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File format for the Magicard Enduro/Pronto printers

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2 Introduction

The following text outlines the required file format for the Magicard Enduro/Pronto. The file consists of three types of data: control characters, command data and image data. The control characters are in ASCII and define the file structure. The command data consists of ASCII character strings that specify transmission, print formats and so on. Figure 1 illustrates the general file structure for a single-sided print job, while Figure 2 illustrates the same for a double-sided print job.

Start of header byte	<SOH>
Comma	,
Command data	
File separator byte	<FS>
Image data	
End of text byte	<ETX>

Figure 1: Single-sided job file structure

Start of header byte	<SOH>
Comma	,
Side 1 command data	
File separator byte	<FS>
Side 1 image data	
End of text byte	<ETX>
Start of header byte	<SOH>
Comma	,
Side 2 command data	
File separator byte	<FS>
Side 2 image data	
End of text byte	<ETX>

Figure 2: Double-sided job file structure

There are five valid control characters associated with the image file, shown in Figure 3. Illegal characters will be discarded.

Character	Hex	Description	Function
<SOH>	01	Start of header	Indicates the start of the file, or page in a double-sided print job.
,	2C	Comma	Separates one command from another. No comma follows the last command in the header.
<FS>	1C	File separator	Marks the end of a header, or part of the sequence at the end of a block of image data (see main text for details).
:	3A	Colon	Part of the sequence at the end of a block of image data (see main text for details).
<ETX>	03	End of text	Indicates the end of the transmitted file, or page in the case of a double-sided print job.

Figure 3: Valid control characters

The image data consists of several blocks, one for each colour plane (yellow, magenta,

cyan and black). Each block consists of pixel data followed by a <FS> byte, then a character as shown in Figure 4, and finally a colon character.

Parameter value	Meaning
B	Yellow data
G	Magenta data
R	Cyan data
K	Black data

Figure 4: Valid values for the character after the file separator

The commands used in the header are described in section 3, and the pixel data format is described in section 4. Additional commands for controlling the printer are described in section 5.

3 Command details

The following subsections describe commands which may appear in the header of a print job. Unrecognised commands are ignored by the printer (the printer simply skips to the next comma in the file).

3.1 AMS command

Valid entries ON or OFF.

Default value OFF.

Description This is a magnetic encoding related command. Normally, if more than one Start Sentinel is included in the magnetic data then the printer will only encode one. However, if AMSON is included as a magnetic command then the printer will encode as many Start Sentinels as are sent (e.g. ...,2,AMSON,;;;;01234,).

3.2 BAC command

Valid entries CKO, CK, CO, C, KO or K.

Default value None—a parameter must be supplied.

Description This command must accompany the DPXON command (see subsection 3.7 on page 8) in the header of the first page/side to indicate in advance the format requirements of the second page. For single side documents this command is not required. The meaning of the possible parameter values is given in Figure 5.

Parameter value	Meaning
CKO	The second side contains yellow, magenta, cyan and black data, and the second side has overcoat switched on.
CK	The second side contains yellow, magenta, cyan and black data, and the second side has overcoat switched off.
CO	The second side contains yellow, magenta and cyan data, and the second side has overcoat switched on.
C	The second side contains yellow, magenta and cyan data, and the second side has overcoat switched off
KO	The second side contains black data, and the second side has overcoat switched on.
K	The second side contains black data, and the second side has overcoat switched off.

Figure 5: Valid paramteres for the BAC command.

3.3 BPI command

Valid entries 75 or 210.

Default value ISO standard.

Description This command is for magnetic encoding, and specifies the required bit density in bits per inch. This command must only be used in conjunction with the `MAG` command (see subsection 3.17 on page 11). Whilst it is possible to encode on any of the three tracks at 75 or 210 bpi, with 5 bits per character (numeric) or 7 bits per character (alphanumeric) with complete freedom, *most magnetic stripe readers will only recognise magnetic stripe data that conforms to the ISO standard.*

3.4 `COE` command

Valid entries `H` or `L`.

Default value None—a parameter must be supplied.

Description This command is for magnetic encoding, and informs whether the cards are to be encoded under High-Coercivity control or Low-Coercivity.

3.5 `CPW` command

Valid entries A positive integer from `1` to `100`.

Default value `50`.

Description This command provides user adjustment for the power applied to the Printhead for Yellow, Magenta and Cyan. Also see subsection 3.14 on page 10.

3.6 `DDD` command

Valid entries A positive integer from `1` to `100`.

Default value `50`.

Description This command is used to adjust the position of the image on the card in the Y-axis to compensate for the variation in the printhead.

3.7 `DPX` command

Valid entries `ON` or `OFF`.

Default value `OFF`.

Description This command instructs double-sided printer models to operate in double-sided print mode.

3.8 EOI command

Valid entries A positive integer from 1 to 100.

Default value 50.

Description End of Image adjust. Provides adjustment to the number of lines printed when printing a full bleed size image.

3.9 ERA command

Valid entries ON or OFF

Default value OFF.

Description Tells the printer whether or not to automatically erase rewritable cards before printing on them.

3.10 HGT command

Valid entries From 1 up to the maximum height for the specified image size.

Default value 0 (for a null file).

Description This command specifies the height of the window. The Height refers to the Y axis. The height of the window plus any YCO offset (see subsection 3.37 on page 15) must not exceed the bounds of the image area for the image size specified.

3.11 HKM command

Valid entries A six-digit hexadecimal number.

Default value FFFFFF

Description This command specifies a 24-bit integer which selects the HoloKote tile positions to be activated. By default, all 24 are activated. A bit value of 1 switches the corresponding tile position on, and a bit value of 0 switches it off.

3.12 HKT command

Valid entries 1, 2, 3 or 4.

Default value 1.

Description This command selects the internal UltraSecure image to be printed if USF is ON (see subsection 3.33 on page 14), or NNN is ON (see subsection 3.21 on page 12) or PAT*n* is selected (see subsection 3.27 on page 13).

3.13 `IMF` command

Valid entries `YMC`, `YMCK` or `K`.

Default value None—a parameter must be supplied.

Description This command must be included for each side of the print job. It specifies the image data format for the current side. The meaning of the parameter values is given in Figure 6.

Parameter value	Meaning
YMC	The current side contains yellow, magenta and cyan data.
YMCK	The current side contains yellow, magenta, cyan and black data.
K	The current side contains black data.

Figure 6: Valid parameters for the `IMF` command.

3.14 `KPW` command

Valid entries A positive integer from `1` to `100`.

Default value `50`.

Description This command provides user adjustment for the power applied to the printhead for the black panel. Also see subsection 3.5 on page 8.

3.15 `LAN` command

Valid entries `ENG`, `POR`, `FRE`, `GER`, `SPA`, `ITA`, `POL`.

Default value `ENG`.

Description This command informs the printer which language the Status Monitor messages should be sent as. The meaning of the various parameter values is given in Figure 7

Parameter value	Meaning
ENG	English
POR	Portuguese
FRE	French
GER	German
SPA	Spanish
ITA	Italian
POL	Polish

Figure 7: Valid values for the `LAN` command's parameter

3.16 LRC command

Valid entries OFF, EVN or ODD.

Default value ISO standard.

Description This command instructs the Magicard on whether the LRC (longitudinal redundancy check) for the magnetic encoding is off, even or odd.

3.17 MAG command

Valid entries 1, 2 or 3.

Default value None—a parameter must be supplied.

Description This command is for magnetic encoding, and informs which track to write the data to. For example, to encode the word "Hello" on to Track 1 at 210 bits per inch on a Hi-Co card, the following line must be included in the file header: `MAG1, BPI210, MPC7, COEH, %HELLO?`. To encode all 3 tracks at once, all the required information must be in the same file. An example of the tilde method is: `~1, BPI210, MPC7, COEH, %HELLO?`. Placing this text sequence anywhere on an image, in a true type font, will allow the print driver to extract this data and transmit the data in the file header replacing the ~ with MAG.

3.18 MGV command

Valid entries ON or OFF.

Default value OFF.

Description This command enables or disables the Magnetic stripe verification operation after encoding.

3.19 MPC command

Valid entries 5 or 7.

Default value ISO standard.

Description This command is for magnetic encoding and informs of number of bits to define a character, 5 bits per character for Numeric Data, or 7 bits per character for Alpha-numeric data. This command must only be used in conjunction with the MAG command (see subsection 3.17 on page 11). Whilst it is possible to encode on any of the three tracks at 75 or 210 bpi, with 5 bits per character (numeric) or 7 bits per character (alphanumeric) with complete freedom, *most magnetic stripe readers will only recognise magnetic stripe data that conforms to the ISO standard.*

3.20 `NCT` command

Valid entries A sequence of four positive integers separated by commas.

Default value None—a parameter must be supplied.

Description Used to define rectangular "holes" in the overcoat layer. Up to 2 separate areas of overcoat may be defined. The `NCT` command takes two co-ordinates for the bottom left hand corner of the area and two co-ordinates for the upper right hand corner of the area. There can be up to 2 separate `NCT` commands in the header. The areas may overlap. Also see subsection 3.28 on page 13

3.21 `NNN` command

Valid entries `ON` or `OFF`.

Default value `OFF`.

Description This command enables/disables the printer's Secure Shield™ feature.

3.22 `NOC` command

Valid entries A positive integer from `1` to `255`.

Default value `1`.

Description The parameter specifies the number of printed copies required of the complete image. The Magicard Enduro/Pronto also uses this command to set the number of copies for encode-only jobs. Note that the `NOC` command must *always* be the very first command to appear in the header for each side.

3.23 `OPW` command

Valid entries A positive integer from `1` to `100`.

Default value `50`.

Description This command provides user adjustment for the for the power applied to the Printhead for the Overcoat. Also see subsection 3.5 on page 8.

3.24 `OVR` command

Valid entries `ON` or `OFF`.

Default value `ON` for page 1, `OFF` for page 2.

Description This command enables/disables overcoat printing. `OVROFF` will cause the overcoat panel to be skipped entirely.

3.25 PAG command

Valid entries 1 or 2.

Default value Parameter must be specified for duplex printing.

Description This command shall indicate to the printer which side to print the page, Page 1 being the front. This command is not required for single-sided printing, but for duplex printing must be specified for each side.

3.26 PAR command

Valid entries OFF, EVN or OFF.

Default value ISO standard.

Description This command instructs whether the character parity bit during magnetic encoding is switched off, set to even or odd.

3.27 PAT command

Valid entries A positive integer from 1 to 24.

Default value 50.

Description This command informs the printer that the HoloPatch™ feature is to be enabled and that the accompanied parameter refers to the position of the HoloPatch™.

3.28 PCT command

Valid entries A sequence of four positive integers separated by commas.

Default value None—a parameter must be supplied.

Description Used to define rectangular regions where overcoat will be laid down. Up to 2 separate areas of overcoat may be defined. The PCT command takes two co-ordinates for the bottom left hand corner of the area and two co-ordinates for the upper right hand corner of the area. There can be up to 2 separate PCT commands in the header. The areas may overlap. OVRON must be sent for any overcoat to be printed. Also see subsection 3.20 on page 12.

3.29 SOI command

Valid entries A positive integer from 1 to 100.

Default value 50.

Description Start of Image adjust. Provides positional adjustment for the first printed line and therefore provides user adjustment of the width of the white border at the front of the image.

3.30 SSP command

Valid entries A positive integer from 1 to 100.

Default value 50.

Description Provides adjustment for the Start Sentinel Position of the Magnetic Data.

3.31 SZ command

Valid entries One of the letters Y, M, C or K followed by an integer.

Default value None—a parameter must be supplied.

Description Essential commands that provide the exact size in bytes transmitted for each colour.

3.32 TRO command

Valid entries 0, 90, 180 or 270.

Default value 0.

Description Provides for each side the ability to rotate the Ultra Secure™ key tile design.

3.33 USF command

Valid entries ON or OFF.

Default value ON for page 1, OFF for page 2.

Description This command enables the driver to disable the Ultra Secure™ overlay feature. This provides deselection for either side of the card.

3.34 VER command

Valid entries A positive integer from 1 to 100.

Default value None.

Description This command reflects the issue number of the Driver.

3.35 `WID` command

Valid entries From `1` up to the maximum width for the specified image size.

Default value `0` (for a null file).

Description This command specifies the width of the window. The width refers to the X-axis. The width of the window plus any `XCO` offset (see subsection 3.36 on page 15) must not exceed the bounds of the image area for the image size specified.

3.36 `XCO` command

Valid entries A positive integer from `0` to `1016`.

Default value `0`.

Description This command specifies the X co-ordinate of the length of the print that indicates the corner reference point of the window.

3.37 `YCO` command

Valid entries A positive integer from `0` to `671`.

Default value `0`.

Description This command specifies the Y co-ordinate of the width of the print that indicates the corner reference point of the window.

4 Pixel data format

The image data is 1016 pixels wide and 642 pixels high, but sits in a canvas that is actually 672 pixels high. The driver must place the image in the correct position within this canvas, as determined by the printer's Printhead Vertical Position setting, which can be determined using the `INF` command (see subsection 5.4 on page 19).

In addition, the 1016×672 data is then processed to make the printer's task of driving the printhead simpler, and is mapped into a buffer which is effectively 768 pixels high (24 words of 32 bits each, per vertical line). The x-coordinate of each pixel is unchanged, but each pixel is moved to a new y-coordinate in the following manner: y-coordinates from 0 to 287 get mapped onto the even numbered bits of 32-bit words 6 to 23, and y-coordinates 288 to 671 get mapped onto the odd-numbered bits of 32-bit words 0 to 23.

The following code might be used to prepare some lookup tables which give the word number and bit number assigned to each y-coordinate. Note that this code, as with all samples given in this document, is designed for a *big-endian* 32-bit processor.

```
typedef struct {
   int word;
   int bit;
} PixelLayout;

static PixelLayout pixelLayout[768];

void precalculateLookupTables(void)
{
   int y, tmp_y;

   for(y = 0; y < 288; ++y) {
      pixelLayout[y].bit  = 31 - ((y & 0x000f) << 1);
      pixelLayout[y].word = 6 + (y >> 4);
   }

   for(y = 288, tmp_y = 0; y < 672; ++y, ++tmp_y) {
      pixelLayout[y].bit  = 31 - (1 + ((tmp_y & 0x000f) << 1));
      pixelLayout[y].word = tmp_y >> 4;
   }
}
```

Using these tables, it is relatively easy now to write some code which sets a pixel to a particular colour. For example, the following code writes a pixel in one of the colour planes (yellow, magenta, cyan or black):

```
#define NUM_PRINTHEAD_WORDS   24
#define APPLY_PIXEL_MASK(ptr, mask, set) \
   do {  if(set) { *(ptr) |= (mask);  }  \
         else    { *(ptr) &= ~(mask); }  \
```

```
   } while(0)

typedef unsigned int uint32;
typedef unsigned short int uint16;

void setPixel(
   uint32 *colourData,        /* pointer to buffer for desired plane, which
                                 must be 1016*768*6/8 = 585216 bytes in size */
   uint32 bitDepth,           /* bits per pixel: 6 for colour, 1 for black */
   uint32 x, unsigned int y,  /* pixel coordinates */
   uint32 colourValue         /* pixel colour 0...255 */
)
{
   uint32 *linePtr;
   uint32 *wordToModify;
   uint32 pixelMask;

   /* correct y-coordinate using printhead vertical
      position obtained from INF command response  */
   y += (50 - getPrintheadPosition());

   /* get pointer into buffer for start of affected line */
   linePtr = colourData + (x * bitDepth * NUM_PRINTHEAD_WORDS);

   /* find 32-bit word and pixel mask for first pixel
      in this horizontal line */
   pixelMask = 1 << pixelLayout[y].bit;
   wordToModify = line_ptr + pixelLayout[y].word;

   if(bitDepth == 1) {
      /* bit depth is 1 for black */
      APPLY_PIXEL_MASK(wordToModify, pixelMask, colourValue);
   }
   else {
      /* bit depth is 6 for yellow, magenta and cyan */
      APPLY_PIXEL_MASK(wordToModify, pixelMask, colourValue & 0x04);
      wordToModify += NUM_PRINTHEAD_WORDS;
      APPLY_PIXEL_MASK(wordToModify, pixelMask, colourValue & 0x08);
      wordToModify += NUM_PRINTHEAD_WORDS;
      APPLY_PIXEL_MASK(wordToModify, pixelMask, colourValue & 0x10);
      wordToModify += NUM_PRINTHEAD_WORDS;
      APPLY_PIXEL_MASK(wordToModify, pixelMask, colourValue & 0x20);
      wordToModify += NUM_PRINTHEAD_WORDS;
      APPLY_PIXEL_MASK(wordToModify, pixelMask, colourValue & 0x40);
      wordToModify += NUM_PRINTHEAD_WORDS;
      APPLY_PIXEL_MASK(wordToModify, pixelMask, colourValue & 0x80);
   }
}
```

5 Non-printing commands

The printer accepts a number of non-printing commands, which enable the driver to determine the printer status and command it to clear errors. There are also commands to initiate printer cleaning cycles, and erase cycles (for erasing rewritable cards).

The general structure of a non-printing command is given in Figure 8.

Start of header byte	`<SOH>`
Non-printing command header	`REQ,` *(note the trailing comma)*
Command	
Comma	`,`
File separator byte	`<FS>`
End of text byte	`<ETX>`

Figure 8: Non-printing command file structure

The commands available to the driver are given in the following subsections.

5.1 `CAN` command

Valid entries None.

Default value None.

Description This command instructs the printer to clear an error, and is equivalent to pressing the "Cancel" button either on the printer or the Status Monitor. Also see subsection 5.5 on page 20.

5.2 `CLN` command

Valid entries None.

Default value None.

Description This command instructs the printer to initiate its cleaning routine. Note that the cleaning routine is interactive—the user must insert a cleaning card when prompted to do so.

5.3 `ERASE` command

Valid entries None.

Default value None.

Description This command instructs the printer to erase a rewritable card.

5.4 `INF` command

Valid entries None.

Default value None.

Description This command instructs the printer to report its status. The response is sent on USB bulk-in endpoint 2, and has the form given in Figure 9. The status string itself consists of fields separated by either commas or colons. The order of the fields in the string is given in Figure 10.

Start of header byte	`<SOH>`
Reply header	`STA$$`
Status string	(see main text)
Comma	,
End of text byte	`<ETX>`

Figure 9: Response format for `INF` command.

Field	Description
Model	Unsigned 32-bit integer. Bit 0 set if duplex, bit 1 set if mag encoder, bit 5 set if Pronto-type. Other bits are ignored by the driver.
Model name	String, maximum 16 characters.
Printhead type	Unsigned 32-bit integer. Obsolete.
Printer serial number	String, maximum 16 characters.
Printhead serial number	String, maximum 16 characters.
PCB serial number	String, maximum 16 characters.
Firmware version	String, maximum 16 characters.
PCB version	String, maximum 16 characters.
Hand feed mode	Unsigned 32-bit integer. 0 for hopper feed, 1 for hand feed.
Total cards printed	Unsigned 32-bit integer.
Total card on printhead	Unsigned 32-bit integer.
Total dye panels printed	Unsigned 32-bit integer.
Cleans since shipped	Unsigned 32-bit integer.
Dye panels since cleaned	Unsigned 32-bit integer.
Cards since cleaned	Unsigned 32-bit integer.
Cards allowed between cleans	Unsigned 32-bit integer. Default is 700.
Printhead vertical position	Unsigned 32-bit integer.
Image start position	Signed 32-bit integer.
Image end position	Unsigned 32-bit integer.
Major error code	Unsigned 32-bit integer.
Minor error code	Unsigned 32-bit integer.
Dye film RFID tag UID	String, maximum 20 characters.
Total shots on film	Unsigned 32-bit integer.
Shots used on film so far	Unsigned 32-bit integer.
Film name	String, maximum 16 characters.
Colour panel length (mm)	Unsigned 32-bit integer.
Black panel length (mm)	Unsigned 32-bit integer.
Overcoat panel length (mm)	Unsigned 32-bit integer.
Dye film flags	Unsigned 32-bit integer. Bit 0 = continuous resin film, bit 1 = duplex film.
Command code	Unsigned 32-bit integer.
Date of birth	Unsigned 32-bit integer.
Ribbon manufacturer ID	Unsigned 32-bit integer.
RFID tag programmer ID	Unsigned 32-bit integer.

Figure 10: Status string format for `INF` command.

5.5 `OKY` command

Valid entries None.

Default value None.

Description This command instructs the printer to clear an error, and is equivalent to pressing the "OK" button either on the printer or the Status Monitor. Also see subsection 5.1 on page 18.