PRIVILEGE

AN Eltron COMPANY

Card Printer Programmer's Manual

Eltron®

User's Manual No. 980081-001 Rev. B

FOREWORD

This manual provides programming information for the Privilege series printers manufactured by Eltron International Incorporated, Simi Valley, California.

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TRADEMARKS

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INTRODUCTION

This manual describes programming commands that control operations and specify data for the following card printer models:

- P300 Monochrome
- P300 Color
- P400 Duplex Color
- P500 Duplex Color with Laminator
- P600 Multiple-Station Duplex Color

Features

All models can print bar-codes in several formats and have resident scaleable font descriptions. Also, all models can include a Smart-Card Docking Station and/or a Magnetic Stripe Encoder. A Serial host interface is an option on the P300 and P400 series, where an associated RS-232C setup Command exists.

The programming commands control the printing process by color and by ribbon material, allowing overprinting and separate control of various multiple-overlay finishes.

Significant model/configuration differences related to programming include the following:

P300 Monochrome card printers have a limited command set along with an image buffer sufficient for a one-bit image mapping depth. Only imaging using the thermal transfer methodology can occur. For gray-scale images, host software must produce multiple-dot pixel matrixes sized for the desired gray-scale range (e.g., a four-by-four dot pixel matrix can produce 16 levels of gray plus white, [$(4 \times 4)^2/16$ + white]).

P300 Color card printers employ dye defusion methodology for color imaging and thermal transfer methodology for imaging from resin monochrome ribbons or ribbon panels. A yellow, magenta, and cyan imaging sequence occurs using five-bit-per-dot data for imaging with three associated ribbon panels. The black panels on Eltron-supplied ribbons with color panels have a resin coating that particularly suits bar-code and other solid image printing. However, resin responds poorly as a dye defusion print medium. Therefore, the black used for gray-scale imaging results from equal amounts of the yellow, magenta, and cyan (YMC), which means dye-defusion black also has a five-bit-per-dot range. If the need for a resin-panel-generated gray scale should ever become necessary, host software must generate multiple-dot pixel matrixes as with the P300 Monochrome.

Standard P300 Color Card Printers have two image buffers—one used for color and another used for monochrome. Because of limited size, the single color buffer requires three downloads for the associated full-color dye defusion imaging. The single monochrome buffer requires separate downloads for resin black and for overlay varnish in situations that require different bit-maps. However, card areas with resin images not only require no varnish for the associated ultraviolet protection, but also varnish does not adhere well to resin. Therefore, because of reverse imaging for varnish, the same bit-map used for resin produces a varnish overlay that omits the areas with resin. For a full-

coverage varnish, the monochrome buffer only requires a clear command.

P300 Color Printers with Extended Memory installed have the potential for three color buffers and two monochrome buffers. These buffers have the same uses as described for the P300 Color above. However, more buffers means that a high probability exists that data for a complete card image can download in a single host access. With a complete image resident in the printer, multiple card prints can occur at a much faster rate.

P400s have all the same implementations as the P300 Color, including Expanded Memory as an option. Because P400s have a Card-Flip assembly, these models respond to commands related to duplex printing.

P500s have all the same implementations as a P400, including Expanded Memory, Smart Card stations, and Magnetic Encoders as options. However, P500s also have a Card Laminator station. Laminators serve as heat-transfer devices for material or panels contained on Laminator Ribbons. A variety of these kinds of ribbons exist:

Ribbons with die-cut panels have die-cut sizes that substantially cover the card, die cuts with cutouts for Smart card contacts, and smaller die cuts that serve to avoid magnetic stripes. Preprinted die cuts can contain graphics, holograms, or optically-encoded patches.

Laminators also serve a thermal-transfer function of ribbon coated material instead of the die-cut panels. However, only a total card application can occur. Because the print station can have a dye sublimation ribbon with a varnish panel, many choices exist for selection of protective coatings. Additional commands exist to implement Laminator use.

Whereas P300s and P400s have single CPU boards, P500s employ two—one controls printing, and card feeds (Module 1 operations) the other controls card flips and lamination (Module 2 operations). Because of a master-slave arrangement, Module 1 also receives Laminator commands. However, all commands destined for the Module 2 require a #ESC1 preface, for example:

ESC#ESC1ESC+TCESC165↵

P600s have two complete Print Station modules (including associated CPU Boards) separated by a Card-Flip assembly. Although controlled by a common parallel host interface, both Print Stations respond to the same command set (with some additional positioning parameters and some differing responses to positioning commands). To simplify memory management, both Print Stations have Expanded Memory as a standard feature.

Overall, the same commands apply, but the Card Feed command applies only to the print station attached to the Card Feed assembly (Module 1). Similarly, the Card Flip commands apply only to the Print Station closest to the Card Output (Module 2). A communication protocol serves to direct commands through the common parallel interface lines to either Module.

Also, because of the master-slave arrangement, Module 2 commands can be sent to Module 1. As with P500s, Module 2 commands sent to Module 1 require a #ESC1 preface. Either module can have a Smart-Card Station and/or a Magnetic Stripe Encoder, with an associated command set. However, Eltron recommends Module 1 as the best place to locate these options.

Related Publications:

User's Guide for P300 and P400, (Available in French, German, Italian, Spanish, Chinese, and English versions).

Maintenance Manual for P300 and P400 (Available in English Only)

Conventions

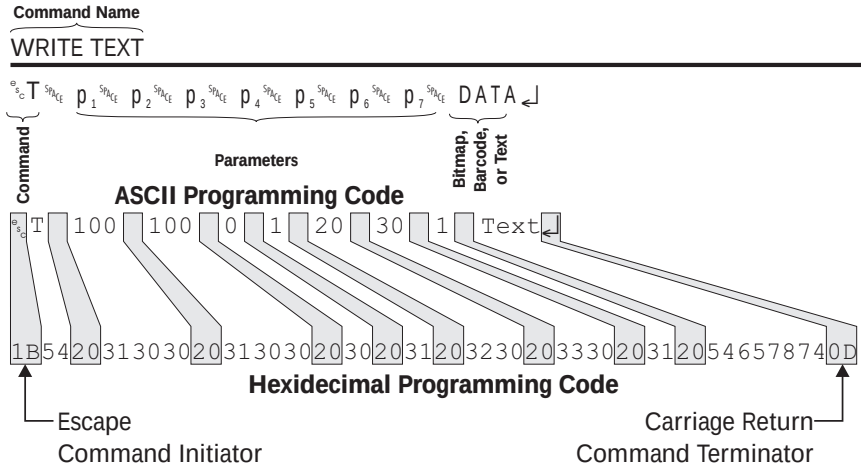
In this manual, the following conventions apply:

$^{e}_{s_c}$	Escape Key (Indicates command characters follow)
^{SPACE}	Space Key (Delimiter used to separate commands from parameters and parameters from other parameters)
$p_1 \sim p_n$	Parameters that follow some commands separated by space delimiters
$\{p_1 \sim p_n\}$	Optional Parameters
↵	Enter Key (Indicates the end of a Command and Parameter string
→	Command string continues on next line (no line feed at this text wrap)
data	Specifies where to place data in an associated Command String
[	Linking delimiter when used with "M" and "m" commands, which see; Placed in front of [, $^{e}_{s_c}$, and ↵ to specify data instead of control characters

Basic Command Syntax

Each command begins with an “Escape” character. The Escape identifies the character(s) immediately following as command identifiers. Command identifiers vary between one (1) and five (5) characters (or up to five (5) bytes of hexadecimal data).

Some commands require one or more additional parameters to supply the printer with sufficient information to complete the command. A “Space” character delineates individual command control parameters. Refer to the example below for the basic command syntax.



Each command line requires a Carriage Return (↵) character (13 Dec. or 0D Hex.). A single Line Feed (LF) character (Dec. 10 or 0A Hex.) is ignored by the printer when it immediately follows the command terminating Carriage Return. Most PC based systems send a CR/LF when the Enter key is pressed.

Command Editor Any ASCII based text editor can serve to create simple command files. In the DOS environment, MS-DOS EDIT offers a good choice. To execute the file, use the Print command from the editor, or from DOS, the COPY command to send the file to the printer. Examples using of the COPY command are:

COPY *file name.ext* LPT1↵
or
COPY *file name.ext* COM1↵

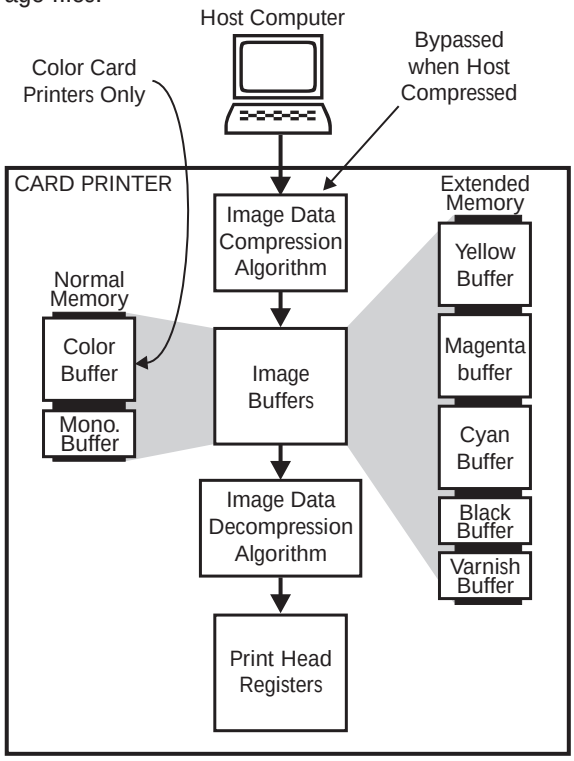
For more information on the use of the COPY command, refer to a DOS software manual.

Some text editing programs can cause printer errors by adding extra characters or by changing existing characters when generating a near ASCII formatted file. *Example: A common ASCII editor, BRIEF, changes all NUL characters to the SPACE or TAB characters with a file save. The graphic data for print intensity level "0" is the NUL character. This causes the resulting file to print with horizontal lines in all graphics with solid white, i.e., no print, areas. Other editors may add a SUB character (Dec. 26 or 1A Hex.), which causes the printer to error.*

Memory Arrangements

Figure 1-1 shows the various elements involved in image data flow. Note that three Image Memory configurations exist and that Image Memory always contains compressed data. If possible, the host should send data compressed, which requires a compatible compression algorithm. This can substantially reduce the data transfer times of most image files.

Figure 1-1. Memory Arrangements



Monochrome printers have no color buffers. Color printers without Expanded Memory have single color and monochrome buffers, requiring a print pass after each color download for yellow, magenta, and cyan data, and as stated previously, separate monochrome downloads when black and varnish require different bit-maps. The arrangement further requires a full set of print preparation and print commands after each download in order to make way for the next image-data download. In contrast, Extended

Memory makes possible a single download containing commands that specify the contents of all five buffers.

Bit-Map Compression Algorithm

Characteristically, a bit-map compression algorithm flags data segments as either repeating or non-repeating, specifies the bytes repeated, and the number of repeats. For these card printers, compression applies to byte-wide bit-map segments, which the host sends with the PS, GS, Z, and vZ commands. The PS and GS commands include parameters specifying a buffer (YMCK). Monochrome commands Z and vZ send associated bit-map data to the black (K) and Varnish buffers, respectively. All of these commands include parameters that specify whether or not the command applies to compressed data. For recognition by the card printer, compressed data must conform to the following rules:

Rule 1. When high, the most significant bit (the flag bit) of a two-byte sequence indicates that the second byte repeats. The remaining seven bits of the first byte specify the number of repeats, allowing a field-specification of from zero to 127 repeats.

Rule 2. When low, the most significant bit of a data sequence indicates that the remaining seven bits of the byte specify the number of the following bytes that represent non-repeating image data. However, only from zero to 31 repeats can occur.

Rule 3. The first byte in the data field of any command specifying a compressed bit-map must have the compression flag high, even if a one must be entered as the number of bytes repeated.

Rule 4. No other algorithm can be used to compress image data for this card printer.

Figure 1-2 includes examples of data strings employing compression.

Figure 1-2. Bit-Map Compression

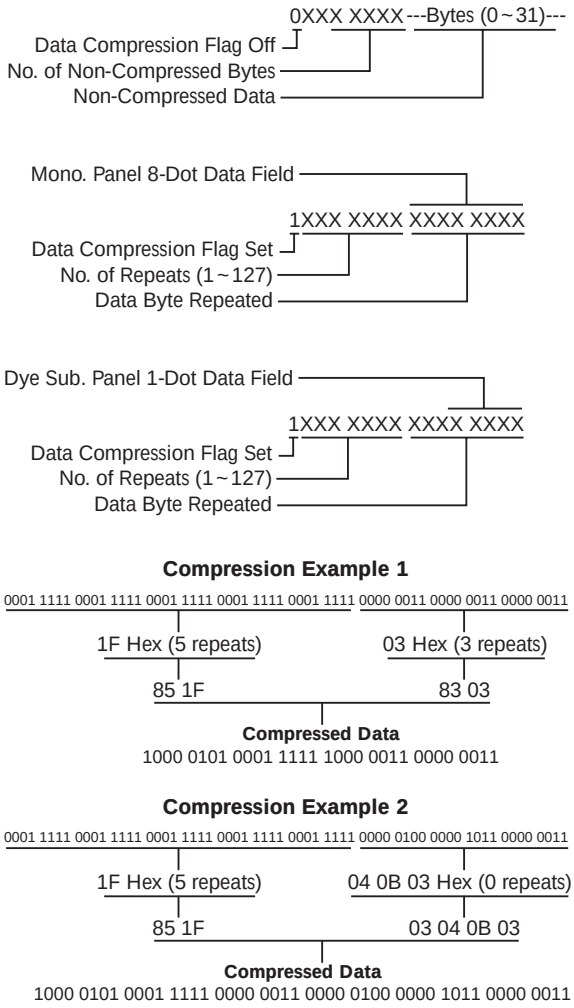


Figure 1-3 shows how a bit-map relates to associated non-compressed data. Figure 1-4 shows the same bit-map in association with compressed data.

Figure 1-3. Non-Compressed Bit-Map

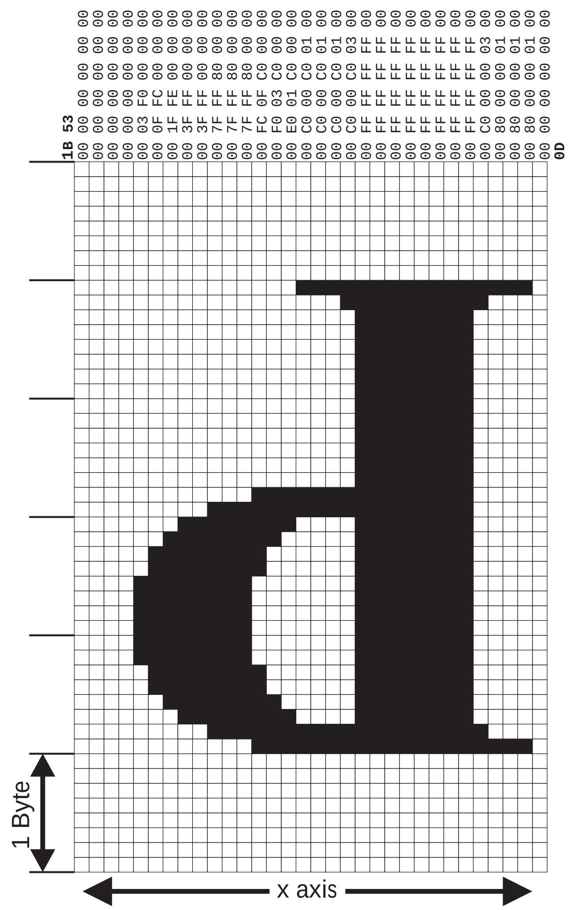
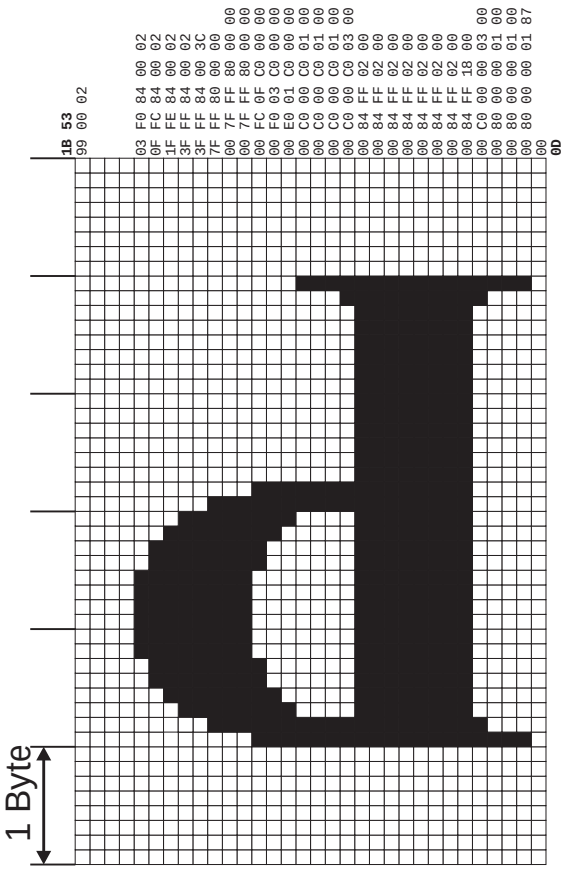


Figure 1-4. Compressed Bit-Map

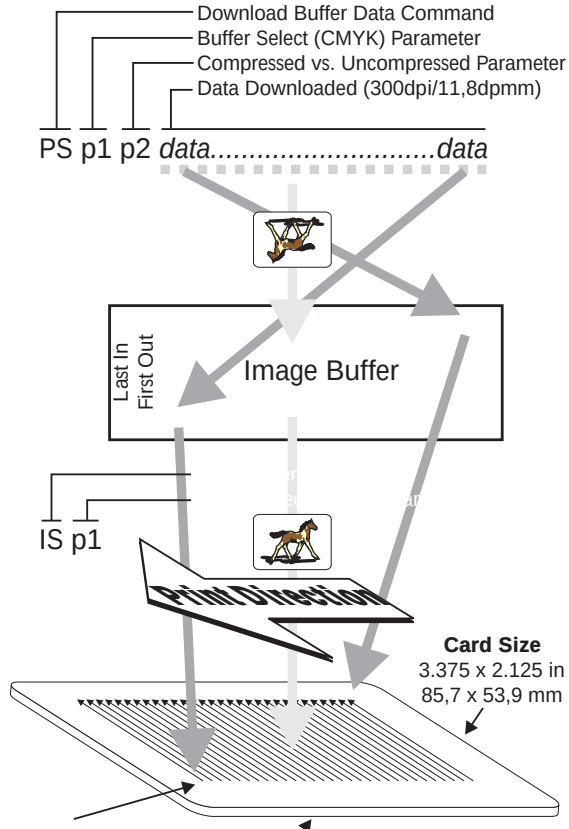


Data-to Card Mapping

Figure 1-5 shows a card consistent with the orientation of a card traveling right to left in the card path of a printer. From this perspective, the data field of the PS, GS, Z, and vZ commands first becomes a memory-resident image in a designated image buffer. The Image Buffer, as shown, fills from top to bottom and from right to left. Because the Image Buffer has a last-in-first-out arrangement, card images build from bottom to top and from left to right. This suits the front-to-back loading of Print Head Registers and the right-to-left card movement during print cycles. As noted in the figure, an object

mirrored in both axis in the data sent to the buffer would print normally on the card.

Figure 1-5
Data Sent verses Card Mapping



MAXIMUM CARD IMAGING
624 Line Bytes by 1008 Lines (Standard Memory)
640 Line Bytes by 1024 Lines (Extended Memory)

ASSOCIATED COMMANDS

Monochrome	Overlay	Color
G	IH	PS
O	IV	GS
Z	vZ	IS
P	vP	
L	vL	
C	vC	
D	vD	
T	vT	
B	vB	
I		

Color Data Considerations

Color data always enters a color image buffer, either as yellow, magenta, cyan, or dye defusion black. If only one color image buffer exists, the command designates the buffer differently according to the buffer specification parameter in the command. Note that the specification for dye defusion only applies to images produced using a dye sublimation black ribbon. All data associated with these commands represents five-bit-per-dot imaging.

Whether downloading data for a partial image (GS command) or for a complete card image (PS command) the data must match the associated card area. For partial images (sometimes called logos because of a typical application) the GS command parameters specify the area imaged. This assures proper line breaks. Any either over- or under-flow produces an error. Note that the previous figure shows different full-card image areas for Standard and Extended memory. For proper appearance, color images should not overprint other card printing.

Monochrome Data Considerations

Monochrome data always enters a monochrome image buffer. Monochrome data commands prefaced with a “v” designate the varnish buffer. Commands without the “v” preface designate the buffer used for resin printing. If only one monochrome image buffer exists, the command designates the buffer differently depending on the associated data.

However, most color imaging does not need a preestablished varnish buffer to apply the varnish coating. If no varnish buffer is downloaded, the printer defaults to the resin buffer for the application of varnish. This works for three reasons. First, color ribbons have resin black followed by varnish panels, both limited to monochrome data. Second, the proper use of varnish is to protect just the dye defusion imaging from ultraviolet radiation. Third, because resin needs no varnish protection and resists adhesion to varnish, an inverted-resin bit-map can apply varnish.

The IV command has a parameter setting to produce an inverted data print. In summary, leave the resin buffer unchanged after printing resin. Then, issue an IV command for inverted data to print the

varnish. Note that full-coverage varnish, as required for ultraviolet protection using dye-sublimation black ribbons, requires only a buffer clear command (F) followed by the inverted print command.

A watermark simulation can result by, in effect, punching holes in the varnish image. A hologram transfer from an associated ribbon occurs by printing a varnish buffer that images the area of the ribbon containing the hologram. Both of these images require data previously downloaded into the Varnish buffer.

Monochrome graphic objects can be entered into either the resin or varnish buffer. As with the preceding, a "v" preface designates a buffer that prints with the "IV" command, and commands without the "v" preface designate a buffer that prints with the "I" command. Commands exist for entry of the following graphic objects:

P/vP	Write Dot
L/vL	Write Line
C/vC	Write Box
D/vD	Write Diagonal Line
T/vT	Write Text
B/vB	Write Bar-Code

Rotational parameters (clockwise) exist for the following:

D/vD Center of Rotation	0, 90, or 180° lower-left
T/vT Center of Rotation	90° Increments (0~270) lower-left or object center
B/vB Center of Rotation	90° Increments (0~270) lower-left or object center

Monochrome bit-maps require entry of two commands—first an initializing command (G) and then the associated data command. The "G" command specifies image placements associated with the following commands:

O/vO	Download Single Line
Z/vZ	Download Multiple Lines

Figure 1-5 shows the relationship between data sent by "O" or "Z" commands and an area previously established by a "G" command. The "G" command can also define data as single bits (i.e., image dots).

With dots selected as the data mode in the "G" command, data sent to the printer must, nevertheless, finish on an even byte boundary. When necessary, add zeros where byte bits extend past the boundary specified in the "G" command.

Data is handled in bytes (0~255 decimal or hexadecimal 00~FF) by the printer.

Bar Codes

Bar codes vary in capacity, size, character sets, and density. Several industries have adopted specific coding and bar code formats. Verify that the selected bar code matches a code supported by the scanning equipment.

All the bar codes supported by the Privilege card printer have the data characters, 2 quiet zones, and a start and stop character. The bar codes include optional human readable font characters as part of the printed bar code. Some of the bar codes include a printer generated check digit (or data check sum) character automatically or as an option.

A command error condition occurs when image data extends beyond the addressable range of the image buffer. The bar code and human readable text fields must remain within the addressable area of the image buffer. Each one of the bar codes, described in the Command B and Appendix A, have a formula to determine a bar code length.

HINT

Selecting a larger bar code the width multiplier and a higher ratio of the narrow to wide bars (and spaces where applicable), improves the general readability of a given bar code. Additionally, wider bars and spaces increase the depth of field for improved performance with moving-beam lasers and other non-contact scanning devices for a given bar code.

Control Commands

The card printer can perform a variety of print, card, ribbon, and head movement and control command operations.

Print Controls

1. **Intensity** - Adjusts the amount of heat applied to transfer a maximum intensity color or Monochrome dot.

2. **Contrast** (Color Only) - Adjusts the minimum amount of heat applied when printing the dots at the lowest color setting.

3. **Image Positioning** - Locates the printable image on the card.

4. **Head** - Raises the print head to move the card and lowers it to print. *Not normally required.*

5. **Print Test Cards**

Card Movement

1. **Print Ready** position - The card moved to a position just prior to the card edge sensor.

2. **Exit Card** - The printer exits the card to the 'Output Hopper' or tray.

3. **Duplex** - Flips the card over using the Card-Flip Assembly, initiated by the 'MF' command.

4. **Ready Smart Card** - Positions the Smart Card under the Smart Card programming station with the contacts on the Smart Card engaged.

5. **Encode Ready** position - The card moves to a position just prior to the magnetic encoding station read/write head.

Ribbon

1. **Reset Ribbon** - Sets the ribbon panel to the first panel (color - yellow panel) or cycles the continuous color Monochrome ribbon.

2. **Select Panel** - Resets, then selects a specific ribbon panel.

Card Handling Process

The following outlines a recommended card handling sequence.

1. Smart Card Programming - Option
2. Magnetically Encode Card - Option
3. Print Card

   For color printing:
   Yellow
   Magenta
   Cyan
   Black
   Clear Varnish or Hologram Transfer
4. Duplex - Flip Card - Option

5. Print Card Backside - Option

   For color printing:
   Yellow
   Magenta
   Cyan
   Black
   Clear Veneer
   Hologram Lamination

6. Eject Card

DO NOT print, veneer or laminate over the magnetic stripe or Smart Card contacts. This can impair subsequent associated read and write operations and must be controlled by the programming.

Batch Processing

The "M" and "m" commands serve as command linking operators. A string of linked commands may execute one (1) time or multiple times. The "[" character acts as delimiter for linked commands in the associated syntax.

For the complete "M" command syntax, and an example, see M/m in the Command Reference,

Port Signals

Only P300 and P400 printers can have the optional serial port. When so equipped, these printers communicate with the host over an RS-232C interface where ACK/NAK flow control exists. All card printers have parallel ports in their standard configuration, with P500 and P600 card printers only available with Parallel Ports. Card printers *with* Parallel Ports communicate with the host using the following signal lines:

DATA (0~7) Eight bits of parallel data.

STROBE (Pin 1) A signal that the host activates to indicates stable data on the DATA lines

ACK/ (Pin 10) A signal that the printer activates to indicate reception of data. The host drops the STROBE signal in response.

BUSY (Pin 11) A signal that the printer activates to indicate an inability to accept commands due to ongoing processing associated with a previously received command. Note that P500 and P600 card printers have two processors. A BUSY response from one processor does not automatically imply a BUSY at the other processor.

READY (Pin 13) A signal that the printer activates to indicate its availability for reception of host commands.

PAPER ERROR (Pin 12)
Card printers report errors to the host by encoding the PAPER ERROR and ERROR lines (see Error Line Coding below).

ERROR/ (Pin 15) Card printers report errors to the host by encoding the PAPER ERROR and ERROR lines (see Error Line Coding below).

INIT (Pin 14) Only used by P600 card printers, where a high (1) directs commands to Module 1 (Master) and a low (0) directs commands to Module 2 (Slave).

Error Line Coding

Paper Error	Error/	Description
0	1	No Error
0	0	Syntax Error
1	1	Ribbon End or Empty Feeder
1	0	Mechanical Error
Note: To clear an Error, Send: ESC . CR (1B 2E 0D Hex)		

COMMAND REFERENCE

This section contains a listing of printer commands required to print, magnetically encode, position to program a Smart Card, and control card movements. The commands are grouped by function. Note that individual commands may not apply to all versions of the printer.

Com-mand	Description	Page
Control Commands		
.	Clears Error Status Lines	2-5
R	Reset Printer	2-6
MC	Clear Media Path	2-7
V	Check Printer Type/Version	2-8
+O	Offset Start Print Position (X-axis)	2-9
+OY	Offset Start Print Position (Y-axis)	2-10
+EC	Print Length (X-axis)	2-11
!OR	Offset Print Head Resistance	2-12
M/m	Multiple Command Strings	2-13
MI	Input Card To Print Position	2-14
MIB	Reverse Card to Print Position	2-15
ME	Exit Card To Output (Hopper)	2-16
MB	Back Card Into Feeder	2-17
MO	Exit Loaded Card To Output	2-18
!FF	Set Ribbon Color Sequence	2-19
+RIB	Ribbon Type	2-20
!M	Move Printhead Up	2-21
!D	Move Printhead Down	2-22
+BS	Set Black Speed	2-23
IM	Print Color Test Card	2-24
IMB	Print Test Card	2-25
A	Print Standard Test Card	2-26
Monochrome/Varnish Thermal Transfer Mode Commands		
F	Clear Monochrome Image Buffers	2-27
G	Initialize Monochrome Graphic	2-28
O/vO	Load Single Line Graphic Dots Download	2-29
Z/vZ	Multiple Line of Graphic Dots Download	2-31
P/vP	Write Dot	2-33
L/vL	Write Line	2-34
C/vC	Write Box	2-35

Com-mand	Description	Page
D/vD	Write Diagonal Line	2-36
T/vT	Write Text	2-37
B/vB	Write Bar Code	2-39
I	Print Card Monochrome Panel	2-41
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. Command - Clear Error Status

Description Clears the Paper Error (Paper Fault) and Error (Fault) printer return signal status lines.

Syntax ESC . ↵

Parameters None

R Command - Reset Printer

Description Resets the printer.

Syntax $^{e}{}_{c}$R↵

Parameters None

MC Command - Clear Media Path

Description Sends any card in the Media Path of the printer to the Output Tray.

Note: A Ribbon Error can leave a card in the printer. If issued at Power-On, this command assures a clear media path for subsequent operations.

Syntax ESC c MC ↵

Parameters None

V Command - Check Printer Type/Version

Description This command is used to check the model (and options) of a printer.

The printer responds via the serial interface with serial data stream containing the model number and firmware version.

A printer connected to the parallel port only responds without an error when the 'V' command is sent with the matching printer version code. The color printer does not report firmware. See the 'A' command, this section, to print the firmware version (and model number).

Syntax $^{e}{}_{5c}V\{{}^{5h}{}_{1c}p_1\}_{\hookleftarrow}$

Parameters p_1 = *Optional Command Parameter:*

Value	Description
None	Monochrome printer only.
10	P300CF
11	Not Used
12	Magnetic Encode Installedr
13	Smart-Card Docking Installed
14	P400CF
20	Extended Memory Option Installed
30	Magnetic Encoder with expanded encoder command set. (Printer serial numbers 5000 and greater.)
50	Monochrome printer with Parallel Port only.
70	P500 Printer

+O Command - Print Offset X-axis

Description Alters the horizontal (X-axis) start print offset point, in dots.

Syntax ESC + O p_1 ↵

Parameters p_1 = Horizontal (X-axis) start print offset, in dots:

Default (Std Memory) = 10

Default (Expanded Memory = 8

Range = 0 ~ 20

+OY Command - Print Offset Y-axis

Description Offsets the vertical (Y-axis) start print location in dots.

Syntax ESC + OY p_1 ↵

Parameters p_1 = Vertical (Y-axis) offset, in dots.

Standard Memory Default = 15

Expanded Memory Default = 6

+EC Command - End of Print

Description Specifies a point, beyond which, no card printing occurs. Print stations with associated Extended Memory installed have storage for 1024 lines of imaging, which exceeds the x-axis image area on the cards. The parameter for End of Print causes the print head to raise at the end of card point, not the end of data. If left down beyond the end of card, the print head can shear the ribbon as the print head abruptly drops below the surface of the card.

Syntax $^{ESC}+EC^{SP}p_1\langle CR\rangle$

Parameters p_1 = line count for end-of-print.

Example The following example sets the End of Print to 8 (the default value). Parameter p1 can range between 0 and 24.

$^{ESC}+EC^{SP}8\langle CR\rangle$

!OR Command - Offset Print Head Resistance

Description Specifies an offset to the manufactures average resistance that appears on the print head label. Note that replacement to a print head with 10-micron glass can produce faint printing if not offset (typically from 180 to 225 ohms). An offset that optimizes print quality should be found.

Note: This setting interacts with the following commands:

+C	Thermal Transfer Intensity
+$L	Color Intensity
+$C	Color Contrast

Syntax ESC!OR SPACE p1 SPACE p2 ↵

Parameters

p_1 = Offset (0 ~ 400)

p_2 = Polarity
0 = Positive
1 = Negative

Example The following example adds 200 ohms to the factory-established value entered according to the print head label.

ESC**!OR** SPACE 200 SPACE 0 ↵

M/m Commands - Multiple Command

Description Groups and repeats a string of commands "N" times. "M" differs from "m" only regarding the response to errors. Errors encountered during commands linked by "M" commands abort any remaining commands, while m-linked commands resume after error removal.

Syntax $^{e}{}_{sc}\mathbf{M}^{Sp}{}_{hCE}\ p_1{}^{Sp}{}_{hCE}C_1[C_2[C_3...[C_n\hookleftarrow$

Parametes p_1 = Number of times to repeat following command string.

$C_1 \sim C_n$ = Series of linked commands repeated p1 times. *Note the square bracket ([) delimiters.*

Example This example shows an "M" command used to group and repeat four commands.

$^{e}{}_{sc}M^{Sp}{}_{hCE}3^{Sp}{}_{hCE}MI[\ !D[\ !M[MO\hookleftarrow$

The "M" command groups a command string. A card loads to the print ready position with the "MI" command. "!D" lowers the print head; "!M" raises the print head, and "MO" sends the card to the output tray. The "M" command specifies three repeats of this sequence. If an error occurs (e.g., the input tray runs out of cards) a command sequence linked by the "M" command terminates. After error correction and an associated pressing of the Panel Button, a command sequence linked by the "m" command resumes.

MI Command - Input Card To Print

Description Moves a card from the card feeder to the Print Ready position.

For P600:

Moves a card to the Print Ready position of Module 1.

Syntax ESC MI ↵

Parameters None

MIB Command - Reverse Card To Card Feeder

Description Moves a card from beyond the print position back to the Print Ready position.

For P600:

Sent to Module 1, returns a card from beyond the Print Ready position of Module 1 (not yet in Module 2) to the Print Ready position of Module 1.

Sent to Module 2, returns a card to Print Ready position of Module 2.

Syntax ESC c **MIB** ↵

Parameters None

ME Command - Exit Card To Output Tray

Description Moves and exits a single card from the card feeder or any position to the output tray.

For P500 and P600:

Sent to Module 1, ejects a card anywhere in the card printer.

Sent to Module 2, ejects any card present in Module 2. If no card is present, a Ribbon End or Card-Feed error occurs.

Syntax <esc>**ME**{<sp>p_1}<cr>

Parameters p_1 = Number of cards to pass through printer.

MB Command - Return Card To Card Feeder

Description Moves the card in the reverse direction and returns the card to the card feed point (just inside the card printer) from any position between the card feeder and the output tray.

Sent to Module 2 of P500 and P600:

Returns a card in Module 2 to the Module 1 exit point.

Syntax ^c**MB**↵

Parameters None

MO Command - Exit Card To Output Tray

Description Moves and exits a single card from any position between the card feeder and the output tray.

P500:

Sent to Module 1, ejects a card from anywhere in printer to the Output Tray.
Sent to Module 2, ejects a card in Module 2 to the Output Tray.
If no card is present, printer responds ACK.

P600:

Sent to Module 1, moves card to Module 2
Sent to Module 2, moves card to Output Tray
If no card is present, printer responds ACK.

Syntax ESC **MO** ↵

Parameters None

!FF Command - Set Ribbon Sequence

Description Resets and moves the ribbon to a selected panel.

The printer first aligns on the Cyan (and Black) panels and then counts ribbon panel positions from the Yellow “0" panel.

Syntax ^{esc}**!FF**^{space}p_1↵

Parameters p_1 = Panel detection number where:

0 =

Ribbon	Sync Position
YMCKO	Yellow Panel
YMCKOK	Yellow Panel
KsO	Mid Overlay
KrO	Mid Overlay

1 = Next transparent panel, unless already there

2 = Next non-transparent panel, unless already there

3 = Beginning of Black (for 5-panel ribbons only)

+RIB Command - Set Ribbon Type

Description Sets printer operation for either a Standard or Special ribbon, as follows:

- Standard Ribbons:
  Kr (Monochrome)
  YMCKO
  KsO
  KrO
- Special Ribbon:
  YMCKOK

Note: Parameter settings associated with this command establish the ribbon positioning that occurs following a long press of the Panel Button.

Syntax ^{esc}**+RIB**^{SP}p_1↵

Parameters p_1 = Type
0 = Standard Ribbon
10 = Special Ribbon

Note: Card imaging using the YMCKOK ribbon requires the following command sequence:

IS 0	Image Yellow
IS 1	Image Magenta
IS 2	Image Cyan
I	Image Black and Return (YMCKOK only)
IV 10	Image Varnish and Return
I 20	Image Black and Return
MO	Eject Card

!M Command - Move Printhead Up

Description Moves the printhead assembly up from the card (and platen roller).

Syntax ESC!M↵

Parameters None

!D Command - Move Printhead Down

Description Moves the printhead assembly down to the card (and platen roller).

Syntax ESC!D↵

Parameters None

+BS Command - Set Black Speed

Description Optimizes Resin printing for either quality or print speed.

Syntax ESC + BS SP p_1 ↵

Parameters p_1 = Speed
0 = High Speed Printing
1 = High Quality Printing

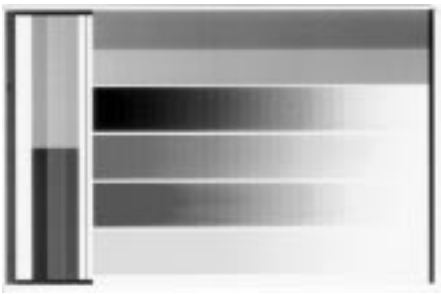
IM Command - Print Color Test Card

Description Prints a card with a color test pattern.

Syntax ESC **IM** ↵

Parameters None

Figure 2-1 Hollow Box Image Positioning



IMB Command - Print Test Card

Description Prints an all black card. Typically this card serves as a basis for Print Head adjustments. Note that a black ribbon is required (PVC-L BLK preferred).

Syntax ESC c **IMB** ↵

Parameters None

Figure 2-2 Print Test Card

A Command - Print Standard Test Card

Description Prints a standard test card with printer parameters, version number, and test pattern.

Syntax ESC A ↵

Parameters None

Figure 2-4 Standard Color Printer Test Card

Figure 2-3 Standard Monochrome Print Test Card

F Command - Clear Monochrome Image Buffers

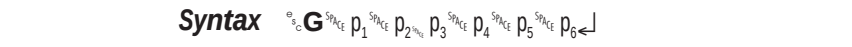
Description Clears Monochrome image buffers of bit-maps and printable data (lines, text, bar codes, etc.).

Syntax ESC **F** ↵

Parameters None

G Command - Initialize Monochrome Graphic (B/W)

Description Initializes Monochrome graphic area by defining the height, width and position of the graphic.

Syntax 

Parameters

p_1 = Horizontal (X-axis) start position (X) in dots.

p_2 = Vertical (Y-axis) start position (Y) in dots.

p_3 = Download Mode for Graphic (Bit-map):
When using bytes, the byte count must be rounded up to the next nearest whole byte.
Example:
25 dots = 3 bytes + 1 dot = 4 bytes

Value	Data	Description
0	Byte	Standard
1	Byte	Standard with Checksum
2	Byte	Compressed
3	Byte	Compressed with Checksum
10	Dot	Standard
11	Dot	Standard with Checksum
12	Dot	Compressed
13	Dot	Compressed with Checksum

p_4 = Horizontal (X-axis) width of graphic in dots (i.e. horizontal lines).

p_5 = Vertical (Y-axis) height of graphic in bytes.
Round up the number of bytes loading in multiples of 8 bits (i.e. Monochrome dots).

p_6 = Graphic Mode:

Value	Description
0	**Reverse Bit-map** - Clear print area and load reverse bit-map image
1	**Standard Bit-map** - Clear print area and load bit-map image
2	**Merge Bit-map** - Overwrite background bit-map image with printable dot locations leaving non-printing dot locations alone.

O/vO Commands - Load Single Line Bit-map (Mono.)

Description Loads a single line of Monochrome bit-map data into a monochrome image buffer. The printer uses the proceeding "G" command to specify and control the line bit-map placement. The "O" command specifies the Monochrome Buffer used for Resin printing, and the vO command specifies the Monochrome Buffer used for Varnish printing.

Syntax ESC **O** *data*{SPACE CHECKSUM}↵
ESC **vO** *data*{SPACE CHECKSUM}↵

Note: NO space (20 Hex.) exists between the "O" and the "data."

Parameters *data* = Uncompressed or compressed Monochrome bit-map data. Data length should match the line length as specified in the proceeding "G" command.

See Chapter 1 for the relationship on how Monochrome Bit-maps relate to *data*.

CHECKSUM = Single byte of XOR data generated from image *data*.

Example Proceeding Command is:

ESC G SPACE 200 SPACE 200 SPACE 0 SPACE 6 SPACE 32↵

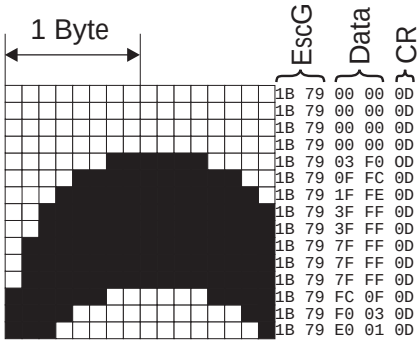
(This "G" command specifies 32 lines of 6-byte bit-map data)

O/vO Commands - Load Single Line Bit-map (Continued)

The 32 “O” command lines immediately follow the “G” command as:

“O*data*Line1↵
“O*data*Line2↵
“O*data*Line3↵
etc.

Figure 2-5 Line by Line Image Object & Hexadecimal Code



Z/vZ Commands - Load Bit-map (Monochrome)

Description Loads a monochrome bit-map into a monochrome image buffer. The printer uses the proceeding "G" command to specify and control the bit-map placement. The Z command places the bit-map in a buffer used for Resin printing, and the vZ command places the bit-map in a buffer used for Varnish printing.

Syntax ^c**Z***data*{CHECKSUM}↵
^c**vZ***data*{CHECKSUM}↵

Note: NO space (20 Hex.) exists between the "Z/vZ" and the "data."

Parameters *data* = Uncompressed or compressed Monochrome bit-map data. The bit-map data must match the size and dimension specified in the proceeding "G" command.

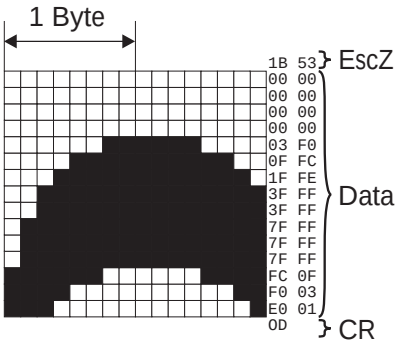
See Section 1 for the relationship on how monochrome bit-maps relate to *data*.

CHECKSUM =
Single byte of XOR data generated from the image data.

Example The following command and figure show a “G” command with an associated “Z” command containing data for the image buffer.

<esc>G<SPACE>200<SPACE>200<SPACE>0<SPACE>6<SPACE>32↵
<esc>Zdata↵

Figure 2-6 Image Object & Hexadecimal Code



P/vP Commands - Write Dot (Monochrome)

Description Writes a single monochrome dot to a monochrome image buffer. The " P"command writes to the buffer used for Resin printing. The vP command writes to a buffer used for Varnish printing.

Syntax ^{esc}**P**^{SPACE} p_1 ^{SPACE} p_2 ^{SPACE} p_3↵

Parameters p_1 = Horizontal (X-axis) start position (X) in dots.

p_2 = Vertical (Y-axis) start position (Y) in dots.

p_3 = Graphic Mode:

Value	Description
0	**Reverse Bit-map** - Clear print area and load reverse bit-map image
1	**Standard Bit-map** - Clear print area and load bit-map image
2	**Merge Bit-map** - Overwrite background bit-map image with printable dot locations leaving non-printing dot locations alone.

L/vL Command - Write Line (Monochrome)

Description Writes a Monochrome graphic line using parameters to specify origin, height, and width. The resulting line overwrites any existing graphics data.The "L"command writes to the buffer used for Resin printing. The "vL" command writes to a buffer used for Varnish printing.

Syntax $^{e}{}_{sc}\mathbf{L}\,^{SPACE}\,p_1\,^{SPACE}\,p_2\,^{SPACE}\,p_3\,^{SPACE}\,p_4\,^{SPACE}\,p_5$↵

Parameters

p_1 = Horizontal (X-axis) start position (X) in dots.

p_2 = Vertical (Y-axis) start position (Y) in dots.

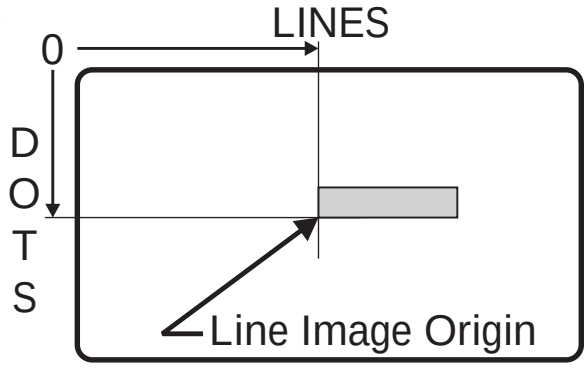
p_3 = Horizontal (X-axis) width of graphic in dots (i.e. horizontal lines).

p_4 = Vertical (Y-axis) height of graphic in dots.

p_5 = Graphic Mode

Value	Description
0	**Reverse Bit-map** - Clear print area and load reverse bit-map image
1	**Standard Bit-map** - Clear print area and load bit-map image
2	**Merge Bit-map** - Overwrite background bit-map image with printable dot locations leaving non-printing dot locations alone.

Figure 2-7 Line /Rectangle Image Positioning



C/vC Command - Write Box (Monochrome)

Description Writes a hollow-box rectangle graphic to the a monochrome image buffer by defining the height, width, line thickness (width) and origin .The "C"command writes to the buffer used for Resin printing. The "vC" command writes to a buffer used for Varnish printing.

Syntax ⊖sc**C** SPACE p_1 SPACE p_2 SPACE p_3 SPACE p_4 SPACE p_{54} SPACE p_6↵
⊖sc**vC** SPACE p_1 SPACE p_2 SPACE p_3 SPACE p_4 SPACE p_{54} SPACE p_6↵

Parameters

p_1 = Horizontal (X-axis) start position in dots.

p_2 = Vertical (Y-axis) start position in dots.

p_3 = Horizontal (X-axis) width of graphic line in dots (i.e. horizontal lines).

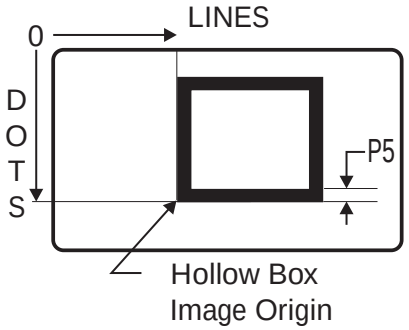
p_4 = Vertical (Y-axis) height of graphic line in dots.

p_5 = Thickness/width of diagonal graphic line in dots.

p_6 = Graphic Mode

Value	Description
0	**Reverse Bit-map** - Clear print area and load reverse bit-map image
1	**Standard Bit-map** - Clear print area and load bit-map image
2	**Merge Bit-map** - Overwrite background bit-map image with printable dot locations leaving non-printing dot locations alone.

Figure 2-8 Hollow Box Image Positioning



D/vD Commands - Write Diagonal (Monochrome)

Description Write a monochrome diagonal line graphic by defining the total height, total width, line thickness (width) and position in the Monochrome image buffer. The "D" command writes to the Resin buffer, and the "vD" command writes to the Varnish buffer.*The actual image placed is a rectangle.*

Syntax $^{e}{}_{sc}\mathbf{D}\ ^{SPACE}\mathbf{p}_1\ ^{SPACE}p_2\ ^{SPACE}p_3\ ^{SPACE}p_4\ ^{SPACE}p_5\ ^{SPACE}p_6\ ^{SPACE}p_7\hookleftarrow$

Parameters

p_1 = Horizontal (X-axis) start position, in dots.

p_2 = Vertical (Y-axis) start position, in dots.

p_3 = Horizontal (X-axis) width of graphic, in dots.

p_4 = Vertical (Y-axis) height of graphic, in dots.

p_5 = Thickness/width of the line, in dots.

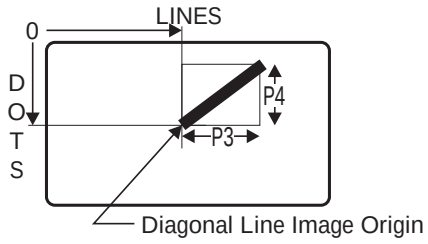
p_6 = Rotation & Origin:

Value	Description	Origin
1	90 degrees	Lower Left
2	180 degrees	Lower Left

p_7 = Graphic Mode:

Value	Description
0	**Reverse Bit-map** - Clear print area and load reverse bit-map image
1	**Standard Bit-map** - Clear print area and load bit-map image
2	**Merge Bit-map** - Overwrite background bit-map image with printable dot locations leaving non-printing dot locations alone.

Figure 2-9 Image Object & Hexadecimal Code



T/vT Commands - ASCII Text (Monochrome)

Description Downloads a single line of modified ANSI Windows characters as text. See Appendix A for Character Map. The "T" command downloads to the Resin buffer, and the " vT" command downloads to the Varnish buffer.

A printer error occurs when text extends beyond the addressable buffer area. The resident fonts derive from proportionally-spaced 100-point Arial Bold and 100-point Arial Normal. Because of kerning, characters spacing is minimized.

Syntax ^{esc}**T**^{SPACE} p_1 ^{SPACE} p_2 ^{SPACE} p_3 ^{SPACE} p_4 ^{SPACE} p_5 ^{SPACE} p_6 ^{SPACE} p_7 ^{SPACE}*data*↵

^{esc}**vT**^{SPACE} p_1 ^{SPACE} p_2 ^{SPACE} p_3 ^{SPACE} p_4 ^{SPACE} p_5 ^{SPACE} p_6 ^{SPACE} p_7 ^{SPACE}*data*↵

Parameters p_1 = Horizontal start position (X) in dots.

p_2 = Vertical start position (Y) in dots.

p_3 = Rotation & Origin

Value	Description	Origin
0	No rotation	Lower Left
1	90 degrees	Lower Left
2	180 degrees	Lower Left
3	270 degrees	Lower Left
4	No rotation	Centered
5	90 degrees	Centered
6	180 degrees	Centered
7	270 degrees	Centered

p_4 = Font selection

Value	Description
0	Arial, 100 points "Normal"
1	Arial, 100 points "Bold"

p_5 = Horizontal (X-axis) width (before rotation) of text graphic in dots. If the value is zero (0) the text maintain normal font proportions and scales according to the value of the Y-axis (p_6) value.

p_6 = Vertical (Y-axis) height (before rotation) of text graphic in dots.

Examples:
For 28-point normal, p_6 = 104
For 28-point bold, p_6 = 140

Note:
With p_5 a "0," fonts maintain normal proportions, and just p_6 determines font size.

p_7 = Graphic Mode:

Value	Description
0	**Reverse Bit-map** - Clear print area and load reverse bit-map image
1	**Standard Bit-map** - Clear print area and load bit-map image
2	**Merge Bit-map** - Overwrite background bit-map image with printable dot locations leaving non-printing dot locations alone.

data = Represents a single line modified ANSI text data field. See Appendix A for a supported character font map.

The printer interprets the **Space** character as a command field delimiter and the **Carriage Return** character as a command terminator. However, except as the first character, the **Space** character may be used within a text data string.

To use the **Space** character at the beginning of a text data field, the **Leading Bracket** character ("**[**" Dec. 91 or 5B Hex.) must be added as the first character of the text string. Also, to print a **Leading Bracket** character two Leading Bracket characters must be entered.

B Command - Bar Code (Monochrome)

Description This command is used to print standard bar codes. See Appendix A for character maps and unique parameter settings for each bar code type.

Syntax ^{Esc}**B** ^{SPACE} p_1 ^{SPACE} p_2 ^{SPACE} p_3 ^{SPACE} p_4 ^{SPACE} p_5 ^{SPACE} p_6 ^{SPACE} p_7 ^{SPACE} p_8 ^{SPACE}*data*$_{\hookleftarrow}$

Parameters p_1 = Horizontal (X-axis) start position, in dots

p_2 = Vertical (Y-axis) start position, in dots.

p_3 = Rotation:

Value	Description	Origin
0	No rotation	Lower Left
1	90 degrees	Lower Left
2	180 degrees	Lower Left
3	270 degrees	Lower Left
4	No rotation	Centered
5	90 degrees	Centered
6	180 degrees	Centered
7	270 degrees	Centered

p_4 = Bar Code selection - *See Appendix A*

Value	Bar Code Type
0	Code 39 (3 of 9) (alphanumeric)
1	2/5 Interleaved (Numeric, Even No.)
2	2/5 Standard (Numeric)
3	EAN8 (Numeric, 7 digits encoded)
4	EAN13 (Numeric, 12 digits encoded)
5	UPC - A (Numeric, 12 digits encoded)
6	Reserved for MONARCH
7	Code 128 C without check digits * (Numeric Only, Even Number Printed)
107	Code 128 C with check digits * (Numeric Only, Even Number Printed)
8	Code 128 B without check digits * (**alphanumeric)**
108	Code 128 B with check digits * (**alphanumeric)**
* -Not supported by some Monochrome printer models	

p_5 = Bar width ratio:

Value	Narrow Bar	Wide Bar	Ratio
0	1 dot	2 dots	2:1
1	1 dot	3 dots	3:1
2	2 dots	5 dots	2.5:1 or 2:5

Note: Some bar code types have a selectable bar code width ratio. See Appendix A for supported ratio and settings.

p_6 = Bar code bar width multiplier. Range 3 ~ 9 for all Privilege card bar codes except UPC-A, EAN-8 and EAN-13 which have a range of 4 ~ 7. For a selected bar width ratio of 2:5, the range is 2 ~ 4.

Note: Each bar code type has a specified standard for the width range of a narrow bar width. See Appendix A for optimal values.

p_7 = Bar code height in dots.

Note: Each bar code type has an industry specified minimum height standard. See Appendix A for optimal values.

p_8 = Print human readable code. Acceptable values are 1 = yes or 0 = no.

data = Represents a fixed data field. Each bar code type has a differing data field length and allowable character requirements. See Appendix A.

A printer error occurs when a bar code extends beyond the addressable area of the image buffer. See Appendix A for field size calculations for total bar code length and height.

I Command - Print Monochrome Graphics

Description This command serves to print a monochrome graphic panel from a card image previously stored in the buffer designated for Resin images.

After print completion, the card may be ejected to the output tray (hopper) or repositioned to print another image (ribbon panel). Typically the clear varnish, or for some models, the hologram lamination prints next. Then, a duplex printer may produce additional printing after flipping the card to the opposite side.

Ribbon panels advance during printing, making the installed ribbon the overriding factor in choosing buffers for imaging.

Syntax <ESC>I{SP}{p1}<CR>

Parameters p_1 = *Optional Command Parameter*

Print Options

Value	Description
None	Prints Monochrome image buffer and Ejects card.
10	Prints card and returns the card to the print ready position.
20	*For Ribbons with Monochrome (1 panel) and clear veneer (1 panel) with printer firmware versions 2.00 and above* - Prints card and returns the card to the print ready position. Also, if appropriate, synchronizes multiple-panel ribbon for the next print pass. For P500's using YMCKOK ribbon, the card ejects after the last application of either Kr or laminate, and a prior +DLAMI commaand determines whether or not the I 20 command invokes lamination.
30	Print Card but leave in place (Allows preparation for Module 2 with Module 2 BUSY in P600s.

J Command - Print Multiple Monochrome Cards

Description *Note: This command only applies to monochrome printing using a Monochrome ribbon having a single continuos color and material; i.e., all black, all red, all magenta, etc.*

This command serves to print several Monochrome cards from an image previously stored in the Resin image buffer.

P600:

P600 Printers do not respond to this command.

Syntax $^{e}{}_{sc}\mathbf{J}^{\$p}{}_{\&f}p_1{}_{\leftarrow}\lrcorner$

Parameters p_1 = Number of cards to print.

+C Command - Adjusts Monochrome Intensity

Description Sets the Monochrome ribbon transfer intensity (heat) level. Varying the intensity level affects the "Dot Gain" or size of the dot and the density (opaqueness) of the transferred material.

Syntax ESC + C p1 ↵

Parameters p1 = Printer Default = 3 ; Range 0 ~ 10

VARNISH

IV Command - Print Clear Veneer

Description This command serves either to print the entire addressable image buffer or to reverse print with the clear veneer or any image data (line, rectangles, graphics, text, etc.) previously stored in a monochrome image buffer.

After printing is complete, the card may be ejected to the output tray (hopper) or repositioned to print more ribbon panels for models that support the hologram, lamination, or the duplex operations.

The ribbon panels advance during printing such that completion of printing from one ribbon panel leaves the ribbon ready to print the next panel.

Syntax ^{esc}**IV**{$^{Shift}p_1$}↵

Parameters p_1 = *Optional Command Parameter*

Print Options

Value	Description
None	Prints 100% of image buffer with the clear veneer material and ejects card.
1	Prints the inverse of the image buffer data and ejects card.
10	Prints card and returns the card to the print ready position.
11	Print inverse of image buffer and return card to print ready position.
30	Print card, but leave in place (facilitates advancing card in Module 1 in preparation for not BUSY in Module 2 (P500s and P600s).
31	Similar to 30, but print inverse image.

+CV Command - Adjust Clear Veneer Intensity

Description Sets the clear veneer ribbon transfer intensity (heat) level. Varying the intensity level affects the density (amount) of the transferred material.

Syntax ESC +CV SP p_1 ↵

Parameters p_1 = Printer
Default = 3
Range = 0 ~ 10

$F Command - Clear Color Image Buffers

Description Clears the color image buffers.

This command can be used in conjunction with the "IS" print command to advance the ribbon without printing any data.

Syntax ESC**$F**↵

Parameters None

PS Command - Download Color Image Buffer

Description Initializes and downloads separated color data (C, M, Y, or K) for an associated complete single-color image buffer.

Syntax ESC **PS** SPACE p_1 SPACE p_2 SPACE *data* ↵

Parameters

p_1 = Color image buffer number:
0 = Yellow (Y)
1 = Magenta (M)
2 = Cyan (C)
3 = Thermal Transfer Black (K)

p_2 = Data Mode:
32 = Uncompressed Data - 256 levels (00 ~ FF Hex.)

30 = Compressed Data - 32 levels (00 ~ 1F Hex.)

data = Uncompressed or compressed color bit-map data for a single separated color.

Where the color buffer maximums are:
628,992 Compressed Bytes (Standard Printer)
655,360 Compressed Bytes (Extended. Memory)

GS Command - Download Color Graphic

Description Initializes, downloads, and positions individual color-separated data (C,M,Y, or K) for a partial image. Defines the height, width and position of the graphic.

Syntax ESC **GS** SPACE p_1 SPACE p_2 SPACE p_3 SPACE p_4 SPACE p_5 SPACE p_6 SPACE *data*↵

Parameters

p_1 = Color image buffer number:
0 = Yellow (Y)
1 = Magenta (M)
2 = Cyan (C)
3 = Dye Diffusion Black (K)

p_2 = Data Mode:
32 = Uncompressed Data - 256 levels (00-FF Hex.)
30 = Compressed Data - 32 levels (00-1F Hex.)

p_3 = Horizontal (X-axis) start position, in dots.

p_4 = Vertical (Y-axis) start position, in dots.

p_5 = Horizontal (X-axis) width of graphic, in dots (i.e. horizontal lines).

p_6 = Vertical (Y-axis) height of graphic, in bytes.

data = Uncompressed or compressed color bit-map data for a single separated color.

+$L Command - Adjust Color Intensity

Description Sets the maximum color intensity (heat) level applied to a selected dye diffusion ribbon panel.

Syntax $^{e}{}_{5_c}$ **+$L** $^{SP_{ACE}}$ p_1 $^{SP_{ACE}}$ p_2 ↵

Parameters

p_1 = Color image buffer number:
0 = Yellow (Y)
1 = Magenta (M)
2 = Cyan (C)
3 = Dye Diffusion Black (K)

p_2 = Intensity
Printer Default = 5
Range 0 ~ 10

+$C Command - Adjust Color Contrast

Description Sets the range from the maximum to the minimum color intensity (heat) level applied to a selected dye diffusion ribbon panel.

Syntax $^{e}{}_{sc}$ **+$C** ^{SPACE} p_1 ^{SPACE} p_2 ↵

Parameters

p_1 = Color image buffer
0 = Yellow (Y)
1 = Magenta (M)
2 = Cyan (C)
3 = Dye Diffusion Black (K)

p_2 = Contrast:
Printer Default = 5
Range 0 ~ 10

IS Command - Print Color Graphic

Description This command serves to print a selected color dye diffusion ribbon panel from the associated image buffer.

After completing a printing pass, the card is repositioned to print the next ribbon panel.

The ribbon panel advances during printing such that completion of one panel leaves the ribbon ready to print the next panel.

Syntax ^{esc}**IS**$^{sp}p_1$↵

Parameters p_1 = Color image buffer number:
0 = Yellow (Y)
1 = Magenta (M)
2 = Cyan (C)
3 = Dye Diffusion Black (K)

Note: Card imaging using the YMCKOK ribbon requires the following command sequence:

IS 0	Image Yellow
IS 1	Image Magenta
IS 2	Image Cyan
I	Image Black and Return (YMCKOK only)
IV 10	Image Varnish and Return
I 20	Image Black and Return
MO	Eject Card

HOLOGRAM

IH Command - Print Hologram

Description This command serves to print the entire address able Varnish image buffer or to reverse print any image data (line, rectangles, graphics, text, etc.) previously stored in the Resin image buffer.

After printing is complete, the card may be ejected to the output tray (hopper) or repositioned to print more ribbon panels for models that support the duplex option.

The ribbon panel advances during printing such that the next panel is ready to print.

Syntax ^es_c**IH{**^{sp}h_t{p₁}↵

Parameters p_1 = *Optional Command Parameter*

Print Options

Value	Description
None	Prints 100% of image buffer as hologram lamination and ejects card.
1	Prints the inverse of the image data to card and ejects card.
10	Prints card and returns the card to the print-ready position.

+CH Command - Adjust Hologram Intensity

Description Sets the Hologram material transfer intensity (heat) level. Varying the intensity level affects the "Dot Gain" or size of the dot and the density (opaqueness) of the transferred material.

Syntax ESC +CH Syntax p_1↵

Parameters p_1 = Printer Default = 5 ; Range 0-10

MF Command - Rotate Card To Duplex

Description Flips the card 180° for duplex printing.

Note that for user safety, a card-flip requires a closed cover.

For P400:

Card remains in the Card-Flip Assembly.

For P500:

If a card is in the printer, places card in Card-Flip, flips card, and sends card to Print-Ready position.

If no card is in the printer, feeds a card prior to placing a card in Card Flip, flipping card, and sending card to Print-Ready position.

For P600:

If a card is in Module 2, places the card in Card-Flip and flips card.

If a card is in Module 1, waits for card to arrive in Module 2 and then flips card.

Syntax ESC c **MF** ↵

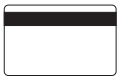
Parameters None

&R Command - Reset Magnetic Encoder

Description Clears the magnetic encoder command and data buffers.
Note: Does not reset the track data format or density to default values.

Syntax ESC&R↵

Parameters None



&E Command - Write Single Track

Description Encode, Write and Read (verify) a single track of data.

The printer feeds a card (if a card is not loaded) and magnetically writes data to the selected ISO track. The card automatically read-verifies the encoded data. The card then moves to the print-ready position.

Syntax 

Parameters p_1 = Encoding Track Number.

data = ISO track

NOTE

The actual data encoded onto the card is converted from ASCII to the encoding format previously specified for the associated ISO card track. See Appendix C for default ANSI/ISO data formats and custom encoding commands.

&B Command - Write Buffer Single Track

Description Load data into the write buffer for a single selected track of encoding.

Syntax ESC **&B** SPACE p_1 SPACE *data* ↵

Parameters p_1 = Encoding Physical Track Number.
1 = Track 1 Decimal data
2 = Track 2 Decimal data
3 = Track 3 Decimal data
11 = Track 1 Hexadecimal data*
12 = Track 2 Hexadecimal data*
13 = Track 3 Hexadecimal data*

data = Each track has unique character and length limitations due to formatting. For p1 values of 1 ~ 3, the printer automatically inserts the required ISO control characters (start and stop sentinel, longitudinal redundancy check character, etc.) into the data.

Track	Characters (Default ANSI/ISO)	Field Separator	Length
1	SPACE $ ( ) - . / 0 through 9 A through Z (All Caps)	^	76
2	0 through 9	=	37
3	0 through 9	=	104
11*	Hexadecimal	N/A	*
12*	Hexadecimal	N/A	*
13*	Hexadecimal	N/A	*
* - For encoders with printer serial number 5000 and greater, see Appendix C for extended encoder command set and custom track data and control parameters.			

The actual data encoded on to the card is converted from ASCII to an ISO track's specified encoding format. See Appendix C for default ANSI/ISO data formats and custom data encoding commands.

&E* Command - Write Track Buffers

Description Encodes, Writes, and Reads (verifies) for all tracks of data stored in printer memory.

The printer feeds a card (if a card is not loaded) and magnetically writes data (stored in memory) to the pre-selected ISO track(s). The card automatically repositions and read-verifies the encoded data. The card then is repositioned to the print ready position. The encoder data buffer is cleared for the next operation.

Syntax ESC&E*↵

Parameters None

&L Command - Read Single Track

Description Reads data for a single track from a magnetic card.

Syntax ESC&Lp_1↵

Parameters p_1 = Track Number.
1 = Track 1 Decimal data per following table
2 = Track 2 Decimal data per following table
3 = Track 3 Decimal data per following table

Note: p1 values of 11, 12, and 13, require a preceeding space.

11 = Track 1 Hexadecimal data
12 = Track 2 Hexadecimal data
13 = Track 3 Hexadecimal data

Track	Characters (Default)	Field Separator	Length
1	SPACE $ ( ) - . / 0 through 9 A through Z (All Caps)	^	76
2	0 through 9	=	37
3	0 through 9	=	104
SPACE11	Hexadecimal*	N/A	*
SPACE12	Hexacedimal*	N/A	*
SPACE13	Hexadecimal*	N/A	*
* - For encoders with printer serial numbers 5000 and greater, see Appendix C.			

The actual data encoded on to the card is converted automatically from an ISO track's specified encoding format to ASCII. See Appendix C for default ANSI/ISO data formats and custom data encoding commands.

&W Command - Change Encoding Direction

Description Change the direction that the encoder starts writing and reading operations.

Syntax ^es_c **&W** ^{SpAcE} p_1 ↵

Parameters p_1 = Direction Select

Value	Description
0	Forward
1	Reverse

&D Command - Change Track Density

NOTE

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. Printers with parallel interfaces cannot respond to this command, (other than flagging an error). The card printer can operate with both interfaces attached and communicating with the printer.

Description Change an individual track data encoding and decoding density.

Syntax ^{esc}**&D**$^{SPACE}p_1{}^{SPACE}p_2$↵

Parameters p_1 = Track Select

Value	Description
1	Track 1
2	Track 2
3	Track 3

p_2 = Density Select

Value	Description
75	75 bpi
210	210 bpi

&CDER Command - Read Custom Track Data

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. The card printer cannot respond to this command, (other than flagging an error), through the printer's parallel interface. The card printer can operate with both interfaces attached and communicating with the printer.

Description Set the encoder to read a selected data format.

The &CDER command in conjunction with the &CDEW command resets the encoder to the default ISO track density and data format settings.

Syntax

$^{e}{}_{s_c}$&CDER$^{Sp}{}_{A_c}{}_{c_r}$p$_1$$^{Sp}{}_{A_c}{}_{c_r}p_2$$_{\hookleftarrow}$┘ ←ISO Data

$^{e}{}_{s_c}$&CDER$^{Sp}{}_{A_c}{}_{c_r}$p$_1$$^{Sp}{}_{A_c}{}_{c_r}p_2$$^{Sp}{}_{A_c}{}_{c_r}p_3$$_{\hookleftarrow}$┘ ←Raw Data

Parameters

p_1 = Track Select: (values 1, 2, 3, or 0 (zero)).

where:

0 resets ALL tracks to ISO default configuration parameters.

p_2 = Custom Data Select:

Value	Description - ISO Format Data
0	Resets ALL tracks to ISO default configuration parameters.
Default Format Select	
Q	ISO Track 1 Data Format to Track 1
R	ISO Track 2 Data Format to Track 2
S	ISO Track 3 Data Format to Track 3
Custom ISO Track Format Location	
qX	Track 1 with ISO Track "X" Format
rX	Track 2 with ISO Track "X" Format
sX	Track 3 with ISO Track "X" Format
X = 1, 2, or 3 as the ISO default track format applied to the selected track (e.g., Q=q1, R=r2, and S=s3.	

p_2 = Custom Data Select

Value	Description - Raw Data Format
Read Forward - "Raw" Data	
U	Track 1
U_	Track 1 read data with NULs in data string
V	Track 2
V_	Track 2 read data with NULs in data string
W	Track 3
W_	Track 3 read data with NULs in data string
Read Reverse - "Raw" Data	
u	Track 1
u_	Track 1 read data with NULs in data string
v	Track 2
v_	Track 2 read data with NULs in data string
w	Track 3
w_	Track 3 read data with NULs in data string

p_3 = Data Block Size Select in Bits
Acceptable values - 3,4,5,6 and 7

The encoder cannot decode and convert "Raw" data into ASCII data. The encoder only reports data read process has completed.

&CDEW Command - Write Custom Track Data

NOTE

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. The card printer <u>cannot</u> <u>respond</u> <u>to</u> <u>this</u> command, (other than flagging an error), through the printer's parallel interface. The card printer can operate with both interfaces attached and communicating with the printer.

Description

Configure the write data to encode a single, selected track of data.

The &CDEW command in conjunction with the &CDER command resets the encoder to the default ISO track density and data format settings.

Syntax

[ESC]&CDEW[SPACE]p1[SPACE]p2↵ ← ISO Data
[ESC]&CDEW[SPACE]p1[SPACE]p2[SPACE]p3↵ ← Raw Data

Parameters

p_1 = Track Select: (values 1, 2, 3 or 0 (zero))

Where:

0 resets ALL tracks to ISO default configuration parameters.

p_2 = Data Format Select:

Value	Description - ISO Format Data
0	Reset ALL tracks to ISO default configuration parameters.
Default Format Select	
A	ISO Track 1 Data Format to Track 1
B	ISO Track 2 Data Format to Track 2
C	ISO Track 3 Data Format to Track 3
Custom ISO Track Format Select	
aX	Track 1 with ISO Track "X" Format
bX	Track 2 with ISO Track "X" Format
cX	Track 3 with ISO Track "X" Format
X = ISO default track format applied to the selected track (e.g., A = a1, B = b2, and C = c3.	

p_2 = Custom Data Select

Value	Description - Raw Data Format
	Read Forward - "Raw" Data
E	Track 1
E_	Track 1 read data with NULs in data string
F	Track 2
F_	Track 2 read data with NULs in data string
G	Track 3
G_	Track 3 read data with NULs in data string

p_3 = Data Block Size Select in Bits
Acceptable values - 3,4,5,6 and 7

The encoder cannot encode and convert ASCII data into "Raw" data. The encoder only reports data write process has completed.

&T Command - Mag. Encoder - Eject Card

Moves and exits a single card from any position between the card feeder to the output tray.

Syntax ESC&T↵

Parameters None

MS Command - Move To Smart Card Programmer

Description Moves a card to the Smart Card programming station.

Pins 5 and 9 of the DB-9 connector interconnect to notify an external programming device that the card is ready to program.

Syntax ESC**MS**↵

Parameters None

+OS Command - Smart Card Y-axis Offset

Description Offsets the horizontal (X-axis) Smart Card programmer location in dots.

Syntax ESC +OS SPACE p_1 ↵

Parameters p_1 = Horizontal start position (X) in dots.
Default = 96 Range = 0 ~ 192

+B Command - Serial Interface Rate


NOTE

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. Printers with parallel interfaces cannot respond to this command, (other than flagging an error). The card printer can operate with both interfaces attached and communicating with the printer.

Description This command changes the baud rate of printers with serial interfaces.

Syntax 

Parameters p_1 = Serial Interface Baud Rate Options

Select	Baud Rate
0	9600 (Default)
1	19200
2	38400

E Command - Retransmit Last Response

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. The card printer cannot respond to this command, (other than flagging an error), through the printer's parallel interface. The card printer can operate with both interfaces attached and communicating with the printer.

Description This command directs the printer to repeat the last status message.

Syntax ESC E ↵

Parameters None

+X Command - Change Command Initiator

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. The card printer cannot respond to this command, (other than flagging an error), through the printer's parallel interface. The card printer can operate with both interfaces attached and communicating with the printer.

Description This command adds an alternate command initiation character. Some host systems cannot transmit an Escape command character. The printer then responds to both the Escape character and the added command initiation character.

Syntax <ESC>+X<SP>p_1<CR>

Parameters p_1 = A single ASCII character
Decimal 33 ~ 255
Hexadecimal 21 ~ FF

Note: To remove an alternate command initiation character, send +X with p_1 < 20Hex (except for 0DHex). A NACK response results, with error code 10 (Syntax Error). Then, Escape remains as the only command initiation character.

!X Command - Check Command Initiator

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. The card printer cannot respond to this command, (other than flagging an error), through the printer's parallel interface. The card printer can operate with both interfaces attached and communicating with the printer.

Description This command checks for an alternate command initiator. The printer either reports the alternate command initiation character or nothing.

Syntax ESC!X↵

Parameters None

&P Command - Check Card Present - Encoder

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. The card printer cannot respond to this command, (other than flagging an error), through the printer's parallel interface. The card printer can operate with both interfaces attached and communicating with the printer.

Description This command is used to check for the presence of a card in the magnetic encoder station.

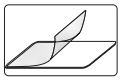
Syntax ESC**&P**↵

Parameters None

Response Typical status response:

(NACK)05(EOT) - *Card in magnetic encoder.*

(NACK)06(EOT) - *Card not in magnetic encoder.*



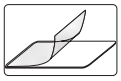
SF Command - Synchronize Film (Polyguard)

Description Positions Polyguard Lamination Ribbon with black index mark at sensor. This is a first-time ribbon synchronization used to position a die-cut panel a known offset from the Laminator Station of P500 card printers. The command is only required for an initialization just after installing a Polyguard ribbon. Subsequent applications of die-cut Polyguard panels occurs via offsets from the previous panel application.

Note: A Laminator previously set for the application of Varnish (see TF Command) does not respond to this command.

Syntax ^es_c# ^{Sp}K_{t1}1 ^{Sp}K_{t2}SF↵

Parameters None

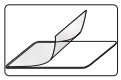


TF Command - Film Type

Description Specifies either Polyguard or Varnish as the type of Ribbon installed in the Laminator Station of P500s.

Syntax ^c#1TFp_1↵

Parameters P1 = Type of Laminator Ribbon
0 = Varnish
1 = Polyguard

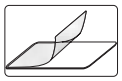


+TC Command - Set Temperature

Description Sets amount of heat applied in transferring material or die-cut panels from the Laminator Ribbon to the cards.

Syntax ESC # SPACE 1 SPACE + TC SPACE P1 ↵

Parameters P1 = Temperature
Polyguard ≅ 165
Varnish ≅ 155



+DLAMI Command - Set Lamination Configuration

Description Configures P500 card printers for the application of lamination. The associated application occurs with issuance of an IV command, or in some instances, an I command (In the following Examples, look for the +DLAMI that precedes an I or IV).

Note: This command applies to Module-1 and, therefore, requires no # [SPACE]1 preface.

Syntax [ESC]c + DLAMI [SPACE] p_1 [SPACE] p_2 [CR]

Parameters

p_1 = Print Station Varnish
0 = No
1 = Yes

p_2 = Laminator Station Application
0 = No
1 = Yes

Examples Using YMCKO Ribbon

Print YMCK ribbon panels then laminate (both sides):

+DLAMI 0 1	Only Laminator Enabled
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV 10	Print O (Laminate) & return
MF	Flip Card
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV	Print O (Laminate)

On first side, print YMCK then laminate. On second side, print YMCKO panels (no laminate):

+DLAMI 0 1	Only Laminator enabled
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV 10	Print O (Laminate) & return
MF	Flip Card
+DLAMI 1 0	Only Print Station Enabled
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV	Print O

Print all ribon panels on both sides without lamination:

+DLAMI 1 0	Only Print Station Enabled
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV 10	Print O (Print Station) & return
MF	Flip Card
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV	Print O (Print Station)

Examples Using YMCKOK Ribbon

On first side, print YMCK panels then laminate. On second side, print last K panel then laminate:

+RIB 10	YMCKOK ribbon installed
+DLAMI 0 1	Only Laminator Enabled
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV 10	Print O (Laminate) & return
MF	Flip Card
I 20	Print K, laminate, & eject card

On first side, print YMCK panels then laminate. On second side, print just last K panel:

+RIB 10	YMCKOK ribbon installed
+DLAMI 0 1	Only Laminator Enabled
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV 10	Print O (Laminate) & return
MF	Flip Card
+DLAMI 1 0	Only Print Station Enabled
I 20	Print K & eject card

On first side, print YMCKO panels (no lamination). On second side, print just last K panel (No lamination):

+RIB 10	YMCKOK ribbon installed
+DLAMI 1 0	Only Print Station Enabled
IS 0	Print Y
IS 1	Print M
IS 2	Print C
I	Print K
IV 10	Print O (Print Station)
MF	Flip Card
I 20	Print K & eject card

Examples Using KsO Ribbon

Print Ks and laminate both sides (no ribbon panel varnish):

+DLAMI 0 1	Only Laminator Enabled
IS 3	Print K
IV 10	Print O (Laminator) & return
MF	Flip Card
IS 3	Print K
IV	Print O (Laminator)

On first side, print Ks and laminate. On second side, print Ks and varnish (no laminate):

+DLAMI 0 1	Only Laminator Enabled
IS 3	Print K
IV 10	Print O (Laminator) & return
MF	Flip Card
+DLAMI 1 0	Only Print Station Enabled
IS 3	Print K
IV	Print O (Print Station)

+DLAMI Command - Set Lamination Configuration (Continued)

Print KsO on both sides without lamination;

+DLAMI 1 0	Only Print Station Enabled
IS 3	Print K
IV 10	Print O (Print Station) & return
MF	Flip Card
IS 3	Print K
IV	Print O (Print Station)

Examples Using Monochrome Ribbon

Print K and laminate both sides:

+DLAMI 0 1	Only Laminator Enabled
I 10	Print K, Laminate, & return
MF	Flip Card
I	Print K & eject card

On first side, print K and laminate. On second side just print K:

+DLAMI 0 1	Only Laminator Enabled
I 10	Print K, Laminate, & return
MF	Flip Card
+DLAMI 1 0	Only Print Station Enabled
I	Print K

Print K on both sides without lamination:

+DLAMI 1 0	Only Print Station Enabled
I 10	Print K & return
MF	Flip Card
I	Print K & eject card

Appendix A

This section contains a listing of all fonts, bar codes, and their respective character sets supported by the Privilege Card Printer programming language.

Resident Fonts

The Eltron Privilege programming language supports 2 different fonts based on Arial “Normal” and Arial “Bold.” The fonts are proportionally generated by the printer from Arial 100 point “Normal” and Arial 100 point “Bold” font descriptions.

Hexidecimal - Most Significant Digit

Hexidecimal - Least Significant Digit	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	16	32	0 48	@ 64	P 80	` 96	p 112	128	144	160	176	À 192	Ð 208	à 224	ð 240
1	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	129	145	161	177	Á 193	Ñ 209	á 225	ñ 241
2	2	18	" 34	2 50	B 66	R 82	b 98	r 114	130	146	162	178	Â 194	Ò 210	â 226	ò 242
3	3	19	# 35	3 51	C 67	S 83	c 99	s 115	131	147	£ 163	179	Ã 195	Ó 211	ã 227	ó 243
4	4	20	$ 36	4 52	D 68	T 84	d 100	t 116	132	148	164	180	Ä 196	Ô 212	ä 228	ô 244
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	165	181	Å 197	Õ 213	å 229	õ 245
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	166	182	Æ 198	Ö 214	æ 230	ö 246
7	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	167	183	Ç 199	× 215	ç 231	÷ 247
8	8	24	(40	8 56	H 72	X 88	h 104	x 120	136	152	168	184	È 200	Ø 216	è 232	ø 248
9	9	25	) 41	9 57	I 73	Y 89	i 105	y 121	137	153	169	185	É 201	Ù 217	é 233	ù 249
A	10	26	* 42	: 58	J 74	Z 90	j 106	z 122	Š 138	š 154	170	º 186	Ê 202	Ú 218	ê 234	ú 250
B	11	27	+ 43	; 59	K 75	[91	k 107	123	139	155	171	187	Ë 203	Û 219	ë 235	û 251
C	12	28	, 44	< 60	L 76	\ 92	l 108	124	Œ 140	œ 156	172	188	Ì 204	Ü 220	ì 236	ü 252
D	13	29	- 45	= 61	M 77	] 93	m 109	125	141	157	173	189	Í 205	Ý 221	í 237	ý 253
E	14	30	. 46	> 62	N 78	^ 94	n 110	126	142	158	174	190	Î 206	Þ 222	î 238	þ 254
F	15	31	/ 47	? 63	O 79	_ 95	o 111	127	143	Ÿ 159	175	¿ 191	Ï 207	ß 223	ï 239	ÿ 255

Code 39
(Code 3 of 9)

Code 39 is an alphanumeric bar code. Each character consists of 5 bars and 4 spaces. 3 of the 9 bars or spaces are wide. The wide to narrow bar and space width is set by the ratio. **The minimum narrow bar or space is 3 dots or 0.010 inch (0.254 mm).**

The supported ratio of narrow bar to wide bar widths are: **2:1, 5:2 (2.5:1), and 3:1**. The equation to calculate the Code 39 bar code length is:

$L = [(C+2)(3R + 7) - 1]X$

L = Length of bar code
C = Number of characters
R = Ratio of wide to narrow bars
X = Number of Dots times 0.0033 inches per dot (0.0847 mm per dot)
For the 5:2 ratio, the X = Dots times 2

The specified minimum recommended height of a Code 39 bar code is **0.25 inches (6.35 mm) or 75 dots.** The recommend "Quite Zone" is **0.25" (6.35mm or 75 dots) or 10 times X** if larger.

Privilege card printers support Code 39 with the following 43 data characters, shown below:

Hexidecimal - Most Significant Digit

Hexidecimal - Least Significant Digit	0	1	2	3	4	5	6	7
0	0 0	16	32	0 48	64	P 80	96	112
1	1 1	17	33	1 49	A 65	Q 81	97	113
2	2 2	18	34	2 50	B 66	R 82	98	114
3	3 3	19	35	3 51	C 67	S 83	99	115
4	4 4	20	36	4 52	D 68	T 84	100	116
5	5 5	21	% 37	5 53	E 69	U 85	101	117
6	6 6	22	38	6 54	F 70	V 86	102	118
7	7 7	23	39	7 55	G 71	W 87	103	119
8	8 8	24	40	8 56	H 72	X 88	104	120
9	9 9	25	41	9 57	I 73	Y 89	105	121
A	10 10	26	* 42	58	J 74	Z 90	106	122
B	11 11	27	+ 43	59	K 75	91	107	123
C	12 12	28	44	60	L 76	92	108	124
D	13 13	29	- 45	61	M 77	93	109	125
E	14 14	30	. 46	62	N 78	94	110	126
F	15 15	31	/ 47	63	O 79	95	111	127

Standard 2 of 5
(Code 2/5)

The Two of Five code symbology encodes all information in the width of the bars. None of the information is carried by the spaces. Bars are wide or narrow and the wide bars are set by the ratio. Spaces are the same width as the narrow bars.

Two of Five code supports the numeric characters:

0123456789

The supported ratio of narrow bar to wide bar widths are: **2:1, 5:2 (2.5:1), and 3:1**.

The equation to calculate the Code 2/5 bar code length is:

$L = [(C (2R + 8)) + 14] X$

L = Length of bar code
C = Number of characters
R = Ratio of wide to narrow bars (5:2 = 2.5)
X = Number of Dots times 0.0033 inches per dot (0.08847 mm per dot)
For 5:2 ratio, the X = Dots times 2

The specified minimum recommended height of a Code 2/5 bar code is **0.25 inches (6.35 mm) or 75 dots.** The recommend "Quite Zone" is **0.25" (6.35mm or 75 dots) or 10 times X** if larger.

Interleaved 2 Of 5 (Code I 2/5)

The name Interleaved 2 of 5 is derived from the method used to encode two characters. In the symbol, two characters are paired, using bars to represent the first character and the interleaved spaces to represent the second character. Each character has two sets, one bars and one spaces. Each consisting of two wide elements and three narrow elements. Bars and spaces are wide or narrow and the wide bars are set by the ratio.

Interleaved Two of Five code support the numeric characters:

0123456789

The printer will automatically add a leading zero ('0') to the odd number of bar code data characters.

The supported ratio of narrow bar to wide bar widths are: **2:1, 2:5 (2.5:1), and 3:1**.

The equation to calculate the Code 2/5 bar code length is:

$L = [(C(2R + 3)) + 6 + R]X$

L = Length of bar code
C = Number of characters
R = Ratio of wide to narrow bars (5:2 = 2.5)
X = Number of Dots times 0.0033 inches per dot (0.08847 mm per dot)

The minimum recommended height of a Code 2/5 bar code is **0.25 inches (6.35 mm) or 75 dots.** Ideally the bar code height should be 15% of the bar code length. The recommend "Quite Zone" is **0.25" (6.35mm or 75 dots) or 10 times X** if larger.

UPC-A

UPC (Universal Product Code) version A is the basic version of UPC and is usually the version seen on grocery store items in the United States. The symbology is used to encode the ten-digit Universal Product Code number. An eleventh digit, at the beginning, indicates the type of product and a twelfth digit is a module check digit.

The UPC code number and check digit are assigned by:

Uniform Code Council (UCC)
8163 Old Yankee Rd., Ste. J, Dayton, OH 45458
Phone (513) 435-3870; Fax: (513) 435-4749

UPC-A code support the numeric characters:

0123456789

The ratio command parameter (narrow bar to wide bar width) is ignored by the printer.

The equation to calculate the UPC-A bar code length is:

L = (91) X
L = Length of bar code
X = Number of Dots times 0.0033 inches per dot (0.08847 mm per dot)

UPC-A bar code height, by specification, is six (6) individual UPC-A bar code characters high. The following equation can be used to calculate the industry specified height in Dots.

H = (42) X
H = Height of bar code in Dot
X = Bar code Multiplier

Multiply the height of the bar code in dots by 0.0033 inches per dot (0.08847 mm per dot) to get the actual bar code height.

EAN-8 European Article Numbering, now also called IAN (International Article Numbering), is the international standard bar code for retail food packages corresponding to the Universal Product Code (UPC) in the United States. The symbology is used to encode a seven-digit EAN-8 number. An eight digit is a check digit that is automatically generated by the printer.

The EAN code number and check digit are assigned by numerous international agencies. See the list at the end of this appendix.

EAN-8 code support the numeric characters:

0123456789

The ratio command parameter (narrow bar to wide bar width) is ignored by the printer.

The equation to calculate the EAN-8 bar code length is:

L = (67) X

L = Length of bar code

X = Number of Dots times 0.0033 inches per dot (0.08847 mm per dot)

EAN-8 bar code height, by specification, is six (6) individual EAN-8 bar code characters high. The following equation can be used to calculate the industry specified height in Dots.

H = (42) X

H = Height of bar code in Dot

X = Bar code Multiplier

Multiply the height of the bar code in dots by 0.0033 inches per dot (0.08847 mm per dot) to get the actual bar code height.

EAN-13

EAN-13 is one of two versions of the European Article Numbering system (EAN) and is a superset of UPC. EAN-13 has the same number of bar as UPC version A, but encodes a 13th digit. The 12th and 13th digit define the country code. The codes 00-04 and 06-09 are assigned to the United States.

The EAN-13 code numbers are assigned by numerous international agencies. See the list at the end of this appendix.

EAN-13 code support the numeric characters:

0123456789

The ratio command parameter (narrow bar to wide bar width) is ignored by the printer.

The equation to calculate the EAN-13 bar code length is:

L = (98) X

L = Length of bar code

X = Number of Dots times 0.0033 inches per dot (0.08847 mm per dot)

EAN-13 bar code height, by specification, is six (6) individual EAN-13 bar code characters high. The following equation can be used to calculate the industry specified height in Dots.

H = (42) X

H = Height of bar code in Dot

X = Bar code Multiplier

Multiply the height of the bar code in dots by 0.0033 inches per dot (0.08847 mm per dot) to get the actual bar code height.

Code 128 Subsets B & C

Code 128 is a high density alphanumeric bar code. The Privilege printer in Code 128 B mode encodes single digit alphanumeric as a single bar code character. The printer in Code 128 C mode encodes two (2) numeric digits as a single bar code character.

The printer accepts ASCII input data and encodes with a Code 128 bar code value (or digit). The following table represents the Code 128 B encoded value and the corresponding ASCII characters supported by the Privilege card printer. Code 128 C encodes numeric ASCII pairs, i.e. 0 & 5 would encode to a single Code 128 C digit 05. The printer will automatically add a leading zero ('0') to the odd number of Code 128 C bar code data characters.

Encoded Value	Code A	Code B	Code C
0	SP	SP	00
1	!	!	01
2	"	"	02
3	#	#	03
4	$	$	04
5	%	%	05
6	&	&	06
7	'	'	07
8	(	(	08
9	)	)	09
10	*	*	10
11	+	+	11
12	,	,	12
13	-	-	13
14	.	.	14
15	/	/	15
16	0	0	16
17	1	1	17
18	2	2	18
19	3	3	19
20	4	4	20
21	5	5	21
22	6	6	22
23	7	7	23
24	8	8	24
25	9	9	25
26	:	:	26
27	;	;	27
28	<	<	28
29	=	=	29
30	>	>	30
31	?	?	31
32	@	@	32
33	A	A	33
34	B	B	34
35	C	C	35

Encoded Value	Code A	Code B	Code C
36	D	D	36
37	E	E	37
38	F	F	38
39	G	G	39
40	H	H	40
41	I	I	41
42	J	J	42
43	K	K	43
44	L	L	44
45	M	M	45
46	N	N	46
47	O	O	47
48	P	P	48
49	Q	Q	49
50	R	R	50
51	S	S	51
52	T	T	52
53	U	U	53
54	V	V	54
55	W	W	55
56	X	X	56
57	Y	Y	57
58	Z	Z	58
59	[	[	59
60	\	\	60
61	]	]	61
62	^	^	62
63	_	_	63
64	NUL	.	64
65	SOH	a	65
66	STX	b	66
67	ETX	c	67
68	EOT	d	68
69	ENQ	e	69
70	ACK	f	70
71	BEL	g	71

Encoded Value	Code A	Code B	Code C
72	BS	h	72
73	HT	i	73
74	LF	j	74
75	VT	k	75
76	FF	l	76
77	CR	m	77
78	SO	n	78
79	SI	o	79
80	DLE	p	80
81	DC1	q	81
82	DC2	r	82
83	DC3	s	83
84	DC4	t	84
85	NAK	u	85
86	SYN	v	86
87	ETB	w	87
88	CAN	x	88
89	EM	y	89
90	SUB	z	90
91	ESC	{	91
92	FS	|	92
93	GS	}	93
94	RS	~	94
95	US	DEL	95
96	FNC3	FNC3	96
97	FNC2	FNC2	97
98	SHIFT	SHIFT	98
99	CodeC	CodeC	99
100	CodeB	FNC4	CodeB
101	FNC4	CodeA	CodeA
102	FNC1	FNC1	FNC1
103	Start A	Start A	Start A
104	Start B	Start B	Start B
105	Start C	Start C	Start C

The percentile (%) character must be preceded by another percentile character to encode.
Example: %% = %

The ratio command parameter (narrow bar to wide bar width) is ignored by the printer.

The equation to calculate the Code 128 B bar-code length is:

L = [(C (11)) + 24] X

L = Length of bar code
C = Number of characters & checksum character
X = Number of Dots times 0.0033 inches per dot (0.08847 mm per dot)

The equation to calculate the Code 128 C bar code length is:

L = [(C (11) / 2) + 24] X

L = Length of bar code
C = Number of characters (rounded up to the next even digit) & checksum character
X = Number of Dots times 0.0033 inches per dot (0.08847 mm per dot)

The minimum recommended height of a Code 128 bar code is **0.25 inches (6.35 mm) or 75 dots.** Ideally the bar code height should be 15% of the bar code length. The recommend "Quite Zone" is **0.25" (6.35mm or 75 dots) or 10 times X** if larger.

EAN International Regulation Agencies

General Specifications for the Article Symbol Marking (1987), EAN Prefix List
EAN International (EAN)
Rue Royale 29, B-1000 Bnuxelles (Belgium)

Reinhold Van Lennep, Secretary General

prEN 797 Bar coding - Symbology specifications - EAN/UPC
NNI
P.O. Box 5059, NL-2600 GB DELFT
THE NETHERLANDS

ANSI
11 West 42nd Street, 13th floor
New York, N.Y. 10036, USA

Australian EAN Coding Authority
Australian Product Numbering Association, Ltd. (APNA), Unit 8, 417 Femtree Gully Rd.
Mount Waverlet, Vidoria 3149, Australia

England EAN Coding Authority
Article Numbering Assoc. (UK) Ltd. (ANA)
11 Kingsway
London WC2B 6AR, England

Japan EAN Coding Authority
Distribution Code Center (DCC)
No. 3 TOC-Bldg.7-23-1
Nishigotanda, Shinagawaku, Tokyo 141, Japan

Mexico EAN Coding Authority
Asociacion Mexicana del Codigo de Producto (AMECOP)
Horatio,1855-6O, Col. Polanco, DFCP 11570, Mexico

New Zealand EAN Coding Authority
New Zealand Product Number Association, Ltd.
PO Box 11-110, Wellington, New Zealand

South Africa EAN Coding Authority
South Africa Numbering Association
PO Box 41417, Craighall, 2024, Johannesburg, South Africa

Appendix B

This section contains status and error reporting information for color and monochrome Privilege card printers.

Parallel Port Printer Data Handshake Signal Lines

The Busy and Acknowledge signal lines are used to transfer data to the printer only.

Parallel Port Printer Error Response

The color card printers will respond to error conditions with combinations of the Error and Paper Error signals at the printer's parallel interface. Detailed error responses are sent via the serial port only.

Paper Error	Error/	Description
0	1	No Error
0	0	Syntax Error
1	1	Ribbon End or Empty Feeder
1	0	Mechanical Error
Note: To clear an Error, Send: ESC.↵ (1B 2E 0D Hex)		

Serial Port Printer Data Handshake

Some programs, like WindCard Mono, use Acknowledge (ACK) and Not Acknowledge (NACK) to display these communication protocol responses. The ACK response signifies 'Command Accepted, Waiting for Command'. The NACK response signifies an 'Error" or 'Check Status' condition exists and typically includes a corresponding error/status code. The NACK can also signify that the printer input buffer is full.

Serial Port Printer Error Response

The printers will respond, via the serial port, to various conditions with status and error codes.

Status/Error responses have the following format:

(NACK)05(EOT) *- Card in magnetic encoder.*

Code	Error	Status	Condition
-1	✔		Mechanical Error - Printer
01	✔		Ribbon Broken / Missing
02	✔		Temperature
03	✔		Mechanical
04	✔		Feeder Empty
05		✔	Card In Encoder
06		✔	Card Not In Encoder
10	✔		Invalid Command or Parameter
11	✔		Invalid Coordinates (Image placement)
12	✔		Unknown Bar Code Reference
13	✔		Unknown Text/Font Reference
14	✔		Unknown Command
20	✔		Bar Code Data Syntax
21	✔		Text Data Syntax
22	✔		Graphic Data Syntax
30	✔		Graphic Image Initialization - Failed
31	✔		Graphic Image Maximum Width Exceeded
32	✔		Graphic Image Maximum Height Exceeded
33	✔		Graphic Image Data Checksum Error
34		✔	Data Transfer Time-out
40	✔		Parameter / Syntax
41	✔		Mag. Encoder Write
42	✔		Mag. Encoder Read/Verify
43	✔		Mag. Encoder Mechanical
44	✔		Mag. Encoder Not Responding
45	✔		1) Magnetic Stripe Missing 2) Card Jam

Appendix C

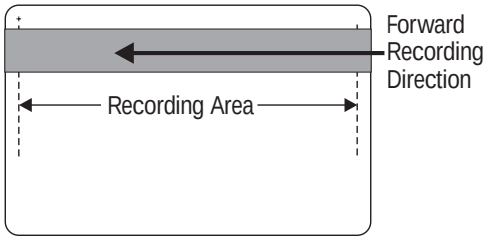
This section contains information on the magnetic stripe card encoder operation and formatting.

Magnetic Encoders

All Privilege printers with encoders write and read ANSI 4.16 and ISO 7811/2/3. The encoder track positions are fixed and cannot be modified.

The current units with serial numbers 5000 and above, have two (2) possible encoder mounting options:
Forward - mounting the encoder to read the magnetic stripe up and:
Reverse - mounting the encoder to read the card with the magnetic stripe down.

Both current encoder options mount the encoder after the print head. *Older printers with serial numbers less than 5000, have the encoder mounted before the print head*.



Encoder Operation

The encoder executes commands received one at a time. When the encoder receives a command, it performs the requested action and reports the result. The printer cannot execute a new encoder command until the previous encoder command has been completed. Detailed encoder (and general printer) status information is reported to the host via optional serial interface ports only. See Appendix B for a detailed listing of printer and encoder responses.

Write

The encoder, in default configuration, can write in the forward or reverse directions and then automatically perform a write-verify data read. The printer then repositions the card to the print-ready position.

Read

The encoder can only read (back to the host) a single track of data at a time. The "&L" command performs read-only operations, see Command Reference, page 2-59.

The "M or m" multiple commands can serve to group several read commands. The encoder performs each command in the string until command string is completed. An error terminates an "M" Command string, while command execution resumes with error correction for an "m" command string. The "M" command concatenates the read data into a single response to the host. (The "M" command was implemented in firmware version _____ and above).

Example of Multiple Read Command String

(Escape and Carriage Returns not shown)

Track 1 *data* = `1111`
Track 2 *data* = `2222`
Track 3 *data* = `3333`

Multiple read command string is:

```
M 1 &L1[&L2[&L3
```

Data sent to the host, in a single response:

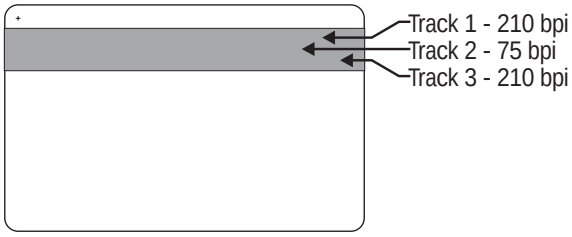
```
111122223333
```

Data Errors

The encoder will retry, up to three (3) times, any read or write (write-verify read) operation, before reporting an error.

Encoder Default Configuration

The printer's encoder will read and write the standard ANSI/ISO track data formats in the standard ANSI/ISO track locations. See the simple diagram below for the three standard ANSI/ISO tracks.



Each track can be encoded and decoded with ASCII characters in the standard default ANSI/ISO data formats.

Encoder ANSI/ISO (Default) Track Data Formats

Track	Density	Data Format	Data Characters	Data Separator
1	210 BPI	7 Bit (6 data, 1 parity)	SPACE $ ( ) - . / 0 through 9 A through Z (All Caps)	^
2	75 BPI	5 Bit (4 data, 1 parity)	0 through 9	=
3	210 BPI	5 Bit (4 data, 1 parity)	0 through 9	=

The ANSI/ISO data formats include a preamble (all zeros), a start character, data (7-bit or 5-bit as specified by ANSI/ISO), a stop character, and a longitudinal redundancy check character. The 7-bit data format has 6 bits of encoded data and a parity bit. The 5-bit data format has 4 bits of encoded data and a parity bit.

The ANSI/ISO data formats include a “data field” separator (or delimiter) that allows the encoded data on a track to be parsed. An example of separate data fields would be the American Bankers As-

sociation (ABA) data format (normally located on track 2) that includes a primary account number (PAN) field and an account information field (for expiration date, country code, etc.).

The encoder reports a data error when the total number of data characters has exceeded the maximum allowed by physical encoding (bit density) and the data format in any read or write data function.

Basic Commands

All Privilege card printers with encoders, perform the basic functions of reading and writing to ANSI/ISO track and data formats. The commands for these basic encoder functions are listed below.

Basic Encoder Commands		Page
&E	Encode Single Data Track	2-56
&B	Buffer Single Track Data	2-57
&E*	Encode All Data Tracks	2-58
&L	Read Single Track Data	2-59

Advanced Encoder Commands

Printers with magnetic stripe encoders, that have serial numbers 5000 or greater, have an expanded encoder command set. These commands allow the programmer to create custom data and track formats.

The encoder can be programmed to read and write custom data and formats. The encoder can be programmed to use a standard ANSI/ISO data formats on one of other ANSI/ISO track locations. For example, the encoder can be programmed to read and write ANSI/ISO Track 3 data format on Track 1. When in this mode, the advanced encoder commands support encoding of and decoding to host with ASCII character data. The encode automatically adds the selected ANSI/ISO data format. The encoder will report errors when reading and writing in this mode.

The encoder will not accept ASCII characters that are not part of the selected ANSI/ISO data character set. See C-3 for table of character sets.

The advanced encoder command set is listed below.

Advanced Encoder Commands		
&R	Reset Encoder	2-55
&B	Buffer Track Data	2-57
&L	Read Single Track Data	2-59
&W	Change Encoding Direction	2-60
&D	Change Track Density	2-61
&CDEW	Custom Write Format	2-64
&CDER	Custom Read Format	2-62

The encoder will not write data unless the read buffer is programmed to read identical data parameters. An error will result.

Resetting The Encoder To ANSI/ISO Track Defaults

To ensure that the encoder is in the proper configuration, the programmer should reset the encoder to ANSI/ISO track data, format, density and location. Reset the encoder to ANSI/SIO defaults with the following command sequence.

Example: *(Escape and Carriage Returns not shown)*

```
&R
&CDEW 0 0
&CDER 0 0
```

The encoder stores the track settings in flash memory. If the encoder is powered down, the printer will retain the encoder's last read, write and track density settings.

Change Track Density

A track's density is changed with the &D command. The &D command changes a given track's density without changing the tracks data format or character set. See Command Reference &D, page 2-61 for command details.

Changing Read Configuration

The &CDER command is used to change the read data format configuration. This command can configure a given track to:

- It's ANSI/ISO data format.
- Change it to another ANSI/ISO track format.
- Allows data to be read forward and reverse.
- Change it to "Raw" data format that has custom track data format and data block encoding.

The &L read command needs to be configured to read "Raw" (or hexadecimal) custom data.

Changing Write Configurations

The &CDEW command is used to change the read data format configuration. This command can configure a given track to:

- It's ANSI/ISO data format.
- Change it to another ANSI/ISO track format.
- Change it to "Raw" data format that has custom track data format and data block encoding.

The &B read command needs to be configured to store to write "Raw" (or hexadecimal) custom data.

Custom ISO Data

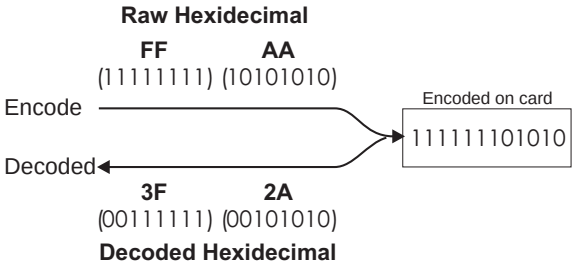
The encoder can be configured to process ISO track data in non-ISO track locations. The printer interprets and processes the ASCII data normally. The custom data control commands; &D (track density), &CDER (read data format) and the &CDEW (write data format).

The printer automatically read verifies after a write, so all three commands (&D, &CDER, and &CDEW) must be properly configured to function without reporting a data error.

Unique Custom Data Formats

The encoder is capable of reading and writing non-ANSI/ISO data. The data block and the track's data string formatting is "stripped" and "passed through" the encoder (and printer) without error checking, encoding or decoding. The host sends and receives "Raw" hexadecimal data strings.

Each hexadecimal block sent to the encoder represent a block of magnetic card encoded data. The encoder stripes the most significant bits of the data blocks off of each hexadecimal block.



"Raw" hexadecimal data when encoded, requires the following elements in the final binary data string:

- **Preamble data** - minimum number of leading binary "0" bits, i.e. NUL characters. Note: the NUL (00 hexadecimal) is normally sent to the printer with a character like the @ symbol (40 hexadecimal) and is encoded as all zero bits in 6 (or lower) bit data mode.
  75bpi - 20 min., 24 nominal, 1024 max.
  210bpi - 40 min., 68 nominal, 1024 max.
- **Start Bit** - The first binary "1" bit detected will start the data block grouping. The LSB of the data block (or character) is
- **NUL Data Block** - Without NULs enabled, the encoder will terminate the data string or cause the data string to "restart" when a new "start bit", a data block with a "1"s bit.
- **NUL Data Block with NULs enabled -** Allow the inclusion of NUL data character blocks within the data string.
- **Postamble** - binary "0" bits, i.e. NUL characters, fill remainder of track.

Appendix D

This Appendix includes an example of a P600 command sequence that offers both optimisation and loopback features for duplex printing.

Sample P600 Command Sequence

Start

At host, prepare an image for side-one of the card.

Before sending the image, check Module 1 for Error-Free and Ready status.

Select Module 1 (INIT = 1)

Wait for Module-1 ACK + Error-Free Status

If necessary, correct error.

Download Yellow Buffer data to Module 1 and wait for Ready + Error-Free status, for example:

<esc>GS<spc>0<spc>p1<spc>p2<spc>p3<spc>p4<spc>p5<spc>p6<spc>*data*↵

Download Magenta Buffer data to Module 1 and wait for Ready + Error-Free status, for example:

<esc>GS<spc>1<spc>p1<spc>p2<spc>p3<spc>p4<spc>p5<spc>p6<spc>*data*↵

Download Cyan Buffer data to Module 1 and wait for Ready + Error-Free status, for example:

<esc>GS<spc>2<spc>p1<spc>p2<spc>p3<spc>p4<spc>p5<spc>p6<spc>*data*↵

Download Black Buffer data to Module 1 and wait for Ready + Error-Free status, for example:

<esc>G<spc>p1<spc>p2<spc>p3<spc>p4<spc>p5<spc>p6<spc>*data*↵

If different from inverted black, download Varnish buffer data to Module 1, and wait for Ready + Error-Free status, for example:

<esc>vL<spc>p1<spc>p2<spc>p3<spc>p4<spc>p5↵

Print Image Buffers using Link command, and **do not** wait for Module 1 Ready + Error-Free status, for example:

<esc>m<spc>1<spc>IS<spc>0[IS<spc>1[IS<spc>2[I[IV<spc>xx↵

Where:

xx = 30 (do not move after varnish)
xx = 31 (invert K for varnish and do not move after)
xx = 10 (return to print-ready after varnish)
xx = 11 (invert K for varnish, and return to print-ready)

At host, prepare an image for side-two of the card.

Before sending the image, check Module 2 for Error-Free and Ready status.

Select Module 2 (INIT = 0)

Wait for Module-2 ACK + Error-Free Status

If necessary, correct error.

Download Yellow Buffer data to Module 2 and wait for Ready + Error-Free status, for example:

<ESC>cGS<SP>0<SP>p1<SP>p2<SP>p3<SP>p4<SP>p5<SP>p6<SP>*data*<CR>

Download Magenta Buffer data to Module 2 and wait for Ready + Error-Free status, for example:

<ESC>cGS<SP>1<SP>p1<SP>p2<SP>p3<SP>p4<SP>p5<SP>p6<SP>*data*<CR>

Download Cyan Buffer data to Module 2 and wait for Ready + Error-Free status, for example:

<ESC>cGS<SP>2<SP>p1<SP>p2<SP>p3<SP>p4<SP>p5<SP>p6<SP>*data*<CR>

Download Black Buffer data to Module 2 and wait for Ready + Error-Free status, for example:

<ESC>cG<SP>p1<SP>p2<SP>p3<SP>p4<SP>p5<SP>p6<SP>*data*<CR>

If different from inverted black, download Varnish buffer data to Module 2, and wait for Ready + Error-Free status, for example:

<ESC>cvL<SP>p1<SP>p2<SP>p3<SP>p4<SP>p5<CR>

Before exiting the card from Module 1, check Module 1 for Error-Free and Ready status.

Select Module 1 (INIT = 1)

Wait for Module-1 ACK + Error-Free Status

If necessary, correct error.

Select Module 2 (INIT = 0)

Wait for Module-2 ACK + Error-Free Status

If necessary, correct error.

Make a Card Flip pending in Module 2, and **do not** wait for Ready + Error-Free status:

^e_sc MF↵

Select Module 1 (INIT = 1)

Exit card from Module 1, and check for Ready + Error-Free status:

^e_sc MO↵

Select Module 2 (INIT = 0)

Wait for Module-2 ACK + Error-Free Status

Print Image Buffers using Link command, and **do not** wait for Module 2 Ready + Error-Free status, for example:

^e_sc m^SPACE 1^SPACE IS^SPACE 0[IS^SPACE 1[IS^SPACE 2[I[IV^SPACE xx↵

Where:

xx = 30 (do not move after varnish)
xx = 31 (invert K for varnish and do not move after)
xx = 10 (return to print-ready after varnish)
xx = 11 (invert K for varnish, and return to print-ready)

Loop to Start

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