6	To Printer	25	DATA 6 Return	Reference
8	DATA 7	To Printer	26	DATA 7 Return	Reference
9	DATA 8	To Printer	27	DATA 8 Return	Reference
10	ACK	To Host	28	ACK Return	Reference
11	BUSY	To Host	29	BUSY Return	Reference
12	PE	To Host	30	PE Return	Reference
13	SELECT	To Host	31		
14			32	FAULT	To Host
15			33		
16			34		
17	FG	Frame Ground	35		
18	+5V (Z=24K ohm)		36		

## ACCESSORY (EXT) CONNECTOR

---

The Accessory (or EXT) connector on the XL printer rear panel is intended for use with the external rewinder or stacker.

### PIN ASSIGNMENTS

PIN	DIRECTION	SIGNAL DESCRIPTION
1		No Connection
2	Reference	Signal Ground
3	To Rewinder	Enables the Rewinder.
4		No Connection
5	To Printer	Full Switch - Stops the printer when the stacker or rewinder is full.
6	To Stacker	Enables the stacker.
7		No Connection.
10		No Connection.
12	To Host	+24V - Used to power accessory items.
13	To Host	Vcc - +5V
14	Reference	Frame Ground

## SECTION 7.

# TROUBLESHOOTING

---

This section has been devised to help you if you are unable to produce output on the XL Series printers. Use this section to make sure the basics have been checked before deciding you are unable to proceed any further. The section is divided into three parts:

- Initial Checklist
- Centronics Parallel Interface
- RS232C Serial Interface

### INITIAL CHECKLIST

---

1. Is the printer powered up and ON-LINE?
2. Is the ERROR light on the front panel OFF? If this light is ON, it may mean the print head assembly is open or another error condition is present.
3. Is the Label Hold-Down and Print Head Assembly in the down and latched position?

### USING THE CENTRONICS (PARALLEL) INTERFACE

---

1. Is the IBM parallel printer cable connected securely to your parallel port (DB-25S Female) on the PC and to the Centronics connector on the printer?
2. Is there more than one parallel interface port on your PC (LPT1, LPT2, etc.)? If so, make sure you are sending data out the correct port.
3. When you send the print job to the printer, and it does not respond, do you get an error message on your PC that says "Device Fault" or something similar?

This may mean that the computer doesn't know the printer is there. Verify that:

- A. Both ends of the cable are securely inserted into their respective connectors.
- B. The printer is ON-LINE.
- C. The cable is not defective. There are other things that can cause this error message on your computer, but at this stage, a defective cable may be one of the reasons.

4. When you send the print job to the printer and it does not respond, and there is no error message on the PC:

**A.** Check your data stream for some of the basics. Is your job framed as follows?

`<ESC>A—DATA—<ESC>Z`

**B.** Verify that you've included all required parameters in the data stream.

**C.** Verify the following:

- You have not typed a "0" (zero) for an "O" (letter) or vice-versa.
  - You have not missed any `<ESC>` characters where they're needed.
  - Make sure all printer command codes are capital letters.
  - Your protocol codes are set for Standard or Non-Standard and your data stream is consistent with these.
5. If you've checked all of the above and the printer still isn't printing, you may want to try a Receive Buffer Hex Dump to determine what (if anything) the printer is receiving from your computer. See Printing Test Labels in Section 3, page 17.

The Centronics port is now listening for incoming data. Send your print job. The rinter will now print (only once) a Hexadecimal (Hex) Dump of everything it received from the host computer. Each 2-digit hexadecimal character represents a character the printer received. It may be tedious, but now you can analyze and troubleshoot the data stream.

6. While checking the Hex Dump printout, if you notice 0D 0A (Carriage Return and Line Feed) characters throughout. The command string should be continuous and nor CR or LF characters are allowed between the Start Command (`<ESC>A`) and the Stop Command (`<ESC>Z`). If you are using BASIC, it may be adding these characters automatically as the line wraps. Adding a "width" statement to your program can help to suppress these extra 0D 0A characters by expanding the line length up to 255 characters. See the beginning of Section 5: Command Codes for details on writing a program in BASIC.

If you're not programming in BASIC, check to see if you have an equivalent statement in the language you're using to suppress extra carriage returns and line feeds from your data being sent out to the printer. We want the data stream to be one complete line going to the printer.

## USING THE RS232C (SERIAL) INTERFACE

---

1. Is the RS232C Serial cable connected securely to your serial port on the PC (DB- 25S Male) and to the RS232C connector on the printer?
2. Is the cable defective? At the very least, you should be using a “Null Modem Cable,” which crosses pins in a specific manner. This should enable your printer to print. But we recommend that you eventually use a cable built to specifications as described in *Section 6. Interface Specifications*.
3. Check for obvious errors in the data stream. Remember that all print jobs for serial data must be framed by an **STX** and **ETX**. Again, see Section 6 if necessary.
4. If after sending your job to the printer, it only “beeps” indicating a “framing error” message, you may have a configuration problem. There may be some inconsistencies with the Baud Rate, Parity, Data Bits, or Stop Bits in relation to your host computer. If you are confused as to what the printer’s current RS232 settings are, you may choose the SATO defaults (all DIP switches in the OFF position) to achieve 9600 baud, no parity, 8 databits, and 1 stop bit.

## ERROR SIGNALS

LED	LCD MESSAGE <sup>(1)</sup>	AUDIBLE BEEP	ERROR CONDITION	TO CLEAR
Error On	Machine Error	1 Long	Machine Error	Cycle power on/off
Error On	EEPROM Error	1 Long	EEPROM Read/Write	Cycle power on/off
Error On	Head Error	3 Short	Print Head is damaged	Replace Print Head Cycle power on/off
Error On	Sensor Error	3 Short	Media wandering Mis-selected sensor type	Check media guides Cycle power on/off
Error Blinks	Card R/W Error	1 Long	Memory Card Read/Write	Format Memory Card Cycle power on/off
Error Blinks	Card Low Battery	1 Long	Memory Card Battery Low	Replace MC battery Cycle power on/off
Error Blinks	Head Open	3 Short	Head Open	Close head lever
Error On Line Blinks	Parity Error	3 Short	RS232 Parity Error	Cycle power on/off
Error On Line Blinks	Overrun Error	3 Short	RS232 Overrun Error	Cycle power on/off
Error On Line Blinks	Framing Error	3 Short	RS232 Framing Error	Cycle power on/off
Error On Line Blinks	Buffer Full	3 Short	Buffer Overflow	Cycle power on/off
Error Blinks Label On	Paper End	3 Short	Media End Mis-selected media type	Replinish media Select correct media type Open/close Head Lever Open/close Media Hold-down
Error Blinks	Ribbon End	3 Short	Ribbon End Ribbon Broken	Replace Ribbon Open/close Head Lever Open/close Media Hold-down
Error Blinks	Media Error	3 Short	Media pitch is different that specified by command	Install proper media Open/close Head Lever
Error Blinks	Stacker Full	3 Short	Stacker is full of cut media	Empty Stacker
Error Blinks	Rewinder Full	3 Short	Rewinder is full	Remove roll from rewinder
Error Blinks	Cutter Error	3 Short	Cutter is jammed	Clear Cutter Cycle power on/off
Error Blinks	Cutter Sensor Error	3 Short	Media in cutter sensor Wrong cutter sensor position	Remove mdeia from cutter sensor Select correct sensor



# APPENDIX A.

## COMMAND CODE QUICK REFERENCE

INSTRUCTION	DESCRIPTION	PAGE									
<b>A</b>	<b>Start Code.</b> Begins all print jobs.	Page 5-63									
<b>A1</b>	<b>Media Size.</b>	Page 5-46									
<b>A(space)Z</b>	<b>Form Feed.</b> Feeds a blank tag or label.	Page 5-35									
<b>A3H-aaaa Vbbbb</b>	<b>Base Reference Point.</b> Establishes a new base reference point position in dots for the current label. Units of measurement are dots.	Page 5-17									
<table border="1"> <tr> <td></td><td><b>XL400</b></td><td>XL410</td></tr> <tr> <td>aaaa = Horizontal Print Offset</td><td>0800</td><td>1200</td></tr> <tr> <td>bbbb = Vertical Print Offset</td><td>0001-1920</td><td>0001-2880</td></tr> </table>				<b>XL400</b>	XL410	aaaa = Horizontal Print Offset	0800	1200	bbbb = Vertical Print Offset	0001-1920	0001-2880
	<b>XL400</b>	XL410									
aaaa = Horizontal Print Offset	0800	1200									
bbbb = Vertical Print Offset	0001-1920	0001-2880									
<b>Babbcccd</b>	<b>Bar Codes.</b> Prints a 1:3 ratio bar code. - = Optional character. If included, will shift reference point in negative direction a= 0 Codabar 1 Code 39 2 Interleaved 2 of 5 (I 2/5) 3 UPC-A/EAN-13 4 EAN-8 5 reserved 6 reserved 7 reserved 8 reserved 9 reserved A reserved B reserved C Code 93 D reserved E UPC-E F Bookland G Code 128 I UCC 128 bb = Number of dots (01-12) for narrow bar and narrow space ccc = Bar height in dots (001-600) d = UCC 128 only 0 No human readable text 1 Human readable at top 2 Human readable at bottom	Page 5-11									

INSTRUCTION	DESCRIPTION	PAGE						
<b>BDabbcccd</b>	<p><b>Bar Codes.</b> Prints a 2:5 ratio bar code, except for UPC, EAN, Code 128 and UCC128 symbols, which are fixed width bar codes. For values a, bb, ccc and d see instructions for Babbcccd.</p> <p>For UPC/EAN bar codes, this command puts descender bars and human readable text below the symbol.</p>	Page 5-11						
<b>BTabbccdde</b>	<p><b>Bar Codes - Variable Ratio.</b> provides the ability to print a bar code with a ratio other than those specified through the standard bar code commands (B, BD, and D).</p> <p>a = Bar code option:</p> <p>0 Codabar</p> <p>1 Code 39</p> <p>2 Interleaved 2 of 5</p> <p>bb = Narrow space in dots (01-99)</p> <p>cc = Wide space in dots (01-99)</p> <p>dd = Narrow bar in dots (01-99)</p> <p>ee = Wide bar in dots (01-99)</p>	Page 5-14						
<b>BWaabbb</b>	<p><b>Bar Codes - Expansion.</b> Works together with the BT command to specify an expansion factor and the bar code height for the particular symbol being printed.</p> <p>aa = Expansion factor by which the width of all bars and spaces is increased (01-12)</p> <p>bbb = Bar height by dot (005-600 dots)</p>	Page 5-13						
<b>C</b>	<b>Repeat Label.</b> Prints a duplicate of the last label printed.	Page 5-54						
<b>CSa</b>	<b>Print Speed Selection.</b> Specifies a unique print speed in in./sec. through software for a particular label.	Page 5-53						
<table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>a = Speed Setting</td><td>           5 = 5 ips            6 = 6 ips            7 = 7 ips            8 = 8 ips         </td><td>           4 = 4ips            5 = 5 ips            6 = 6 ips         </td></tr> </tbody> </table>				XL400	XL410	a = Speed Setting	5 = 5 ips 6 = 6 ips 7 = 7 ips 8 = 8 ips	4 = 4ips 5 = 5 ips 6 = 6 ips
	XL400	XL410						
a = Speed Setting	5 = 5 ips 6 = 6 ips 7 = 7 ips 8 = 8 ips	4 = 4ips 5 = 5 ips 6 = 6 ips						
<b>Dabbcccd</b>	<p><b>Bar Codes.</b> Prints 1:2 ratio bar code. For UPC and EAN bar codes, this will add descender bars. For values a, bb, ccc and d see instructions for Babbcccd.</p>	Page 5-11						
<b>Eaaa</b>	<p><b>Line Feed.</b> Provides the ability to print multiple lines of the same character size without specifying a new print position for each line.</p> <p>aaa = Number of dots (1-999) between the bottom of the characters on one line to the top of the characters on the next line.</p>	Page 5-44						
<b>EJ</b>	<b>Tag Feed.</b> Causes a Tag to be fed out of the printer. If the cutter is enabled, it will feed and cut the tag.	Page 5-64						

INSTRUCTION	DESCRIPTION	PAGE															
<b>Faaaabcccc ddee</b>	<b>Sequential Numbering.</b> Allows the printing of sequencing fields (text, bar codes) where all incrementing is done within the printer. aaaa = Number of times to repeat the same data (0001-9999) b = Plus or minus symbol (+ for increments; - for decrements) cccc = Value of step for sequence (001-9999) dd = No. of digits for sequential numbering (01-99, default = 8) ee = No. of digits free from sequential numbering (01-99, default = 0)	Page 5-61															
<b>FWaaHbbbb</b>	<b>Horizontal Line.</b> Prints a horizontal line. Units of measurement are dots.	Page 5-42															
<table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>aa = Width of Horizontal Line</td><td colspan="2">01 to 99</td></tr> <tr> <td>bbbb = Length of Horizontal Line</td><td>0001-0800</td><td>0001-1200</td></tr> </tbody> </table>				XL400	XL410	aa = Width of Horizontal Line	01 to 99		bbbb = Length of Horizontal Line	0001-0800	0001-1200						
	XL400	XL410															
aa = Width of Horizontal Line	01 to 99																
bbbb = Length of Horizontal Line	0001-0800	0001-1200															
<b>FWaabbVccc Hdddd</b>	<b>Box.</b> Prints a box. For values aa, bbbb, cc, and dddd, see instructions for horizontal and vertical lines. Units of measurement are dots.	Page 5-42															
<table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>aa = Width of Horizontal Side</td><td colspan="2">01 to 99</td></tr> <tr> <td>bb = Width of Vertical Side</td><td colspan="2">01 to 99</td></tr> <tr> <td>cccc = Length of Vertical Side</td><td>0001-1920</td><td>0001-2880</td></tr> <tr> <td>dddd = Length of Horizontal Side</td><td>0001-0800</td><td>0001-1200</td></tr> </tbody> </table>				XL400	XL410	aa = Width of Horizontal Side	01 to 99		bb = Width of Vertical Side	01 to 99		cccc = Length of Vertical Side	0001-1920	0001-2880	dddd = Length of Horizontal Side	0001-0800	0001-1200
	XL400	XL410															
aa = Width of Horizontal Side	01 to 99																
bb = Width of Vertical Side	01 to 99																
cccc = Length of Vertical Side	0001-1920	0001-2880															
dddd = Length of Horizontal Side	0001-0800	0001-1200															
<b>FWccVddd</b>	<b>Vertical Line.</b> Prints a vertical line. Units of measurement are dots.	Page 5-42															
<table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>cc = Width of Vertical Line</td><td colspan="2">01 to 99</td></tr> <tr> <td>dddd = Length of Vertical Line</td><td>0001-1920</td><td>0001-2880</td></tr> </tbody> </table>				XL400	XL410	cc = Width of Vertical Line	01 to 99		dddd = Length of Vertical Line	0001-1920	0001-2880						
	XL400	XL410															
cc = Width of Vertical Line	01 to 99																
dddd = Length of Vertical Line	0001-1920	0001-2880															
<b>Gabbbccc(data)</b>	<b>Custom Graphics.</b> Allows the creation and printing of graphic images using a dot-addressable matrix. a = Specifies format of data stream to follow B Binary H Hexadecimal data = Data to describe the graphic image	Page 5-38															
<table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>bbb Horizontal Blocks</td><td>001 - 100</td><td>001 - 150</td></tr> <tr> <td>ccc Vertical Blocks</td><td>001 to 240</td><td>001 - 360</td></tr> </tbody> </table>				XL400	XL410	bbb Horizontal Blocks	001 - 100	001 - 150	ccc Vertical Blocks	001 to 240	001 - 360						
	XL400	XL410															
bbb Horizontal Blocks	001 - 100	001 - 150															
ccc Vertical Blocks	001 to 240	001 - 360															
<b>GPaaaaa</b>	<b>PCX File.</b> Downloads PCX file to the internal graphics image memory. aaaaa = No. of bytes to be downloaded (max DOS file size = 32K)	Page 5-40															

INSTRUCTION	DESCRIPTION	PAGE						
<b>Haaaa</b>	<b>Horizontal Position.</b> Specifies a field's horizontal location across the width of the label from the current base reference point. The units of measurement are dots.	Page 5-50						
	<table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>aaaa = New Horizontal Position</td><td>0001-0800</td><td>0001-1200</td></tr> </tbody> </table>		XL400	XL410	aaaa = New Horizontal Position	0001-0800	0001-1200	
	XL400	XL410						
aaaa = New Horizontal Position	0001-0800	0001-1200						
<b>la</b>	<b>Batch Separator.</b> generates a batch separator.	Page 5-16						
	a = 1 Prints the first tag 2mm longer. The following tag will be 2mm shorter. = 2 Prints an ink mark on the side of the first tag.							
<b>IDaa</b>	<b>Store Job ID.</b> Stores the Job ID number.	Page 5-41						
	aa = Job ID number assigned (01-99)							
<b>Kab90cc</b>	<b>Recall Custom Designed Characters.</b> Recalls for printing a custom character stored by the Tabcc(data) command.	Page 5-38						
	a = 1 16 x 16 matrix 2 24 x 24 matrix b = Indicates the format that data stream was stored in B Binary H Hexadecimal bb = Memory location where the character was stored. Valid locations are 21 to 52 or "I" to "R" in hex values.							
<b>Laabb</b>	<b>Character Expansion.</b> Expands characters in both directions.	Page 5-21						
	aa = Multiple to expand horizontally (01-12) bb = Multiple to expand vertically (01-12)							
<b>LD,a,b,c,d,e,f,g,i</b>	<b>Download Protocol Command Codes.</b> Downloads a user defined set of Alternate Protocol Command Codes. See Appendix E for details on the proper usage of this command.	Page 5-87						
<b>OA</b>	<b>Font type.</b> Specifies the OCR-A font with dot matrix.	Page 5-28						
	<table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>OA Font Matrix</td><td>15W x 22H</td><td>22W x 33H</td></tr> </tbody> </table>		XL400	XL410	OA Font Matrix	15W x 22H	22W x 33H	
	XL400	XL410						
OA Font Matrix	15W x 22H	22W x 33H						
<b>OB</b>	<b>Font type.</b> Specifies the OCR-B font dot matrix.	Page 5-28						
	<table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>OB Font Matrix</td><td>20 W x 24H</td><td>30W x 36H</td></tr> </tbody> </table>		XL400	XL410	OB Font Matrix	20 W x 24H	30W x 36H	
	XL400	XL410						
OB Font Matrix	20 W x 24H	30W x 36H						
<b>Paa</b>	<b>Character Pitch.</b> Designates the number of dots between characters.	Page 5-23						
	aa = Number of dots between characters (01-99)							

INSTRUCTION	DESCRIPTION	PAGE						
<b>Qaaaaaa</b>	<b>Print Quantity.</b> Specifies the total number of labels to print. aaaaaa = Total number of labels to print for the job (000001-999999)	Page 5-52						
<b>Tabcc(data)</b>	<b>Store Custom Designed Characters.</b> To create and store custom characters or images in the printer's volatile memory. See Kab90cc to recall the character for printing. a = 1 16 x 16 matrix 2 24 x 24 matrix b = Specifies data stream format to follow B Binary H Hexadecimal cc = Memory location to store the character. Valid locations are 21 to 52 or "I" to "R" in hex values. (data)= Data to describe the character.	Page 5-19						
<b>Vbbbb</b>	<b>Vertical Position.</b> Specifies a field's vertical location down the length of the label from the current base reference point. Units of measurement are dots.	Page 5-50						
<table border="1"> <tr> <td></td><td><b>XL400</b></td><td><b>XL410</b></td></tr> <tr> <td>bbbb = New Vertical Position</td><td>0001-1920</td><td>0001-2880</td></tr> </table>				<b>XL400</b>	<b>XL410</b>	bbbb = New Vertical Position	0001-1920	0001-2880
	<b>XL400</b>	<b>XL410</b>						
bbbb = New Vertical Position	0001-1920	0001-2880						
<b>WDHaaaaVbbbb XccccYdddd</b>	<b>Copy Image Area.</b> To copy an image to another location of the label. aaaa = Horizontal position of the top left corner of image area bbbb = Vertical position of the top left corner of image area cccc = Horizontal length of image area dddd = Vertical length of image area	Page 5-26						
<b>XBa</b>	<b>Font type.</b> Specifies the 48W x 48L dot matrix font (including descenders). a = 0 Disables auto-smoothing of font 1 Enables auto-smoothing if expansion is greater than 3	Page 5-32						
<b>XCS,</b>	<b>Font Type.</b> Specifies the 24W x 24H dot matrix Care Symbol character font.	Page 5-34						
<b>XCL,</b>	<b>Font Type.</b> Specifies the 36W x 36H dot matrix Care Symbol character font.	Page 5-34						
<b>XLa</b>	<b>Font type.</b> Specifies the 48W x 48L dot matrix font (including descenders). a = 0 Disables auto-smoothing of font 1 Enables auto-smoothing if expansion is greater than 3	Page 5-32						
<b>XM</b>	<b>Font type.</b> Specifies the 24W x 24H dot matrix font (including descenders).	Page 5-28						
<b>XS</b>	<b>Font type.</b> Specifies the 17W x 17H dot matrix font (including descenders).	Page 5-28						

INSTRUCTION	DESCRIPTION	PAGE									
<b>XU</b>	<b>Font type.</b> Specifies the 5W x 9L dot matrix font (including descenders).	Page 5-28									
<b>Z</b>	<b>Stop Code.</b> Ends all print jobs.	Page 5-63									
<b>%a</b>	<b>Rotate - Fixed Base Reference Point.</b> Rotates printing in 90° increments without changing the base reference point. <ul style="list-style-type: none"> <li>a = 0 Sets print to normal direction</li> <li>1 Sets print to 90° CCW</li> <li>2 Sets print to 180° rotated (upside down)</li> <li>3 Sets print to 270° CCW (90° CW)</li> </ul>	Page 5-59									
<b>\$a,b,c,d</b>	<b>Vector font.</b> Specifies printing of the unique SATO vector font. <ul style="list-style-type: none"> <li>a = A Helvetica Bold (proportional spacing)</li> <li>B Helvetica Bold (fixed spacing)</li> <li>b = Font width (50-999 dots*)</li> <li>c = Font height (50-999 dots*)</li> <li>d = Font variation (0-9) as follows: <ul style="list-style-type: none"> <li>0 Standard</li> <li>1 Standard open (outlined)</li> <li>2 Gray (mesh) pattern 1</li> <li>3 Gray (mesh) pattern 2</li> <li>4 Gray (mesh) pattern 3</li> <li>5 Standard, shadow 1</li> <li>6 Standard, shadow 2</li> <li>7 Standard mirror image</li> <li>8 Italic</li> <li>9 Italic open (outlined)</li> </ul> </li> </ul>	Page 5-30									
<b>\$(data)</b>	<b>Data for Vector font.</b>	Page 5-30									
<b>#Ea</b>	<b>Print Darkness.</b> Specifies a new print darkness setting. The lightest setting is "1".  <table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>a = Print Darkness</td><td colspan="2">1, 2 or 3</td></tr> </tbody> </table>		XL400	XL410	a = Print Darkness	1, 2 or 3		Page 5-49			
	XL400	XL410									
a = Print Darkness	1, 2 or 3										
<b>(aaaa,bbbb</b>	<b>Reverse Image.</b> Reverse image from black to white and vice versa. Units of measure are dots.  <table border="1"> <thead> <tr> <th></th><th>XL400</th><th>XL410</th></tr> </thead> <tbody> <tr> <td>aaaa = Horizontal Length</td><td>0001-0800</td><td>0001 - 1200</td></tr> <tr> <td>bbbb = Vertical Length</td><td>0001-1920</td><td>0001-2880</td></tr> </tbody> </table>		XL400	XL410	aaaa = Horizontal Length	0001-0800	0001 - 1200	bbbb = Vertical Length	0001-1920	0001-2880	Page 5-57
	XL400	XL410									
aaaa = Horizontal Length	0001-0800	0001 - 1200									
bbbb = Vertical Length	0001-1920	0001-2880									
<b>&amp;</b>	<b>Store Form Overlay.</b> Stores a specified label image in the printer's volatile form overlay memory.	Page 5-37									
<b>/</b>	<b>Recall Form Overlay.</b> Recalls the label image from the printer's form overlay memory for printing.	Page 5-36									

INSTRUCTION	DESCRIPTION	PAGE
<b>0 (zero)</b>	<b>Replace Data (Partial Edit).</b> Provides the ability to replace a specified area of the previous label with new data.	Page 5-55
<b>*a</b>	<b>Clear Print Job(s) and Memory.</b> Clears individual memory and buffer areas. a = Memory section to be cleared T Custom character memory, printer & Form overlay memory, printer X Clears all memory all memory and buffers	Page 5-25
<b>@ ,nn...n</b>	<b>Off-Line/Pause.</b> Signals the printer to go off-line after the completion of a print job. nn..n = 32 ASCII character message to be displayed.	Page 5-47
<b>#abbb</b>	<b>Print &amp; Cut Offset.</b> Specifies amount of cut offset. a = + Positive offset (feed direction) - Negative offset bbbb = Amount of offset (000 to 400)	Page 5-48

INSTRUCTION	DESCRIPTION	PAGE
<b>CALENDAR OPTION COMMANDS</b>		
<b>WA(elements)</b>	<p><b>Calendar Print.</b> Prints the date and/or time field (up to 16 characters) from the printer's internal clock. Use slash to separate date elements and colon to separate time elements.</p> <p>elements =   YY    Year                        MM    Month                        DD    Day                        hh    Hour                        mm    Minutes</p>	Page 5-68
<b>WPabbb</b>	<p><b>Calendar Increment.</b> To add a value to the printer's current date and/or time. Does not change the printer's internal time setting.</p> <p>a     =   Y   Years                 M   Months                 D   Days                 h   Hours</p> <p>bbb   =   Numeric data, Years (1-9), Months (01-99), Days (001-999), Hours (001-999).</p>	Page 5-66
<b>WTaabbccdde</b>	<p><b>Calendar Set.</b> To set the time and date of the printer's internal clock.</p> <p>aa    =   Year (00-99)          bb    =   Month (01-12)          cc    =   Day (01-31)          dd    =   Hour (00-23)          ee    =   Minute (00-59)</p>	Page 5-70



INSTRUCTION	DESCRIPTION	PAGE
<b>MEMORY CARD OPTION COMMANDS</b>		
<b>BJ(aa..abb..b</b>	<b>Start TrueType Font Storage.</b> Prepares the Memory Card to accept TrueType font data. aa...a = 40 byte font description bb...b = 10 byte date field	Page 5-76
<b>BJDccccccddd ee...e</b>	<b>Download TrueType Font Data.</b> Downloads the TrueType font data to the memory area specified. cccc = Memory Offset (hexadecimal) ddd = Data size in bytes (max = 2000) ee...e = Font data to be downloaded	Page 5-76
<b>BJ)</b>	<b>End TrueType Font Storage.</b> Ends the TrueType font storage process	Page 5-76
<b>BJFaaaaaaaa</b>	<b>Initialize Memory Card.</b> Initializes the Memory Card and formats it for use. Should be preceded by the Slot Select command for the card to be initialized. aaaaaaaa = 8 character alphanumeric password	Page 5-84
<b>BJRaabbccdd eeeeff..f</b>	<b>TrueType Font Recall.</b> Recalls a previously stored TrueType font for use. aa = Font ID (01-09) bb = Horizontal Expansion (01-12) cc = Vertical Expansion (01-12) dd = Character pitch (01-99) eeee = Number of characters ff...f = Data to be printed using font	Page 5-75
<b>BJS</b>	<b>Memory Card Status.</b> Reports the status of the currently active Memory Card to the host by printing a status label.	Page 5-86
<b>CCa</b>	<b>Slot Select.</b> Selects the Memory Card slot for all following Memory Card commands. a = 1 Slot 1 b = 2 Slot 2	Page 5-85
<b>EXa</b>	<b>Expand Memory Area.</b> Expands the memory area used by the printer to image the label. a = 0 Return to using internal printer RAM 1 Use Memory Card in Slot 1 2 Use Memory Card in Slot 2	Page 5-73

INSTRUCTION	DESCRIPTION	PAGE
<b>Glabbbccdd ee...e</b>	<b>Store Custom Graphics.</b> Stores a graphic image in the memory card to be called later for printing on a label. a = Specifies format of data stream to follow B Binary H Hexadecimal bbb = Number of horizontal 8 x 8 blocks (001-248) ccc = Number of vertical 8 x 8 blocks (001-267 for 7" label) dd = Graphics storage number (01-99) ee...e = Data to describe the graphic image	Page 5-80
<b>GRaaa</b>	<b>Recall Custom Graphics.</b> Recalls for printing the graphic image stored by the GI command. aa = Storage number (001-999)	Page 5-79
<b>Plaa,bbbb, cc...c</b>	<b>Store PCX Graphics File.</b> Stores a PCX graphic file. aaa = Storage number (001-999) bbbb= Number of bytes in the file to be stored.	Page 5-83
<b>PYaaa</b>	<b>Recall PCX Graphics File.</b> Recalls a PCX graphics file. aaa = The storage number assigned to the file (001-999)	Page 5-82
<b>YR,aa /D,bb,cc...c</b>	<b>Recall Format/Field.</b> To recall a field from a format previously stored in the memory card. aa = Number of format to be recalled (01 to 99) bb = Number of field to be recalled (01-99) cc...c = Data to be placed in field.	Page 5-77
<b>YS,aa /Nbb,cc</b>	<b>Store Format/Field.</b> To store a field in a format in the memory card. aa = Format number bb = Field number (01-99) cc = Number of characters in the field	Page 5-78
<b>*a,bb</b>	<b>Clear Card Memory.</b> Clears individual memory and buffer areas. a = Memory section to be cleared G SATO graphicfiles (01-99) P PCX graphic file (01-99) F Stored formats (01-99) O TrueType fonts, memory card (01-09) bb = Storage number	Page 5-72

INSTRUCTION	DESCRIPTION	PAGE
<b>2-D BAR CODES</b>		
<b>BKaabbccdd eefffn...n</b>	<b>PDF417.</b> Prints PDF417 2-D symbols. aa = Minimum module dimension (03-09 dots). Will not print for values of 01, 02 or 10. bb = Minimum module pitch dimension (05-240 dots). Will not print for values of 01, 02, 03 or greater than 25. c = Security level (1-8). dd = Code words per line (01-30). If 00 is specified for dd <i>and</i> ee, printer will automatically optimize settings. ee = Rows/symbol (00 or 03). If 00 is specified for dd <i>and</i> ee, printer will automatically optimize settings. fff = Number of characters to be encoded (0001-2700) nn...n = Data to be printed.	Page 5-
<b>BUaaa,bbb, ccccc,dddd, ee...e</b>	<b>Maxicode.</b> Prints 2-D Maxicode symbols. aaa = Service class, numeric only (001-999). bbb = Country code, numeric only (001-999). ccccc = ZIP code, alphanumeric (000000-999999). dddd = Extended ZIP code, numeric only (0001-9999) ee...e = Low priority message, alphanumeric, 84 characters.	Page 5-
<b>BXaabbccdd eefffggh</b>	<b>Data Matrix - Data Format.</b> Specifies the format of the Data Matrix 2-D symbology. aa = Format ID (01-16, The values 07 and 17 will not be accepted) bb = Error correction level (00, 01, or 05-14, the values 02, 03 or ≥ 15 will not be accepted). cc = Horizontal cell size (03-12 dots/cell) dd = Vertical cell size (03-12 dots per cell) eee = Cells per line. Must use 000 for optimized symbol. fff = Cell lines. Must use 000 to optimize. g = Mirror image 0 Normal Print 1 Reverse Print hh = Guide cell thickness (01-15) 01 indicates normal type.	Page 5-
<b>DCxx...x</b>	<b>Data Matrix- Print Data.</b> Prints data using Data Matrix format specified in BX Data Format command. xx...x = Data to be printed. Cannot exceed 500 characters.	Page 5-1
<b>FXaaabccc dddeee</b>	<b>Data Matrix - Sequential Numbering.</b> Prints sequential numbered Data Matrix 2-D symbols. aaa = Number of duplicate labels (001-999) b = Increment or decrement + Increment - Decrement ccc = Increment/decrement steps (001-999) ddd = Sequential numbering start position (001-999). Referenced to left side. eee = Incremented data length (001-999). Measured from start position.	Page 5-1

# APPENDIX B.

## BAR CODE SPECIFICATIONS

### BAR CODE SYMBOLOGIES

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This section contains detailed information on the printing of bar codes on the XL Series printers. Information on printing the following bar code symbologies is provided:

- Codabar
- Code 39
- Interleaved 2 of 5
- UPC-A/EAN-13
- EAN-8
- Code 128
- UPC-E
- UPC Supplements (Bookland)
- UCC-128
- Data Matrix
- Maxicode
- PDF417

# Codabar

**Command Structure**

1:3 ratio <ESC>B0bbcccd..(data)..d  
 2:5 ratio <ESC>BD0bbcccd..(data)..d  
 1:2 ratio <ESC>D0bbcccd..(data)..d

bb = Width of narrow element in dots (01-12)  
 ccc = Bar height in dots (001-600)  
 d = Required Start and Stop character (A, B, C, or D)  
 (data) = Bar code data (alphanumeric)

**Character Set**

0-9, -, \$, :, /, +  
 A, B, C, D (Start/Stop characters)

## Density Table

Printer Model	Narrow/Wide Ratio	Value of "bb"	"X" Dimension (mils)	Density (char/inch)
XL410	1:3	01	3.3	25.0
	1:3	02	6.7	12.6
	2:5	01	6.7	13.6
	1:2	02	3.3	15.1
XL400	1:3	01	5.0	16.9
	1:3	02	10.0	8.5
	2:5	01	10.0	9.2
	1:2	02	5.0	10.2

**Example**

<ESC>H0400<ESC>V0025<ESC>B002100A12345B  
 <ESC>H0440<ESC>V0135<ESC>XS12345

**Notes**

You must add the appropriate (A, B, C or D) Start and Stop characters to the data string. The printer does not automatically add them when printing.



# Code 39

## Command Structure

1:3 ratio: <ESC>B1bbccc\* (data) \*  
 2:5 ratio: <ESC>BD1bbccc\* (data) \*  
 1:2 ratio: <ESC>D1bbccc\* (data) \*

bb = Width of narrow element in dots (01-12)  
 ccc = Bar height in dots (001-600)  
 \* = Required Start and Stop character (asterisk)  
 (data) = Bar code data (alphanumeric)

## Character Set

0-9, A-Z, Space, \$, %, +, -, ., /  
 \* (Start/Stop character)

## Density Table

Printer Model	Narrow/Wide Ratio	Value of "bb"	"X" Dimension (mils)	Density (char/inch)
XL410	1:3	01	3.3	18.8
	1:3	02	6.7	9.5
	2:5	01	3.3	10.3
	1:2	01	6.7	23.1
	1:2	02	3.3	11.5
XL400	1:3	01	5.0	12.7
	1:3	02	10.0	6.4
	2:5	01	10.0	7.0
	1:2	01	5.0	15.6
	1:2	02	10.0	7.8

## Example

<ESC>H0100<ESC>V0025<ESC>B103100\*CODE 39\*  
 <ESC>H0230<ESC>V0130<ESC>XS\*CODE 39\*

## Notes

You must add the "\*" Start/Stop characters to the data stream. The printer does not add them automatically.



# Interleaved Two of Five (I 2/5)

**Command Structure**

1:3 ratio: <ESC>B2bbccc (data)  
 2:5 ratio: <ESC>BD2bbccc (data)  
 1:2 ratio: <ESC>D2bbccc (data)

bb = Width of narrow element in dots (01-12)  
 ccc = Bar height in dots (001-600)  
 (data) = Bar code data (numeric); must be an even number of digits or else the printer will add a leading zero; start and stop code are provided by the printer

**Character Set** 0-9 (numeric only)

## Density Table

Printer Model	Narrow/Wide Ratio	Value of "bb"	"X" Dimension (mils)	Density (char/inch)
XL410	1:3	01	3.3	33.4
	1:3	02	6.7	16.7
	2:5	01	3.3	18.8
	1:2	01	6.7	21.4
	1:2	02	3.3	14.3
XL400	1:3	01	5.0	22.6
	1:3	02	10.0	11.3
	2:5	01	10.0	12.7
	1:2	01	5.0	14.5
	1:2	02	10.0	9.7

## Example

```
<ESC>H0100<ESC>V0100<ESC>B20310045676567
<ESC>H0140<ESC>V0210<ESC>XM45676567
```

## Notes

To add horizontal guard bars to the top and bottom of the bar code, use the Line and Box command (see page 5-42).



# UPC-A/EAN-13

## Command Structure

<ESC>B3bbccc (data)  
 <ESC>D3bbccc (data)  
 <ESC>BD3bbccc (data)

bb = Width of narrow element in dots (01-03)

ccc = Bar height in dots (001-600)

(data) = Bar code data (numeric); must be exactly 13 digits. For UPC-A, the first digit must be a zero and the last 11 digits are the actual UPC-A data followed by a check digit.

To select UPC-A, 11 digits of data is sent. The printer adds a "0" and automatically generates the check digit. If 12 digits of data are sent, the printer assumes an EAN-13 symbol and automatically generates the check digit. The last digit of the bar code data is a modulo 10 check digit. If 13 digits of data are sent to the printer, the check digit is not created and must be supplied by the programmer. It must be the last character in the 13 digit string and can be determined by using the calculations outlined below.

## Character Set

0-9 (numeric only)

## Density Table

Printer Model	Value of "bb"	Narrow Bar Width (mils)	Magnification Factor
XL410	02	6.7	Below Minimum
	03	10.0	75%
	04	13.3	100%
XL400	02	10.0	75%
	03	15.0	112%
	04	20.0	150%

## Notes

D3 provides guide bars that extend longer than the rest of the bar code. BD3 provides guide bars and the human readable text below the symbol.

## Example

<ESC>H0100<ESC>V0375<ESC>D30215001234567890





**Calculating the  
Mod 10 Check Digit**

If you wish to encode the UPC-A data "01234567890", follow these steps to find the correct check digit.

<b>ODD</b>	0		2		4		6		8		0	
<b>EVEN</b>		1		3		5		7		9		CD

1. First add all the numbers in the ODD positions.  
i.e.,  $0+2+4+6+8+0 = 20$
2. Multiply the result of Step 1 by 3.  
i.e.,  $20 \times 3 = 60$
3. Add up all the numbers in the EVEN positions.  
i.e.,  $1+3+5+7+9 = 25$
4. Add the result of Step 2 to that of Step 3.  
i.e.,  $60 + 25 = 85$
5. Subtract the result of Step 4 from the next highest increment of 10.  
i.e.,  $90 - 85 = 5$
6. The correct Modulo 10 check digit for the 11 digit string  
"01234567890" is 5.

# EAN-8

**Command Structure**    <ESC>B4bbccc (data)  
                                  <ESC>D4bbccc (data)

bb        =   Width of narrow element in dots (01-03)  
 ccc       =   Bar height in dots (001-600)  
 (data)   =   Bar code data (numeric); must be exactly 8 digits.

**Character Set**            0-9 (numeric only)

## Density Table

Printer Model	Value of "bb"	Narrow Bar Width (mils)	Magnification Factor
XL410	02	6.7	Below Minimum
	03	10.0	75%
	04	13.3	100%
XL400	02	10.0	75%
	03	15.0	112%
	04	20.0	150%

- Notes**
1. D4 provides guide bars that extend longer than the rest of the bar code and the human readable text below the symbol.
  2. The check digit is automatically calculated for EAN-8.

**Example**                    <ESC>H0400<ESC>V0375<ESC>BD4031001234567



# Code 128

**Command Structure**    <ESC>BGbbccdd (data)

bb    = Width of narrow element in dots (01-12)  
ccc    = Bar height in dots (001-600)  
dd    = Start code to specify initial subset of bar code data  
>G    Subset A Start code  
>H    Subset B Start code  
>I    Subset C Start code  
(data) = Includes bar code data and subset Shift codes; Shift codes are used to change the subset type within the bar code data.  
Shift codes:  
>E    Subset A Shift code  
>D    Subset B Shift code  
>C    Subset C Shift code

**Character Set**            See Code 128 Character Table on Page B-18

**Density Table**

Printer Model	Value of "bb"	"X" Dimension (mils)	Density (char/inch)	
			Subsets A, B	Subset C
XL410	01	3.3	27.3	54.7
	02	6.7	13.6	27.2
	03	10	9.1	18.3
XL400	01	5.0	18.2	36.5
	01	10.0	9.1	18.3
	03	15.0	13.8	12.2

**Example**

The following will start in Subset A for the characters "AB", shift to Subset B for "789", then shift to Subset C for "123456".

```
<ESC>H0200<ESC>V0550<ESC>BG03100>GAB>B789>C123456
<ESC>H0310<ESC>V655<ESC>XSAB789123456
```



# UPC-E

**Command Structure**    <ESC>BEbbccc (data)  
                               <ESC>DEbbccc (data)

bb        =   Width of narrow element in dots (01-03)  
 ccc       =   Bar height in dots (001-600)  
 (data)   =   Bar code data (numeric); must be exactly 6 digits

**Character Set**            0-9 (numeric only)

## Density Table

Printer Model	Value of "bb"	Narrow Bar Width (mils)	Magnification Factor
XL410	02	6.7	Below Minimum
	03	10.0	75%
	04	13.3	100%
XL400	02	10.0	75%
	03	15.0	112%
	04	20.0	150%

**Notes**                      Command DE provides guide bars that extend longer than the rest of the bar code.

**Example**                    <ESC>H0400<ESC>V0550<ESC>DE03100123456  
                                   <ESC>H0375<ESC>V0600<ESC>OB0  
                                   <ESC>H0408<ESC>V0655<ESC>OB123456



# Bookland (UPC/EAN Supplements)

**Command Structure**    <ESC>BFbbccc (data)

bb     =   Width of narrow element in dots (01-03)

ccc    =   Bar height in dots (001-600)

(data) =   Bar code data (numeric); must be exactly 2 or 5 digits

**Character Set**            0-9 (numeric only)

## Density Table

Printer Model	Value of "bb"	Narrow Bar Width (mils)	Magnification Factor
XL410	02	6.7	Below Minimum
	03	10.0	75%
	04	13.3	100%
XL400	02	10.0	75%
	03	15.0	112%
	04	20.0	150%

## Example

```
<ESC>H0325<ESC>V0725<ESC>D30315009827721123
<ESC>L0101<ESC>H0295<ESC>V0800<ESC>OB0
<ESC>H0340<ESC>V0878<ESC>OB98277<ESC>H0480
<ESC>V0878<ESC>OB21123
<ESC>H640<ESC>V0760<ESC>BF0313021826
<ESC>H655<ESC>V0730<ESC>OB21826
```



# UCC-128

<b>Command Structure</b>	<p>&lt;ESC&gt;B bbcccd (data)</p> <p>bb = Width of the narrow elements in dots (01 to 12)</p> <p>ccc = Bar height in dots (001 to 600)</p> <p>d = Placement of human readable text</p> <p>0 None</p> <p>1 Text at top of bar code</p> <p>2 Text at bottom of bar code</p> <p>(data) = 17 digits made up of the following:</p> <p>1st digit = Container type</p> <p>digits 2-8, Shipper identification</p> <p>digits 9-17, Container Sequential number</p> <p>Note: The Container Sequential number is not automatically sequenced by the printer.</p>
<b>Character Set</b>	See Code 128 Character Table on Page B-18
<b>Density Table</b>	See Code 128, Page B-10
<b>Notes</b>	<ol style="list-style-type: none"> <li>1. The Start, Function, Stop and Extension codes will be created by the printer and added automatically.</li> <li>2. The internal Modulo 10 check character will be automatically created and added by the printer. The overall Code 128 symbol check character will be automatically created by the printer and added.</li> <li>3. The automatically created human readable text will be created according to the following rules: <ul style="list-style-type: none"> <li>• The spacing between the bar code and the text is fixed at 10 dots (.050 inches).</li> <li>• If the width of the human readable text is wider than the bar code, it will start at the same position as the bar code and extend past the right of the bar code.</li> <li>• If the width of the human readable text is less than the bar code, it will be centered on the bar code.</li> <li>• The automatically generated human readable font is OCR-B.</li> <li>• If any part of the human readable text extends outside the printable area, none of it will be printed. Care should be exercised when placing the bar code to allow for any automatically created human readable text.</li> </ul> </li> </ol>

**Example**

Without incrementing

```
<ESC>A  
<ESC>H0100<ESC>V0100<ESC>BI04150101234567000000001  
<ESC>Q2<ESC>Z
```



With incrementing

```
<ESC>A  
<ESC>H0100<ESC>V0100<ESC>F001+001  
<ESC>BI04150101234567000000001  
<ESC>Q2<ESC>Z
```



# Data Matrix

## Command Structure

### Data Format

<ESC>BXaabbccddeeffghh

- aa = Format ID. 01-06 or 11-16. The values 07 and 17 will not be accepted by the printer.
- bb = Error correction level. 00, 01, or 04-14. The values 02, 03 or values of 15 or greater will be processed as a 00.
- cc = Horizontal cell size. 03 - 12 dots/cell.
- dd = Vertical cell size. 03 - 12 dots/cell.
- eee = Number of cells in one line. Must use 000 to optimize.
- fff = Number of cell lines. Must use 000 to optimize.
- g = Mirror Image
  - 0 = Normal Print
  - 1 = Reverse Print
- hh = Guide Cell Thickness. 01-15. 01 indicates normal type.

### Sequential Numbering

<ESC>FXaaabccdddeee

- aaa = Number of duplicate labels to be printed (001 - 999)
- b = Increment or Decrement
  - + = Increment
  - = Decrement
- ccc = Increment/Decrement Steps (001 - 999)
- ddd = Sequential numbering start position (001 - 999)  
Referenced to left side.
- eee = Incremented data length measured from start position (001 - 999)

### Print Data

<ESC>DCxxx...x

- xx...x = Data, maximum of 500 characters



**Character Set**

ID NUMBER	CHARACTER SET	ENCODING SCHEME
16 Bit CRC		
01	Numeric, Space	Base 11
02	Upper Case Alpha, Space	Base 27
03	Upper Case Alpha, Space, Comma, Period, Slash, Minus	Base 41
04	Upper Case Alphanumeric, Space	Base 37
05	ASCII 7-bit, Full Keyboard (20 <sub>H</sub> - 7F <sub>H</sub> )	ASCII
06	ISO 8-bit, International (20 <sub>H</sub> - FF <sub>H</sub> )	8-Bit
32 Bit CRC		
11	Numeric, Space	Base 11
12	Upper Case Alpha, Space	Base 27
13	Upper Case Alpha, Space, Comma, Period, Slash, Minus	Base 41
14	Upper Case Alphanumeric, Space	Base 37
15	ASCII 7-bit, Full Keyboard (20 <sub>H</sub> - 7F <sub>H</sub> )	ASCII
16	ISO 8-bit, International (20 <sub>H</sub> - FF <sub>H</sub> )	8-Bit

**Notes**

See AIM USA Technical Specification Data Matrix for information on the structure of this symbology.

**Example**

```
<ESC>V0100<ESC>H0100
<ESC>BX05051010000000001
<ESC>DCDATA MATRIX DATA MATRIX
```



# Maxicode

**Command Structure**     <ESC>BUaaa,bbb,cccccc,dddd,eee..e

aaa	=	Service class, numeric only (001-999)
bbb	=	Country code, numeric only (001-999)
cccccc	=	ZIP code, alphanumeric (000000-999999)
dddd	=	Extended ZIP code, numeric only (0001-9999)
ee...e	=	Low priority message, alphanumeric, 84 digits.

**Character Set**

Field dependent.

Service Class	Numeric
Country Code	Numeric
ZIP Code	Alphanumeric
Message	Alphanumeric

**Notes**

See AIM USA Uniform Symbology Specification - Maxicode for information on the structure of this symbology.

**Example**

```
<ESC>V0100<ESC>H0100
<ESC>BU001,010,123456,6018,MAXICODE MAXICODE MAXICODE MAXICODE
MAXICODE MAXICODE MAXICODE MAXICODE MAXICODE MAX
```



# PDF417

<b>Command Structure</b>	<ESC>BFaabbcddeeffffnnn...n
aa	= Minimum module dimension (03-09 dots). Will not print if values of 01, 02 or greater than 10 are specified.
bb	= Minimum module pitch dimension (04-24 dots). Will not print if values of 01, 02, 03 or greater than 25 are specified.
c	= Security (error detection) Level (1-8).
dd	= Code words per line (01-30). If 00 is specified for both dd and ee, the printer automatically optimizes the number of rows per symbol.
ee	= Rows per symbol (00 or 03-40). If 00 is specified for both dd and ee, the printer automatically optimizes the number of rows per symbol.
ffff	= Number of characters to be encoded (0001-2700).
nn...n	= Data to be printed.
<b>Character Set</b>	ASCII 128 character set plus PC437 Extended Character set.
<b>Notes</b>	See AIM USA Uniform Symbology Specification PDF417 for information on the structure of this symbology.
<b>Example</b>	<ESC>V0100<ESC>H0100<ESC>BK0607400000021PDF417 PDF417 PDF417



## CODE 128 CHARACTER TABLE

The Code 128 Table lists 105 data values for the three subsets: A, B, and C. Each subset column displays either a single column of data or a double column of data.

- If the subset column displays a single column of data, that is the data to be entered to produce the result.
- If the subset column displays a double column of data, the first column contains the desired output, and the second column contains the actual characters to be entered.

For example, look at value 99 in the table:

If you are currently using Subset A or Subset B, you can change to Subset C by encoding ">C".

VALUE	SUBSET A	SUBSET B	SUBSET C
99	Subset C >C	Subset C >C	99
100	Subset B >D	FNC4 >D	Subset B >D
101	FNC4 >E	Subset A >E	Subset A >E
102	FNC1 >F	FNC1 >F	FNC1 >F

Note: When Subset C is chosen, you must specify an even number of data positions because of the interleaved encodation method.

## Code 128 Character Table

VALUE	SUBSET A	SUBSET B	SUBSET C	VALUE	SUBSET A	SUBSET B	SUBSET C
0	SP	SP	00	36	D	D	36
1	!	!	01	37	E	E	37
2	"	"	02	38	F	F	38
3	#	#	03	39	G	G	39
4	\$	\$	04	40	H	H	40
5	%	%	05	41	I	I	41
6	&	&	06	42	J	J	42
7	'	'	07	43	K	K	43
8	(	(	08	44	L	L	44
9	)	)	09	45	M	M	45
10	*	*	10	46	N	N	46
11	+	+	11	47	O	O	47
12	,	,	12	48	P	P	48
13	-	-	13	49	Q	Q	49
14	.	.	14	50	R	R	50
15	/	/	15	51	S	S	51
16	0	0	16	52	T	T	52
17	1	1	17	53	U	U	53
18	2	2	18	54	V	V	54
19	3	3	19	55	W	W	55
20	4	4	20	56	X	X	56
21	5	5	21	57	Y	Y	57
22	6	6	22	58	Z	Z	58
23	7	7	23	59	[	[	59
24	8	8	24	60	\	\	60
25	9	9	25	61	]	]	61
26	:	:	26	62	^	^	62
27	;	;	27	63	—	—	63
28	<	<	28	64	NUL >(space)	' >(space)	64
29	=	=	29	65	SOH >!	a >!	65
30	>	>	30	66	STX >"	b >"	66
31	?	?	31	67	ETX >#	c >#	67
32	@	@	32	68	EOT >\$	d >\$	68
33	A	A	33	69	ENQ >%	e >%	69
34	B	B	34	70	ACK >&	f >&	70
35	C	C	35	71	BEL >'	g >'	71

**Code 128 Character Table (cont'd)**

VALUE	SUBSET A	SUBSET B	SUBSET C	VALUE	SUBSET A	SUBSET B	SUBSET C
72	BS >(	h >(	72	89	EM >9	y >9	89
73	HT >)	i >)	73	90	SUB >:	z >:	90
74	LF >*	j >*	74	91	ESC >;	{ >;	91
75	VT >+	k >+	75	92	FS ><	><	92
76	FF >,	l >,	76	93	GS >=	} >=	93
77	CR >-	m >-	77	94	RS >>	~ >>	94
78	SO >.	n >.	78	95	US >?	DEL >?	95
79	SI >/	o >/	79	96	FNC3 >@	FNC3 >@	96
80	DLE >0	p >0	80	97	FNC2 >A	FNC2 >A	97
81	DC1 >1	q >1	81	98	SHIFT >B	SHIFT >B	98
82	DC2 >2	r >2	82	99	Subset C >C	Subset C >C	99
83	DC3 >3	s >3	83	100	Subset B >D	FNC4 >D	Subset B >D
84	DC4 >4	t >4	84	101	FNC4 >E	Subset A >E	Subset A >E
85	NAK >5	u >5	85	102	FNC1 >F	FNC1 >F	FNC1 >F
86	SYN >6	v >6	86	103	SUBSET A START CODE >G		
87	ETB >7	w >7	87	104	SUBSET B START CODE >H		
88	CAN >8	x >8	88	105	SUBSET C START CODE >I		

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# APPENDIX C.

## CUSTOM CHARACTERS AND GRAPHICS

### CUSTOM-DESIGNED CHARACTER EXAMPLE

The following example is presented to help understand the use of the Custom Designed Characters command. It demonstrates the design and printing of an “arrow” in a 16 x 16 matrix.

1. Determine which matrix size to use
  - 16 dot x 16 dots
  - 24 dots by 24 dots
2. Lay out a grid and draw the image on the grid.
  - Each square represents one dot
  - Blacken squares for each printed dot

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1																
2																
3																
4																
5																
6																
7																
8																
1																
2																
3																
4																
5																
6																
7																
8																



3. Transfer the image into two bit map representations and then into hexadecimal or binary format.

ROW	BIT MAP				HEX
1	0000	0001	0000	0000	01 00
2	0000	0011	1000	0000	03 80
3	0000	0111	1100	0000	07 C0
4	0000	1111	1110	0000	0F E0
5	0001	1111	1111	0000	1F F0
6	0011	1111	1111	1000	3F F8
7	0111	1111	1111	1100	7F FC
8	1111	1111	1111	1110	FF FE
9	0000	0111	1100	0000	07 C0
10	0000	0111	1100	0000	07 C0
11	0000	0111	1100	0000	07 C0
12	0000	0111	1100	0000	07 C0
13	0000	0111	1100	0000	07 C0
14	0000	0111	1100	0000	07 C0
15	0000	0111	1100	0000	07 C0
16	0000	0111	1100	0000	07 C0

4. To store the custom designed character in memory using a hexadecimal data stream, the command would be:

```
<ESC>A
<ESC>T1H3F0100038007C00FE01FF03FF87FFCFFFE07C007C007C007C007C007C007C0
<ESC>Z
```

*Note: This should be a continuous data string without any CR or LF characters.*

5. To recall the custom character from memory, send the following code to the printer. Note that you can print other data as well. Also note how the character size was expanded using the <ESC>L command.

```
<ESC>A
<ESC>L0505<ESC>H0150<ESC>V100<ESC>K1H903F
<ESC>L0505<ESC>H0600<ESC>V100<ESC>K1H903F
<ESC>L0303<ESC>H0125<ESC>V0250<ESC>MTHIS SIDE UP !
<ESC>Q1
<ESC>Z
```

6. To store the custom designed character in memory using a binary data stream, the command would be:

```
<ESC>A
<ESC>T1B3F 01H 00H 03H 80H 07H C0H 0FH E0H 1FH F0H 3FH F8H 7FH FCH FFH FEH
07H C0H 07H C0H 07H C0H 07H C0H 07H C0H 07H C0H 07H C0H 07H C0H
<ESC>Z
```

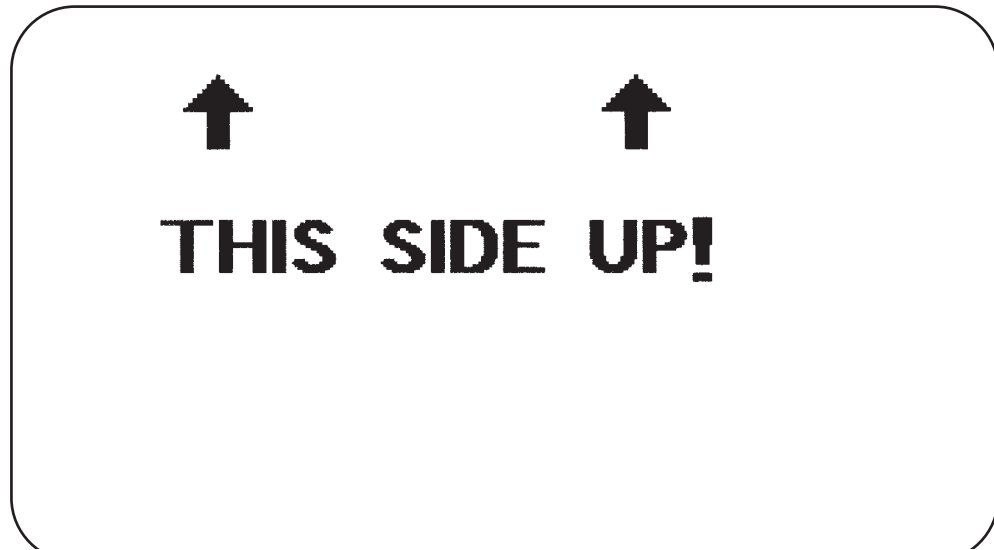
NOTE: Spaces are shown between hexadecimal values in the above example for clarity only and are *not* included in the data string.

*Note that the data stream is only half as long as the hexadecimal format. This is because we can send the binary equivalent of “11111111” (represented above in its hexadecimal value of FF<sub>H</sub>), for example, using one eight bit word while it takes two eight bit words to transmit the hexadecimal equivalent “F” and “F”. To send binary characters using BASIC, the expression “CHR (&HFF)” will send the binary equivalent of FF (i.e., 11111111).*

6. To recall the custom character from memory, send the following code to the printer:

```
<ESC>A  
<ESC>L505<ESC>H0150<ESC>V100<ESC>K1B903F  
<ESC>L505<ESC>H0600<ESC>V100<ESC>K1B903F  
<ESC>L0303<ESC>H0125<ESC>V0250<ESC>XMTHIS SIDE UP !  
<ESC>Q1  
<ESC>Z
```

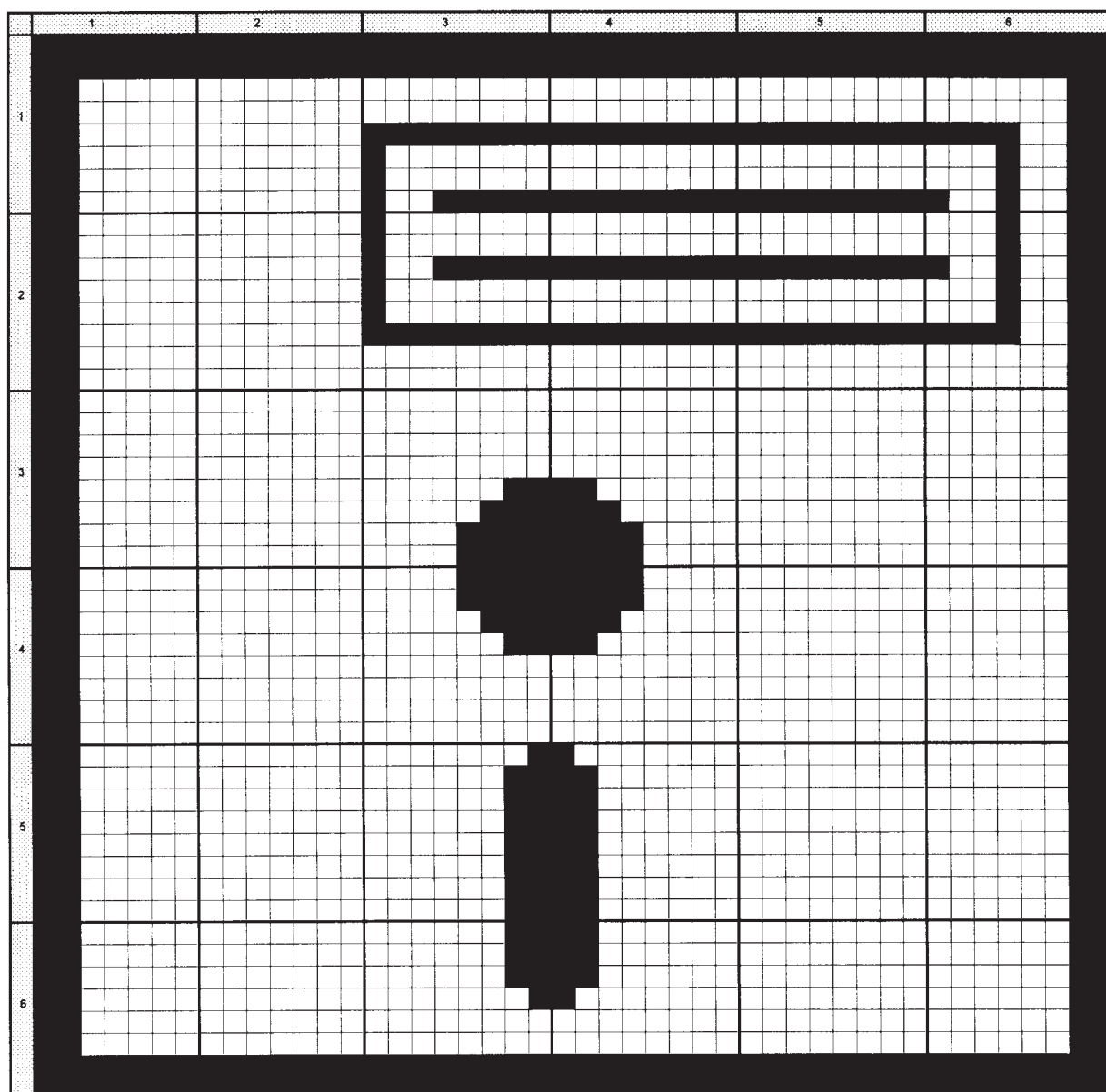
The printer output for both the hexadecimal and binary format examples is:



## CUSTOM GRAPHICS EXAMPLE

The following example is presented to help you understand the use of the Custom Graphics command. It demonstrates the design and printing of a “diskette” in a 48 x 48 matrix.

1. Determine the matrix size for the graphic. It must be in 8 dot by 8 dot blocks. The example here has six blocks horizontally and six blocks vertically (48 x 48).
2. Lay out a grid and draw the image on the grid.
  - Each square represents one dot
  - Blacken squares for each printed dot



## 3. Transfer the image into a bit map representation and then into hexadecimal format:

BIT MAP						HEXADECIMAL FORMAT					
1	2	3	4	5	6	1	2	3	4	5	6
11111111	11111111	11111111	11111111	11111111	11111111	FF	FF	FF	FF	FF	FF
11111111	11111111	11111111	11111111	11111111	11111111	FF	FF	FF	FF	FF	FF
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	03
11000000	00000000	11111111	11111111	11111111	11110011	C0	00	FF	FF	FF	03
11000000	00000000	10000000	00000000	00000000	00010011	C0	00	80	00	00	13
11000000	00000000	10000000	00000000	00000000	00010011	C0	00	80	00	00	13
11000000	00000000	10011111	11111111	11111111	00010011	C0	00	9F	FF	FF	13
11000000	00000000	10000000	00000000	00000000	00010011	C0	00	80	00	00	13
11000000	00000000	10000000	00000000	00000000	00010011	C0	00	80	00	00	03
11000000	00000000	10011111	11111111	11111111	00010011	C0	00	9F	FF	FF	13
11000000	00000000	10000000	00000000	00000000	00010011	C0	00	80	00	00	13
11000000	00000000	10000000	00000000	00000000	00010011	C0	00	80	00	00	13
11000000	00000000	11111111	11111111	11111111	11110011	C0	00	FF	FF	FF	F3
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	13
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	13
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	13
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	13
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000111	11100000	00000000	00000011	C0	00	07	E0	00	03
11000000	00000000	00001111	11110000	00000000	00000011	C0	00	0F	F0	00	03
11000000	00000000	00001111	11110000	00000000	00000011	C0	00	0F	F0	00	03
11000000	00000000	00001111	11110000	00000000	00000011	C0	00	0F	F0	00	03
11000000	00000000	00001111	11110000	00000000	00000011	C0	00	0F	F0	00	03
11000000	00000000	00000111	11100000	00000000	00000011	C0	00	07	E0	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	00	00	00	03
11000000	00000000	00000001	10000000	00000000	00000011	C0	00	01	80	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000011	11000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000001	10000000	00000000	00000011	C0	00	01	80	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	03	C0	00	03
11000000	00000000	00000000	00000000	00000000	00000011	C0	00	03	C0	00	03
11111111	11111111	11111111	11111111	11111111	11111111	FF	FF	FF	FF	FF	FF
11111111	11111111	11111111	11111111	11111111	11111111	FF	FF	FF	FF	FF	FF

- Using the hexadecimal data, send the following code to print the graphic image as designed.

```
<ESC>A<ESC>H0100<ESC>V0100<ESC>GH006006
FFFFFF FFFFFFF FFFFFFF FFFFFFF C00000 000003
C00000 000003 C000FF FFFF3 C00080 000013
C00080 000013 C0009F FFFF13 C00080 000013
C00080 000013 C0009F FFFF13 C00080 000013
C00080 000013 C000FF FFFF3 C00000 000003
C00000 000003 C00000 000003 C00000 000003
C00000 000003 C00000 000003 C00003 C00003
C00007 E00003 C0000F F00003 C0000F F00003
C0000F F00003 C0000F F00003 C00007 E00003
C00003 C00003 C00000 000003 C00000 000003
C00000 000003 C00000 000003 C00001 800003
C00003 C00003 C00003 C00003 C00003 C00003
C00003 C00003 C00003 C00003 C00003 C00003
C00003 C00003 C00003 C00003 C00003 C00003
C00003 C00003 C00001 800003 C00000 000003
C00000 000003 FFFFFFF FFFFFFF FFFFFFF FFFFFFF
<ESC>Q1<ESC>Z
```

*Note: Spaces shown in the hexadecimal listing above are for emphasis only. Spaces must not be encoded within the graphic portion of the data stream to the printer. Also, CR and LF characters to separate the lines must not be encoded in the data stream.*

- To send the data in binary format, the software must convert the data into binary format before transmitting it to the printer. Using the BASIC programming language for example, this is done by notation “CHR\$ (&HC0)” which sends the hexadecimal value of “C0” as binary data (11000000). The BASIC program listing for sending this graphic to the printer (using the RS232 port) in binary format is:

```
CLS
OPEN "COM2:9600,N,8,1,CS,DS" FOR OUTPUT AS #1
E$ = CHR$(27)
PRINT #1,CHR$(2); E$; "A"; E$; "V0100"; E$; "H0100"; E$; "GB006006";
PRINT #1,CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);
PRINT #1,CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);
PRINT #1,CHR$(&HFF);CHR$(&HFF);CHR$(&HC0);CHR$(&H00);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H03);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H80);CHR$(&H00);CHR$(&H00);
PRINT #1,CHR$(&H13);CHR$(&HC0);CHR$(&H00);CHR$(&H80);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H13);CHR$(&HC0);CHR$(&H00);CHR$(&H9F);
PRINT #1,CHR$(&HFF);CHR$(&HFF);CHR$(&H13);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H80);CHR$(&H00);CHR$(&H00);CHR$(&H13);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&H80);CHR$(&H00);CHR$(&H00);CHR$(&H13);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H9F);CHR$(&HFF);CHR$(&HFF);
PRINT #1,CHR$(&H13);CHR$(&HC0);CHR$(&H00);CHR$(&H80);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H13);CHR$(&HC0);CHR$(&H00);CHR$(&H80);
PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H13);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H00);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H03);CHR$(&HC0);
```

```

PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H07);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H0F);
PRINT #1,CHR$(&HF0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H0F);CHR$(&HF0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&H0F);CHR$(&HF0);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H0F);CHR$(&HF0);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H07);CHR$(&HE0);
PRINT #1,CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H03);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H00);CHR$(&H00);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H00);CHR$(&H00);
PRINT #1,CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H01);
PRINT #1,CHR$(&H80);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);
PRINT #1,CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);CHR$(&H03);
PRINT #1,CHR$(&HC0);CHR$(&H00);CHR$(&H03);CHR$(&HC0);CHR$(&H00);
PRINT #1,CHR$(&H03);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);
PRINT #1,CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);
PRINT #1,CHR$(&HFF);CHR$(&HFF);CHR$(&HFF);
PRINT #1,E$;"Q1";E$;"Z";CHR$(3)
CLOSE #1

```

The printer output for both the hexadecimal and binary format examples is:



## PCX GRAPHICS EXAMPLE

---

A graphics file in a PCX format may also be transmitted to the printer. The file must not be larger than 32K bytes (DOS file size reported in a DIR listing). For example,



the WIZ.PCX image shown below has a file size of 15076 bytes.

The uncompressed size (PCX is a compressed file) of the file must not be greater than 64K bytes. Generally this is not a problem unless the graphic image is surrounded by large amount of white space which the PCX algorithm can compress very efficiently. If this is the case, the file should be recaptured to eliminate the surrounding white space as much as possible.

The following basic program will send and print this file:

```
OPEN "WIZ.PCX" FOR INPUT AS #2
DA$ = INPUT$(15706, #2)
C$ = CHR$(27)
WIDTH "LPT1:", 255
LPRINT C$; "A";
LPRINT C$; "V150"; C$; "H100"; C$; "GP15706"; DA$
LPRINT C$; "Q1"; C$; "Z";
CLOSE #2
```

The printer output for this program is:



# APPENDIX D.

## OPTIONAL ACCESSORIES

### INTRODUCTION

---

This section contains instructions for using the following XL Series optional features:

- Label Rewinder
- PCMCIA Memory Cards
- Calendar
- Stacker

### LABEL REWINDER

---

The rewinder is an external unit that allows for labels and tags to be rewound in rolls up to 8.5 inches in diameter. It derives its power directly from the printer's EXT connector using a built-in cable. The rewinder provides the ability to rewind tags/labels from the printer and subsequently be unwound for later use with applicators.

#### Installation

1. Position the **Rewinder** at the front of the printer and align it with the label slot. (The **Rewind Wheel/Spindle** should be positioned away from the printer.)
2. Connect the built-in cable from the **Rewinder** to the EXT connector at the rear of the printer.
3. On the **Rewinder**, remove the metal clamp from the **Rewind Spindle**.
4. Feed the lead end of the label stock under the first spindle and onto the **Rewind Spindle**. Feed the stock around the spindle once, then replace the metal clamp over the label stock. Wind another revolution to ensure the labels are secure on the spindle.
5. Select the REWIND option on the rewinder, then set the power switch to ON. (The printer must be powered ON for the rewinder to function.)

#### Removing and Unwinding the Roll

As labels are printed, tension from the rewinder should keep the label stock taut as it wraps itself on the spindle.

To remove the roll from the spindle, first set the power switch to OFF. Remove the metal clamp, then remove the rewound roll of labels.

To unwind for using with an applicator, first set the power switch OFF. Attach the lead edge of the labels from the rewind spindle to the applicator entry point. Select



the WIND option on the rewinder, and when ready to begin, set the power switch to ON.

## PCMCIA MEMORY CARDS

---

### Description

The Memory Card Option provides the connectors and interface board for two PCMCIA memory cards slots. The two Memory Card slots, labeled A and B, are accessible on the Back Panel. Each card slot can have a standard PCMCIA memory card installed with a maximum of 2MB each, allowing the printer memory to be expanded up to 4MB.

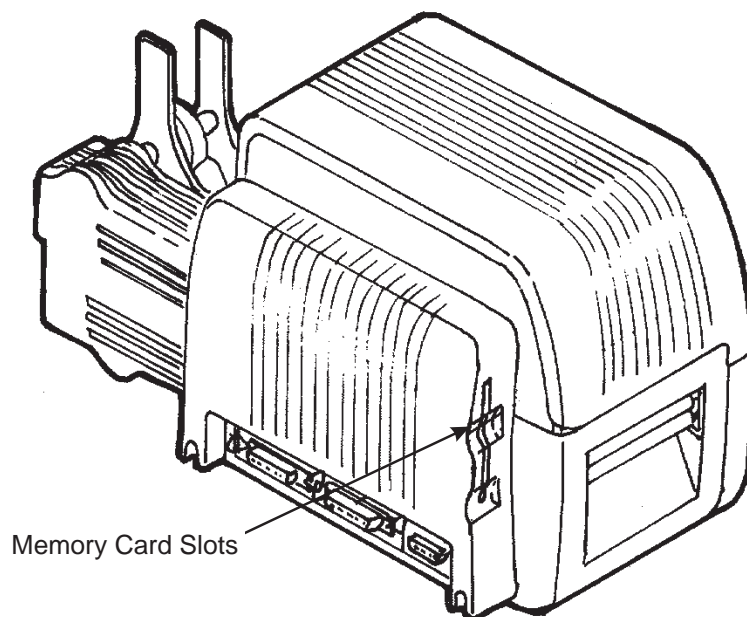
Type	RAM or Flash-ROM
Applicable Specifications	PCMCIA Version 2.1 (JEIDA Version 4.1)
Size	128KB, 256KB, 512KB, 1MB or 2MB
Connector Pins	68
Battery	Two years for SCAM type (approximately)
Write Protect	Yes
Low Battery Detect	Yes

### Installation

Instructions for installing the Memory Card Option are included with the installation kit.

### Error Handling

Memory Card error conditions are indicated to the operator using a combination of the ERROR LED on the front panel, the LCD display (if available) and the audible indicator.



ERROR DESCRIPTION	INDICATION	REMEDY
Low Battery - Low battery condition is detected when printer is powered on.	ERROR LED: Blinking Audible Beep: 1 long Display: Card Low Battery  Depress START/STOP key to print Card Status.	Replace Memory Card battery. Note that all data will be lost when the battery is removed.
Card R/W Error 1. No card is inserted. 2. Card is write protected. 3. Invalid store/recall number. 4. Card has not been initialized.	ERROR LED: On Audible Beep: 1 long Display: Card R/W Error  Printer must be powered off to reset.	1. Insert card into selected slot. 2. Remove write protect tab. 3. Correct program 4. Initialize card with BJT command
Warning 1. Duplicate number. 2. Data not in print area. 3. Data overflows card memory.	Audible Beep: 1 short Display: None  Printer will ignore invalid commands.	1. Correct program. 2. Correct program. 3. Use card with more capacity.

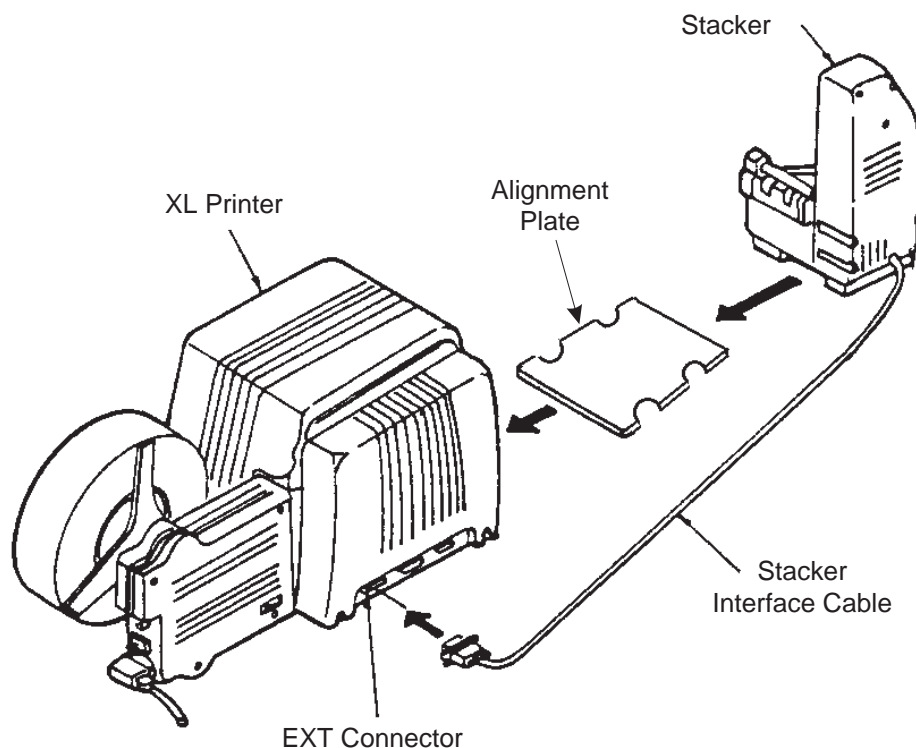
## STACKER

---

The Integrated Stacker option can stack up to 500 tags at the maximum print speed of the XL400 or XL410. It obtains its power through the EXT Accessory port connector on the rear of the XL printer.

### SPECIFICATIONS

<b>Media</b>	Tag (Center/Side Hole, Side Notch or I-Mark)
<b>Size</b>	9.4" W x 9.7" D x 11.6" H 238mm W x 253mm D x 294mm H
<b>Weight</b>	7.7 lb. (3.5 Kg)
<b>Stack Type</b>	Stack Up
<b>Capacity</b>	Maximum of 500 pieces, +/- 50
<b>Tag Size</b>	1.0" (26mm) to 5.9" (150mm)Long 1.26" (32mm) to 3.9" (100mm)Wide
<b>Interface</b>	14 Pin Centronics type
<b>Synchronization</b>	With Print Cycle via EXT port with Stack Full detection



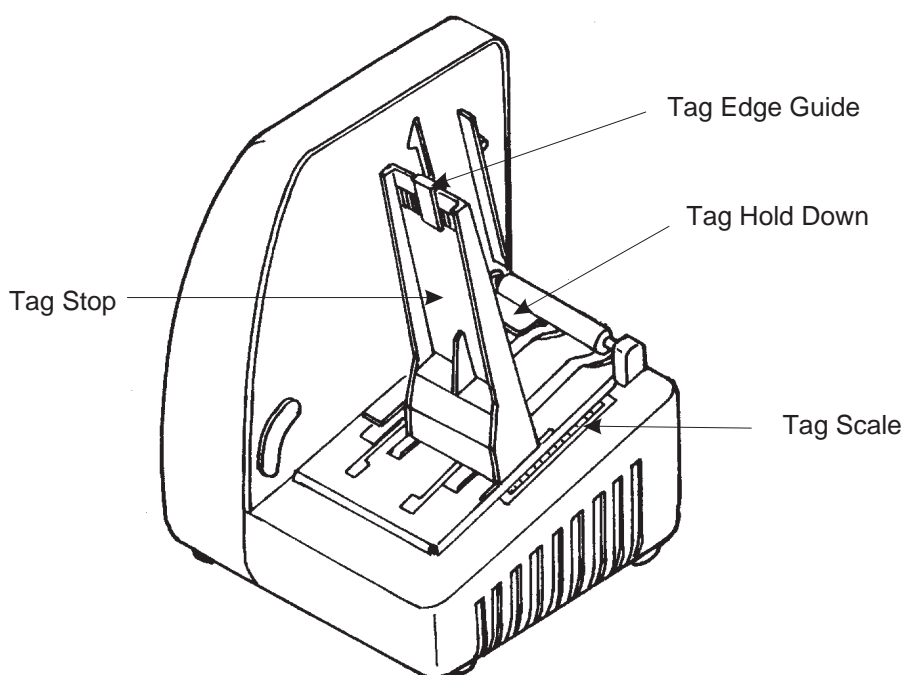
## INSTALLATION

The Stacker Option consists of four major components:

- **Stacker**- The Stacker collects and stacks the tags as they are printed and cut.
- **Tag Stop** - The Tag Stop is adjusted to the length of the label. It is magnetically held in place and should be adjusted for the length of the tags being stacked. A scale is provided for reference when making this adjustment.
- **Tag Edge Guide** - The Tag Edge Guide should be adjusted for the width of the tag. It is held in place after adjustment by friction teeth on the Tag Stop.
- **Alignment Plate** - The Alignment Plate is used to maintain proper alignment between the printer and the Stacker. The front two feet of the Stacker are aligned in the back two notches and the left two feet of the printer are aligned in the other two notches.

To install the Stacker on an XL Printer:

1. Turn the power off.
2. Place the **Alignment Plate** under the printer and align the two notches with the feet.
3. Place the Stacker on the **Alignment Plate**, aligning the other two notches with the Stacker feet.
4. Connect the attached interface cable to the EXT connector on the printer.
5. Adjust the **Tag Stop** for the length of the tag.
6. Adjust the **Tag Edge Guide** to the width of the tag.



6. Turn the printer on and make sure the cutter is enabled and the tags aligned for printing.

*Note: If the tag sensors are not aligned properly, the printer feeds out a length of tag stock without cutting it as it is attempting to determine the tag pitch (length). Temporarily move the Stacker unit to one side if this occurs until the sensors are correctly set and the tags are at the proper position. See Section 2 for instructions on loading and aligning the tags.*

7. Send the print job to the printer and let it cut and stack a few tags. The temporarily stop the printer by pressing the **START/STOP** key and check to make sure the tags are being stacked under the **Tag Hold Down** and that the **Tag Stop** and **Tag Edge Guide** are properly set.
8. When proper operation has been verified, place the printer back ON LINE by pressing the **START/STOP** key again to finish the print job.
9. The printer will automatically stop and go OFF LINE when the Stacker is full. When this happens, remove the tags and finish the print job by pressing the **START/STOP** key to place the printer back ON LINE.

## CALENDAR

---

The Calendar Option allows the date and time to be maintained in the local printer rather than using the system clock. A qualified technician should perform the upgrade as it requires modifications to the main PCB assembly. Please call SATO Technical Support if you need to add this option to an existing printer in the field.

# APPENDIX E.

## CUSTOM PROTOCOL COMMAND CODES

### DESCRIPTION

This section contains information on creating custom Protocol Command Codes for operating the XL Series printers. The Protocol Command codes are used to tell the printer that a specific type of information is being transmitted to the printer. As an example, the Standard Protocol Command Code specifies the use of an <ESC> character to tell the printer that the following character(s) will represent a specific command. Sometimes the host computer is unable to generate the character or it uses the <ESC> character to control another function. In this case, an Alternate Protocol Command Code set can be selected for use by placing DIP switch 2-7 in the ON position. When the Alternate set is selected, the <ESC> character is not used and is instead replaced with a “carrot” (^) character. A command stream would then start with an “^A” instead of an “<ESC>A”. These two sets of Protocol Command Codes are adequate for the majority of all applications, but occasionally situations occur where conflicts exist when using the Alternate set. In these cases, the user can define and download a custom set of Protocol Command Codes that are stored in EEPROM memory in the printer. After these are downloaded, they replace the Alternate Command Code set when DIP switch DS2-7 is in the ON position. When DIP switch DS2-7 is in the OFF position, the Standard Protocol Command Codes are used.

### DOWNLOAD COMMAND STRUCTURE

The command for downloading a new set of Protocol Command Codes takes the form of <ESC>LD,a,b,c,d,e,f,g,h,i. The parameters specified for “a” through “i” can be transmitted in either ASCII characters or hex notation, allowing a complete 128 character (except for the “,”) set to be used for selecting the custom code.

PARAMETER	STANDARD SETTING	ALTERNATE SETTING (DEFAULT)
a	STX	{
b	ETX	}
c	ESC	^
d	ENQ	@
e	CAN	!
g	OFFLINE	]
h	Reserved	Reserved
i (Zero Slash)	No	0 = YES 1 = NO

## DOWNLOAD PROCEDURE

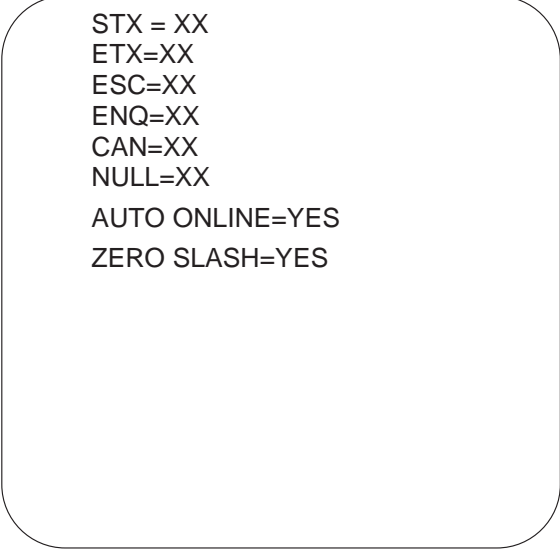
---

The procedure for downloading a custom Protocol Command Code set is:

1. Reset the printer to the default settings using the Reset procedure.
2. Place DIP switch **DS2-7** in the **ON** position.
3. Turn the POWER switch ON while simultaneously pressing the **START/STOP** switch. This places the printer in the USER DOWNLOAD mode as signified by a “User Download” displayed on the LCD panel.



4. Set DIP switch **DS2-7** in the position to accept the Protocol Control codes to be used for downloading (i.e. DS2-7 = OFF for Standard codes and DS2-7 ON to use the Alternate set).
5. Press the **START/STOP** key to place the printer in the ON LINE mode. The printer is ready to receive the download command data stream. See page 5-87 for information on the data stream format.
6. After the command has been sent, the unit will beep and print a status label. If it does not beep and print the label, the printer did not accept the data.



```
STX = XX
ETX=XX
ESC=XX
ENQ=XX
CAN=XX
NULL=XX

AUTO ONLINE=YES
ZERO SLASH=YES
```

7. If the printer does not beep and print a label, turn the printer off, check your download command stream for errors and start the download process over at step 1.
8. If the custom codes are correct, press the **FEED** key to accept them and terminate the download process. If they are incorrect, turn the unit off without pressing the **FEED** key and begin the download process again at step 1.

# APPENDIX F: CARE SYMBOL FONTS

## XCS Font

XCS			
Key	Symbol	Key	Symbol
0		I	
1		J	
2		K	
3		L	
4		M	
5		N	
6		O	
7		P	
8		Q	
A		R	
B		S	
C		T	
D		U	
E		V	
F		W	
G		X	
H		Z	



**XCM Font**

<b>XCM</b>			
Key	Symbol	Key	Symbol
0		I	
1		J	
2		K	
3		L	
4		M	
5		N	
6		O	
7		P	
8		Q	
A		R	
B		S	
C		T	
D		U	
E		V	
F		W	
G		X	
H		Z	