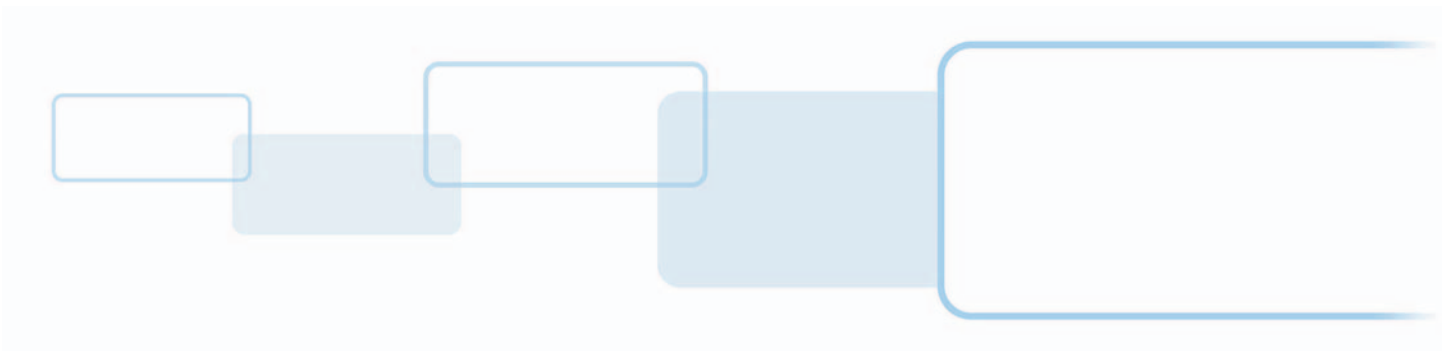




FARGO® DTC®1500
DIRECT-TO-CARD PRINTER
MODEL X001800
USER GUIDE

PLT-03159, Rev A.0
September 2017



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Chapter 1

Specifications

The purpose of this section is to provide you with specific information on the regulatory compliances, agency listings, technical specifications, and functional specifications for the DTC1500 printer.

1.1 Regulatory Compliance

| | |
|---|---|
| UL | The card printer is listed under UL 60950-1 (2 nd edition) Information Technology Equipment. File Number: E145118 Note: This product is intended to be supplied by a listed power unit marked Class 2 and rated for 24 VDC, 3.3A minimum. |
| CSA | The printer manufacturer has been authorized by UL to represent the card printer as CSA Certified under CSA Standard C22.2 No. 60950-1-07 2 nd edition. File Number: E145118 |
| FCC | The card printer complies with the requirements in Part 15 of the FCC rules for a Class A digital device. |
| CE | The card printer has been tested and complies with EN300-330, EN301-489, EN60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013, EN50581, EN62479. Note: Based on testing, the printer manufacturer certifies that the card printer complies with the following European Council Directives and has placed the CE mark on the card printer. LVD 2014/35/EU, RED 2014/53/EU, ROHS2 2011/65/EC |
| Emissions and Immunity Standards | FCC Part 15 Class A, RSS-GEN, RSS 210, CNS 13438, EN55032 Class A, EN55024, EN6100-3-2, EN6100-3-3, EN300-330, EN301-489, GB9254, GB17625 |
| Safety Standards | UL IEC 60950-1 (2nd edition), CSA C22.2 No. 60950-1-07 (2 nd edition), EN60950-1, GB4943, CNS14336 |
| Additional Agency Listings | CCC, BSMI, KC, EAC, BIS, MIC, RCM, S-mark |
| Environmental | GreenCircle Certified Energy Savings. Power supply efficiency level VI minimum. |

1.1.1 United States

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference; in which case, you are required to correct the interference at your expense.

IMPORTANT: Changes or modifications to an intentional or unintentional radiator not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

1.1.2 Canada

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

1.1.3 Taiwan

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

1.1.4 Japan

この装置は総務省の型式指定を受けています。"

(総務省指定番号は第 AC-xxxxx 号です)

本製品は電波を使用した RFID 機器の読み取り□書き込み装置です。





そのため使用する用途□場所によっては、医療機器に影響を与える恐れがあります

1.1.5 Korea





이 기기는 업무용 (A 급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시길 바라며, 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

1.2 Safety Messages

1.2.1 Safety Messages—United States



| Symbol | Critical Instructions for Safety Purposes |
|--|---|
| <p>Danger:</p>  | <p>Failure to follow these guidelines results in personal injury or death.</p> <p>To prevent personal injury or death:</p> <ul style="list-style-type: none"> ■ Reference the safety messages before performing an operation. ■ Always remove the power cord prior to performing repair procedures, unless otherwise specified. ■ Ensure only qualified personnel perform these procedures. |
| <p>ESD:</p>  | <p>This device is electrostatically sensitive. You may damage the device if exposing it to static electricity discharges.</p> <p>To prevent damage:</p> <ul style="list-style-type: none"> ■ Reference the safety messages before performing an operation. ■ Observe all established electrostatic discharge (ESD) procedures while handling cables in or near the circuit board and printhead assemblies. ■ Always wear an appropriate personal grounding device. ■ Always remove the ribbon and cards from the printer before making any repairs, unless otherwise specified. ■ Remove jewelry and thoroughly clean hands before working on the printer. |
| <p>Caution:</p>  | <p>This symbol warns of an electrical hazard that could result in personal injury or death.</p> |
| <p>Caution:</p>  | <p>For safety purposes, do not use Ethernet for a direct connection outside of the building.</p> |

1.2.2 Safety Messages—French

| Symbole | Instructions critiques visant la Sécurité |
|--|--|
| <p>Danger:</p>  | <p>Si ces directives ne sont pas suivies les résultats peuvent être des lésions corporelles ou la mort.</p> <p>Pour éviter des lésions corporelles ou la mort:</p> <ul style="list-style-type: none"> ■ Rapportez-vous aux avis suivants de sécurité avant de procéder à une opération. ■ Retirez toujours le câble d'alimentation avant d'effectuer des procédures de réparation, sauf spécification contraire. ■ Assurez-vous qu'uniquement des personnes qualifiées réalisent des procédures. |
| <p>ESD:</p>  | <p>Ce dispositif est sensible à l'électricité statique. Il peut souffrir des dommages s'il est exposé à des décharges électrostatiques.</p> <p>Pour éviter des dommages:</p> <ul style="list-style-type: none"> ■ Rapportez-vous aux messages suivants avant de procéder à une opération. ■ Suivez toutes les procédures de Décharges Electrostatiques (ESD) en vigueur durant le maniement des câbles dans ou à proximité des Ensembles de Cartes de Circuit Imprimé et Tête d'Impression. ■ Portez toujours un dispositif de mise à la terre personnelle appropriée. ■ Retirez toujours le ruban et les Cartes de l'Imprimante avant d'effectuer toute réparation, sauf spécification contraire. ■ Retirez tous bijoux et lavez soigneusement vos mains avant de travailler à l'Imprimante. |
| <p>Attention:</p>  | <p>Ce symbole est un avis de péril électrique passible de résulter en lésion corporelle ou mort.</p> |
| <p>Attention:</p>  | <p>Pour des motifs de sécurité, n'utilisez pas Ethernet pour une connexion directe hors du bâtiment.</p> |

1.2.3 Safety Messages—Taiwan

繁體中文 射頻發射及安全指令 安全訊息（小心檢查）

| 標記 | 重要的安全事項說明 |
|--|---|
| 危險:  | <p>未按照說明安裝可能造成人員傷亡。</p> <p>在可能產生潛在安全問題的地方有警示標記。（如左圖所示）。</p> <ul style="list-style-type: none"> ■ 為了避免人員傷害，在進行有此警示標記的操作前，請先參考安全資訊提示。 ■ 為了避免人員傷害，在沒有特別說明的情況下，修理前請關掉電源開關。 |
| 小心:  | <p>此設備對靜電很敏感。如果受到靜電放電，設備會損壞。</p> <p>在可能產生潛在靜電安全問題的地方有警示標記。（如左圖所示）。</p> <ul style="list-style-type: none"> ■ 為了避免損壞設備，在進行有此警示標記的操作前，請先參考安全資訊提示。 ■ 為了避免損壞設備，在排放電路板和印刷頭聯合裝置裡面或附近的電線時，請注意觀察所有的靜電放電設備。 ■ 為了避免損壞設備，請隨時佩戴合適的接地裝置（比如：手腕上戴一個高品質的接地手腕帶以免受到可能的傷害）。 ■ 為了避免損壞設備，如果沒有特殊說明，在做任何修理前，請取下印表機上的色帶和卡。 ■ 為了避免損壞設備，在使用印表機之前，請摘下戒指和手上飾品，並仔細清洗手上的油脂。 |

1.2.4 Safety Messages—China

安全消息（请仔细阅读）

| 符号 | 涉及安全的重要过程 |
|--|--|
| 危险：  | 如果不遵循这些安装指南进行操作，可能会导致重伤，甚至死亡。 可能引发安全问题的信息由警告符号（如左图所示）来表示。 <ul style="list-style-type: none"> ■ 为了确保人身安全，在执行前面带有此符号的操作之前，请先阅读下面的安全消息。 ■ 为了确保人身安全，除非另有规定，否则在执行维修过程前，始终应断开电源。 |
| 小心：  | 此设备为静电敏感设备。如果暴露在静电电流下，可能会损坏设备。 可能引发静电安全问题的信息由警告符号（如左图所示）来表示。 <ul style="list-style-type: none"> ■ 为了防止设备或介质受损，在执行前面带有此符号的操作之前，请先阅读下面的安全消息。 ■ 为了防止设备或介质受损，请在处理电路板和打印头部件中或附近的电缆时，遵守所有规定的静电放电（ESD）过程。 ■ 为了防止设备或介质受损，请始终佩带适当的个人接地设备（例如，已接地避免出现潜在损坏的高质量腕带）。 ■ 为了防止设备或介质受损，除非另有规定，否则在执行任何维修过程前，始终应将色带和证卡与打印机分离。 ■ 为了防止设备或介质受损，在操作打印机前，请取下手指和手上的珠宝首饰物，并将手上的油渍和污渍彻底清洗干净。 |
|  | 仅适用于海拔 2000m 以下地区安全使用 Use only at altitudes not more than 2000m above sea level. |
|  | 仅适用于非热带气候条件下安全使用 |
| | 环境保护（中国 -RoHS） 环保使用期是基于本产品用于办公环境。 Environmental Protection Use Period is based on the product being used in an office environment. |



1.3 Technical Specifications

| Term | Function |
|--------------------------------------|--|
| Print Method | Dye-sublimation / Resin thermal transfer |
| Print resolution | 300 dpi (11.8 dots/mm); continuous tone |
| Colors | Up to 16.7 million colors / 256 shades per pixel |
| Print Ribbon Options | <p>Full-color with resin black and overlay panel, YMCKO* (500 prints) Full-color with two resin black panels and overlay panel, YMCKOK* (500 prints) Full-color with two resin black panels, YMCKK* (500 prints) Full-color (1/2) with resin black overlay panel, YMCKO* (850 prints) Full-color (1/2) with two resin black overlay panels, YMCKOK* (650 prints) Full-color (1/2) with two resin black overlay panels, YMCKOKO* (500 prints) Resin black standard (3000 prints)</p> <p>* Indicates the ribbon type and the number of ribbon panels printed where: Y=Yellow, M=Magenta, C=Cyan, K=Resin Black, O=Overlay</p> |
| Print Speed | <p>6 seconds per card (K*) 8 seconds per card (KO*) 16 seconds per card (YMCKO*) 24 seconds per card (YMCKOK*)</p> <p>Print speed indicates an approximate batch print speed and is measured from the time a card feeds into the printer to the time it ejects from the printer. Print speeds do not include encoding time or the time needed for the PC to process the image. Process time is dependent on the size of the file, the CPU, amount of RAM and the amount of available resources at the time of the print.</p> <p>* Indicates the ribbon type and the number of ribbon panels printed where: Y=Yellow, M=Magenta, C=Cyan, K=Resin Black, O=Overlay</p> |
| Card Size and Types Supported | <p>CR-80 3.375"L x 2.125"W (85.6 mmL x 54 mmW) CR-79 3.313"L x 2.063"W (84.1 mmL x 52.4 mmW)</p> |
| Accepted Standard Card Sizes | <p>CR-80 edge-to-edge 3.36"L x 2.11"W (85.3 mmL x 53.7 mmW) CR-79 3.3"L x 2.04"W (83.8 mmL x 51.8 mmW)</p> |
| Accepted Card Thickness | Print only: 0.009" - 0.040" / 9 mil - 40 mil / 0.229 mm - 1.016 mm; print / lamination: 0.030" - 0.040" / 30 mil - 40 mil / 0.762 mm - 1.02 mm |
| Accepted Card Types | PVC or polyester cards with polished PVC finish; monochrome resin required for 100% polyester cards; optical memory cards with PVC finish; rewrite. |
| Input Hopper Card Capacity | 100 cards 0.030" (0.762 mm) |
| Output Hopper Card Capacity | 100 cards 0.030" (0.762 mm) |
| Reject Hopper Card Capacity | 100 cards 0.030" (0.762 mm) |
| Card Cleaning | Card cleaning roller integrated into the ribbon drawer. A new cleaning roller is included with each ribbon. |
| Printer Memory | 32MB RAM |

| Term | Function |
|-----------------------------------|--|
| Operating Systems | Windows 7 (32- and 64-bit) Windows 8 (32- and 64-bit) Windows 10 (32- and 64-bit) Windows Server 2003 R1 and R2 (32-bit only) Windows Server 2008 (32- and 64-bit) R2 (64-bit only) Windows Server 2012 R1 and R2 |
| Interface | USB 2.0 and Ethernet with internal print server |
| Operating Temperature | 65°F to 80°F (18°C to 27°C) |
| Humidity | 20-80% non-condensing |
| Weight | Single-Sided: 8 lb (3.63 kg); Dual-Sided: 10 lb (4.54 kg) |
| Supply Voltage | 100-240 V AC, 1.6 A |
| Supply Frequency | 50 Hz/60 Hz |
| Warranty | Printer—Three years; Printhead—Three years, unlimited pass with UltraCard® |
| Encoding Options Supported | 125 kHz (HID Prox) reader 13.56 MHz (iCLASS®, MIFARE®, ISO 14443 A/B, ISO 15693) read/write encoder Contact smart card encoder reads from and writes to all ISO7816 1/2/3/4 memory and microprocessor smart cards (T=0, T=1) as well as synchronous cards ISO magnetic stripe encoding, dual high- and low-coercivity, Tracks 1, 2, and 3 |
| Options | Single wire Ethernet encoding is only available for iCLASS and contact smart card encoding Smart card encoding (contact/contactless)—Upgradable Magnetic stripe encoding—Upgradable Card lamination Printer cleaning kit |
| Diagnostics | Fargo Workbench™ utility |
| Display | Color changing status buttons |

1.4 Functional Specifications

This card printer utilizes two different, yet closely related printing technologies to achieve its remarkable direct-to-card print quality for dye-sublimation and resin thermal transfer.

1.5 Printer Components: Print Ribbons

The card printer utilizes both dye-sublimation and/or resin thermal transfer methods to print images directly onto blank cards. Since the dye-sublimation and the resin thermal transfer print methods each provide their own unique benefits, print ribbons are available in resin-only, dye-sublimation-only and combination dye-sublimation/resin versions.

To make it easier to remember which print ribbons are which, a letter code has been developed to indicate the type of ribbon panels found on each ribbon. This letter code is as follows:



= Dye-Sublimation Yellow Panel



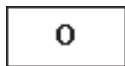
= Dye-Sublimation Magenta Panel



= Dye-Sublimation Cyan Panel



= Resin Black Panel (Premium unless otherwise stated)



= Clear Protective Overlay Panel

1.5.1 Ribbon Types and Print Counts

The following table includes the ribbon types and typical print counts.

| Ribbon | Print Count |
|---|--------------------|
| YMCKO - Full Color / Resin Black / Overlay | 500 |
| YMCKO Half Panel - Full Color (1/2) / Resin Black / Overlay | 850 |
| YMCKK - Full Color / 2 Resin Black | 500 |
| YMCKOK - Full Color / 2 Resin Black / Overlay | 500 |
| YMCKOK Half Panel - Full Color (1/2) / 2 Resin Black / Overlay | 650 |
| YMCKOKO Half Panel - Full Color (1/2) / 2 Resin Black / 2 Overlay | 500 |
| K - Standard Resin | 3000 |



1.6 Printer Components: Blank Cards

| Type | Description |
|------------------------------|---|
| Card Size | The card printer accepts standard CR-79 and CR-80 sized cards. |
| Card Surface | <p>Suitable cards must have a polished PVC surface free of fingerprints, dust or any other types of embedded contaminants. In addition, cards must have a completely smooth, level surface for the printer to achieve consistent color coverage.</p> <p>Certain types of proximity cards have an uneven surface that inhibit consistent color transfer.</p> <p>Certain types of smart card chips are raised slightly above the cards surface which also results in poor color transfer.</p> |
| UltraCard Brand Cards | <p>The UltraCard product line, available exclusively as part of HID Global Fargo brand secure card issuance solutions, has a long-standing reputation among dealers and end users for consistent quality in construction.</p> <ul style="list-style-type: none"> ■ In addition to blank stock, the UltraCard line is available in a variety of configurations for magnetic stripe, custom hologram, and other additional anti-counterfeiting features. ■ UltraCard Premium is the preferred card for Direct-to-Card (DTC) applications that require a higher quality card. The UltraCard Premium composite material construction provides for maximum durability, flexibility, and card life, with optimal resolution print quality for lamination and fluorescent panel ribbon printing applications. ■ UltraCard PVC cards are medium-durability cards for a glossy, photo quality finish. These cards are manufactured to ensure clean, scratch-free cards for high-quality prints and extended printhead life. |

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Setup and Installation Procedures

This section describes the setup and installation for the DTC1500 card printer.

2.1 Choosing a Good Location

The following guidelines help to ensure optimal printing performance:

- Place the unit in a location with adequate air circulation to prevent internal heat buildup.
- Use the dimensions of the printer as a guideline for the minimum clearances to the unit.
Note: Allow for adequate clearance in front of the unit to accommodate the unit with its covers open.
- Do not install the unit near heat sources such as radiators or air ducts or in a place subject to direct sunlight, excessive dust, mechanical vibration or shock.

2.1.1 About Moisture Condensation

If the unit is brought directly from a cold to a warm location or is placed in a very damp room, moisture may condense inside the unit. Should this occur, print quality may not be optimal.

Leave the unit unplugged in a warm, dry room for several hours before using to evaporate any moisture.



Caution: For safety purposes, Ethernet is not intended for a direct connection outside of the building.

Attention: Pour des raisons de sécurité, Ethernet n'est pas conçu pour une connexion directe à l'extérieur du bâtiment.

2.2 Unpacking and Inspection

While unpacking your printer, inspect the carton to ensure that damage has not occurred during shipping. Make sure that all supplied accessories are included with your unit.

Check that the following items are included:

- Power supply
- US/EU power cable
- USB cable (2.0)
- Card printer user guide
- Warranty statement
- Compliance document

2.3 Installing the Print Ribbon Cartridge

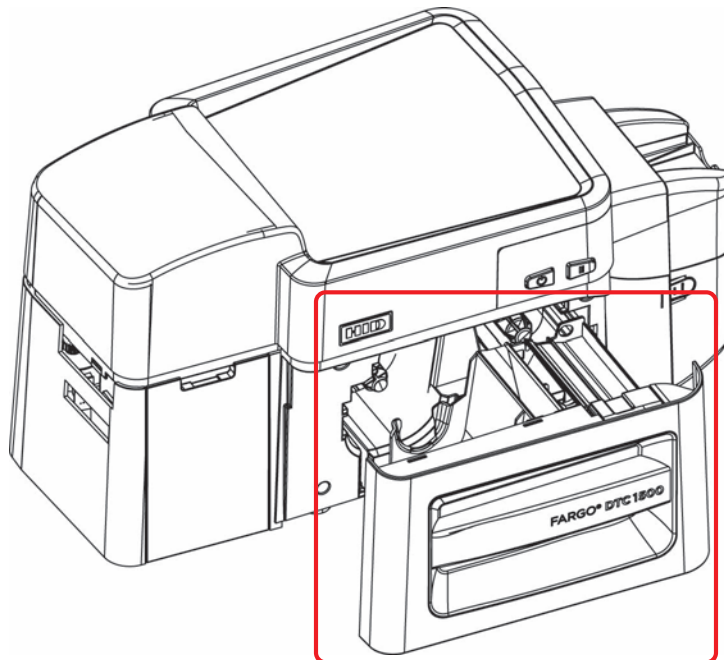
Fargo Direct-to-Card printers require highly specialized supplies to function properly.

To maximize printer durability, reliability, and printed card quality, you must use only Fargo-certified supplies. Your Fargo warranty is void, where not prohibited by law, if you use supplies other than Fargo-certified supplies.

Printer cleaning is recommended with each ribbon change to ensure quality printed cards.

Resin-only print ribbons consist of a continuous roll of a single resin color. No protective overlay panel (O) is provided because resin images do not require the protection of an overlay.

1. Pull open the drawer.



2. Insert the print ribbon cartridge into the printer drawer.
3. Close the drawer.

For additional help with loading the print ribbon cartridge, see the *Fargo Printers* videos available at www.youtube.com/HIDGlobal.

2.4 Installing Blank Cards into the Input Card Hopper

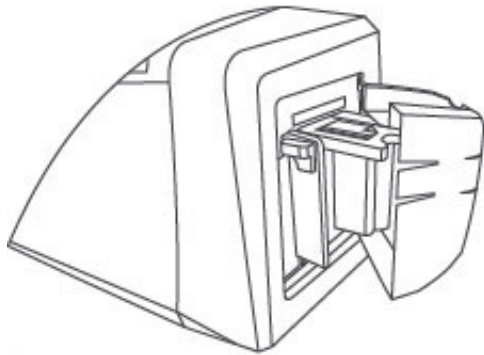
The Fargo DTC1500 card printer is capable of printing single feed cards and multiple feed cards (batch mode). To print a single feed card, remove all cards from the input card hopper, leave its door closed and place a card in the single feed card slot (which can be used repeatedly).

1. Load the cards with the print side down and (if applicable) the magnetic strip up and towards the front of the printer.

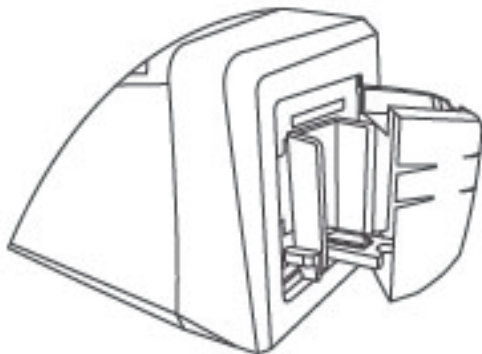
Information: Do not run the cards with a contaminated, dull or uneven surface through the printer. Printing onto these cards may lead to poor print quality and can greatly reduce the life of the printhead.

- Card types include PVC or PVC finish.
- Cards eject into the output hopper or reject hopper.
- The input hopper holds 100 cards.
- Certain types of smart card chips are raised slightly above the cards surface, which may result in poor color transfer. Design the card with white space surrounding the chip.

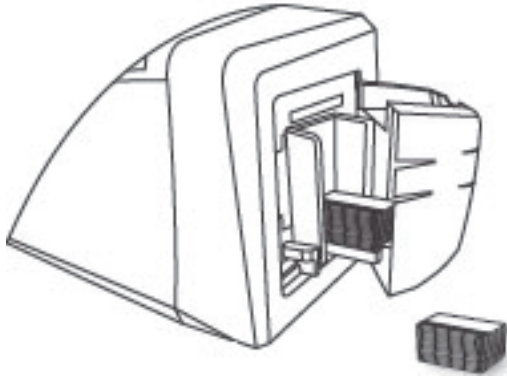
2. Open the input card hopper door.



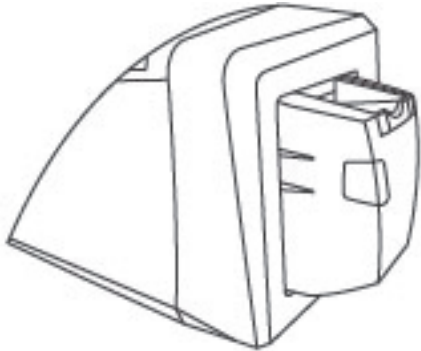
3. Press the card hopper load lever down until the card tray locks into place.



4. Load up to 100 cards into the hopper with the print side down. If using cards with a magnetic stripe, the magnetic stripe should be loaded with the stripe up and to the front of the printer.



5. Close the input card hopper door to release the lever to the printing position.

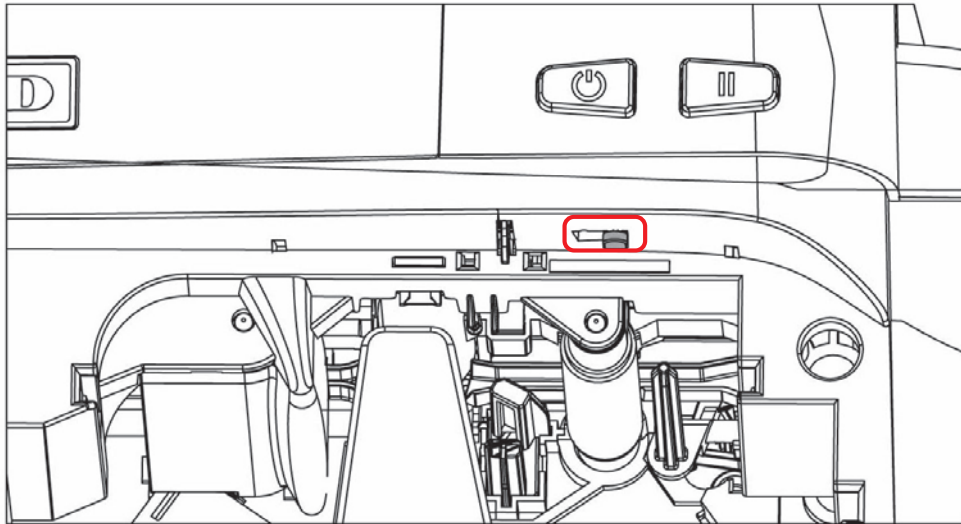


2.5 Card Size Selection

The printer uses standard size CR-79 and CR-80 cards.

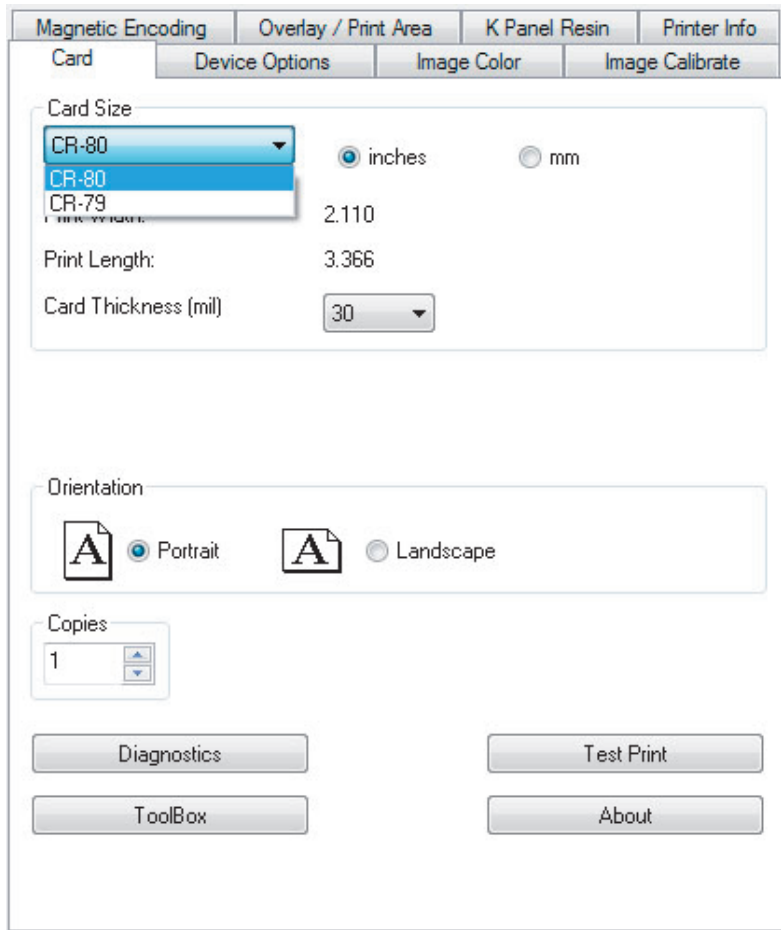
Follow this procedure in the printer and in the printer driver to set up the card size.

1. Open the front door and locate the slide bar.



2. If using the CR-79 card, push the slide bar to the LEFT.
3. If using the CR-80 card, push the slide bar to the RIGHT.

4. From the Driver Printing Preferences, select the correct card size.



2.6 Connecting the Printer Power

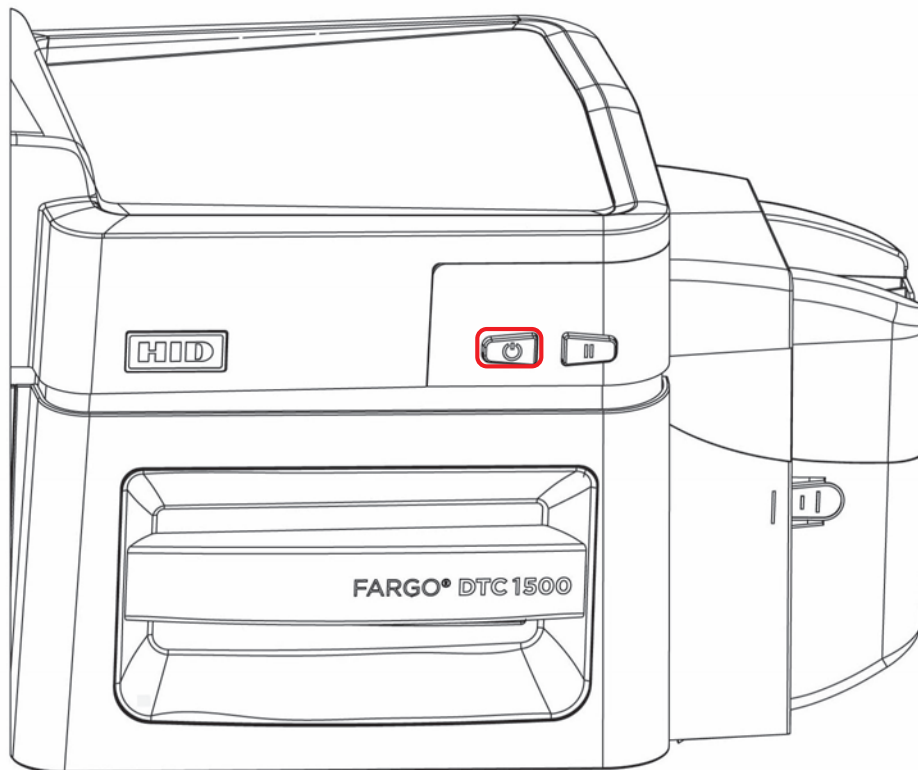
To connect power to the printer, do the following:

Note: Do not connect the printer USB cable until prompted during the printer driver installation.

1. Plug the AC adapter power cable into the back of the printer.



2. Plug the wall power cable into the AC power adapter.
3. Plug the wall power cable into a standard 100-240 V AC power outlet.
4. Press the printer power button to power on the printer.



Note: The printer powers down during the “sleep time” but automatically powers up when a print job is sent.

Print Driver Installation

This section describes the printer driver installation requirements and standard procedures.

The DTC1500 Print Driver supports the following:

- Windows Server 2003 R1 and R2 (32-bit)
- Windows Server 2008 R1 (32- and 64-bit)
- Windows Server 2008 R2 (64-bit)
- Windows Server 2012 R1 and R2
- Windows 7 (32- and 64-bit)
- Windows 8 (32- and 64-bit)
- Windows 10 (32- and 64-bit)

For more information on supported operating systems, see www.hidglobal.com/support.

3.1 Driver Installation Instructions

Note: You must be logged in as an administrator to perform the driver installation. After installation, from **Printer & Faxes**, select **Printer properties**. The **Security** tab must allow you to set the **Print**, **Manage this printer** and **Manage documents** permissions.

Start by downloading the latest driver file from www.hidglobal.com/drivers. Follow the Installaware Wizard screen prompts.

1. Select **Install the Printer Driver** to start the driver installation.
2. Select the **Fargo Workbench Utility Program** to install the diagnostic program.
3. All versions of Windows require Administrator rights.
4. From the **Printer & Faxes**, select **Printing preferences** to set up the printer driver after it has been installed.
5. Use the drop-down arrows to select the correct options for each printing preference.

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Chapter 4

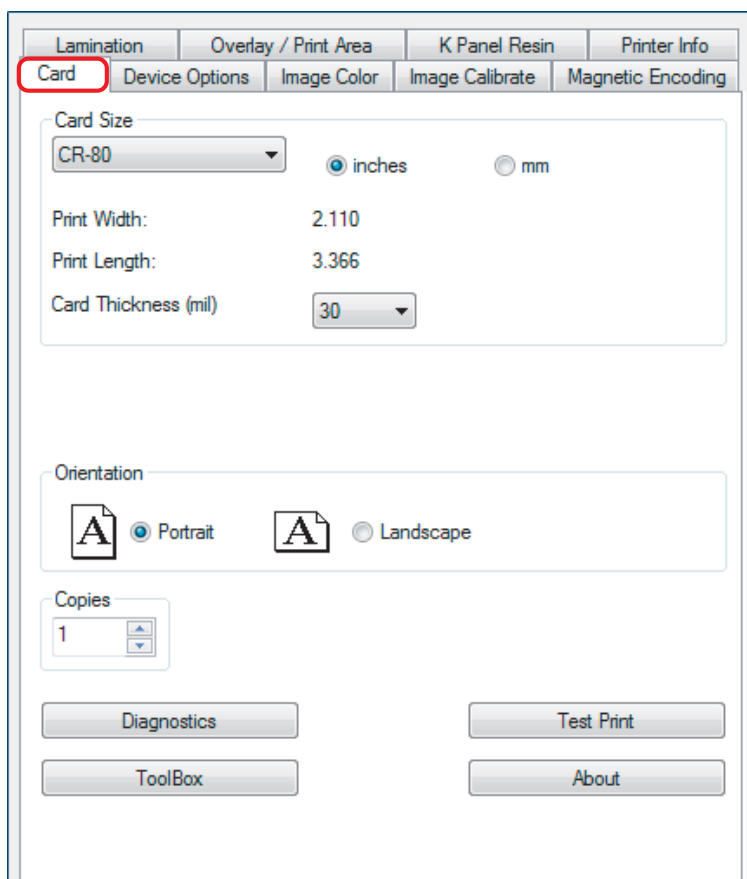
Printer Preferences

This section provides an overview of the Printing Preferences tabs.

4.1 Card Tab

The Card tab provides options that define the basic characteristics of a card—the size and orientation. The Card tab also provides access to helpful utilities and information:

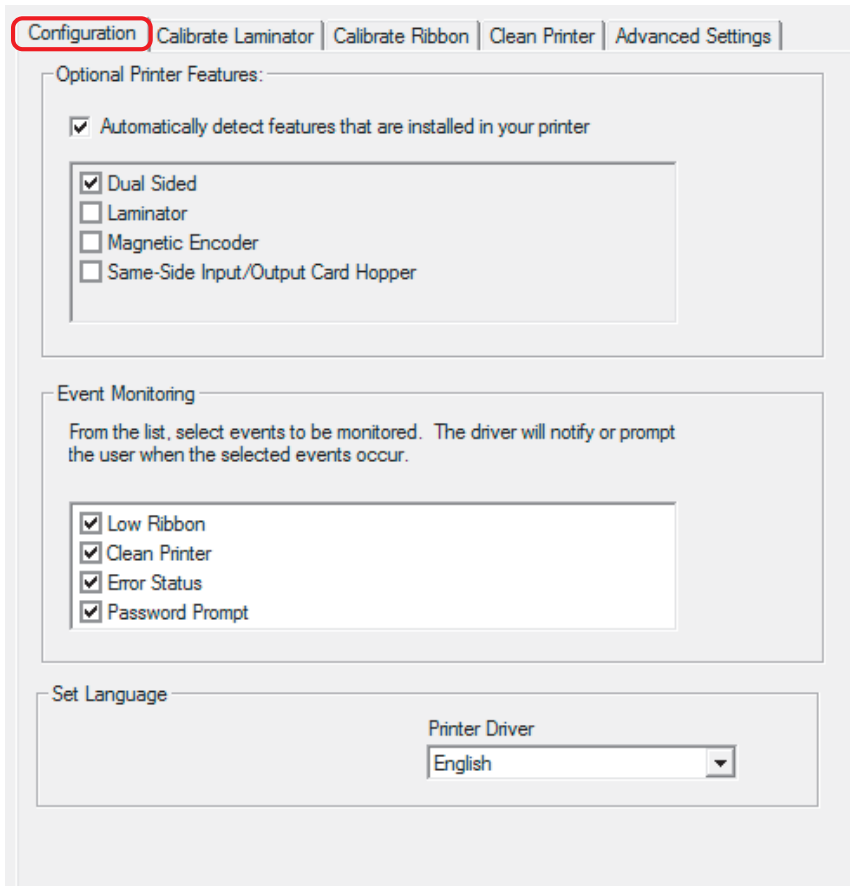
- Diagnostics
- Test Print
- Toolbox
- About



| Field | Description |
|-----------------------------|--|
| Card Size | Select CR-80 or CR-79. |
| Measurement units | Select inches or mm (millimeters). |
| Print Width | Displays width dimension of the card. |
| Print Length | Displays length dimension of the card. |
| Card Thickness (mil) | Select the card thickness in mils. |
| Orientation | Select Portrait for vertical orientation or Landscape for horizontal orientation. |
| Copies | Select the number of copies to print using Test Print. |
| Diagnostics | Click Diagnostics to access the Workbench 3 utility. See the <i>Workbench 3 User Guide</i> or <i>Workbench 3 Help</i> facility for more information. See <i>Section 4.1.1: Toolbox Window</i> . |
| Test Print | Click Test Print to send one or more self-test prints to the printer. |
| Toolbox | Click the Toolbox button for access to the following options: <ul style="list-style-type: none"> ■ Configuration ■ Calibrate Ribbon ■ Clean Printer ■ Advanced Settings |
| About | Displays the About screen. |

4.1.1 Toolbox Window

The Card Toolbox window is displayed with the selection of the **Toolbox** button on the Card tab.



4.1.1.1 Configuration Tab

The **Configuration** tab is used to show the currently installed optional printer features, event monitoring, and to set the printer driver language.

Set Language

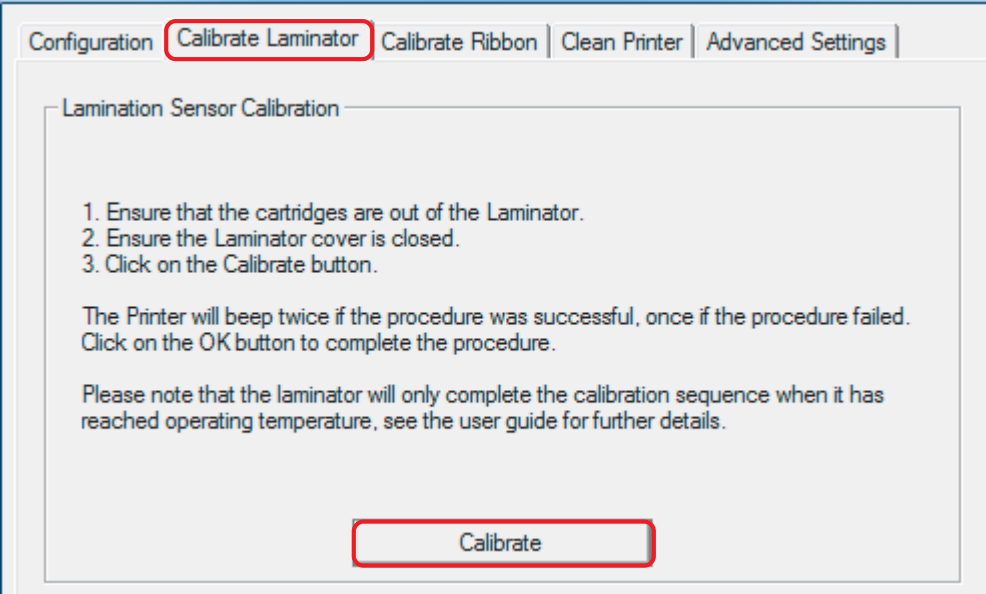
To switch between languages, select the preferred language from the Printer Driver drop-down menu. Click **OK** twice, and then open the driver in the preferred language.

4.1.1.2 Calibrate Laminator Tab

The **Calibrate Laminator** tab provides information about Laminator Sensor Calibration.

To calibrate the laminator,

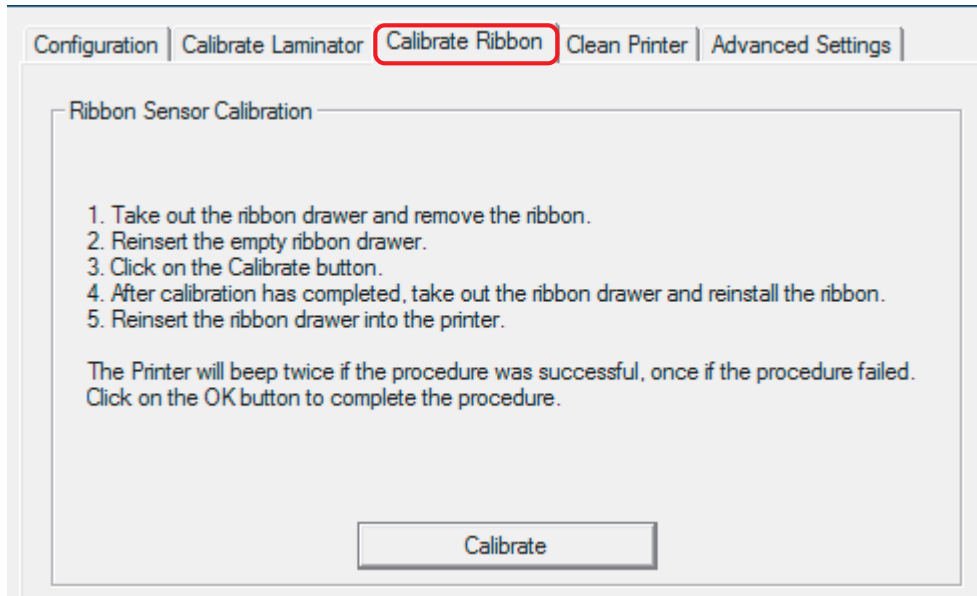
1. Laminate a sample to raise the temperature to the Transfer Temperature displayed on the Lamination tab.
2. Remove the cartridges from the laminator and close the cover.
3. Click the **Calibrate** button.



4.1.1.3 Calibrate Ribbon Tab

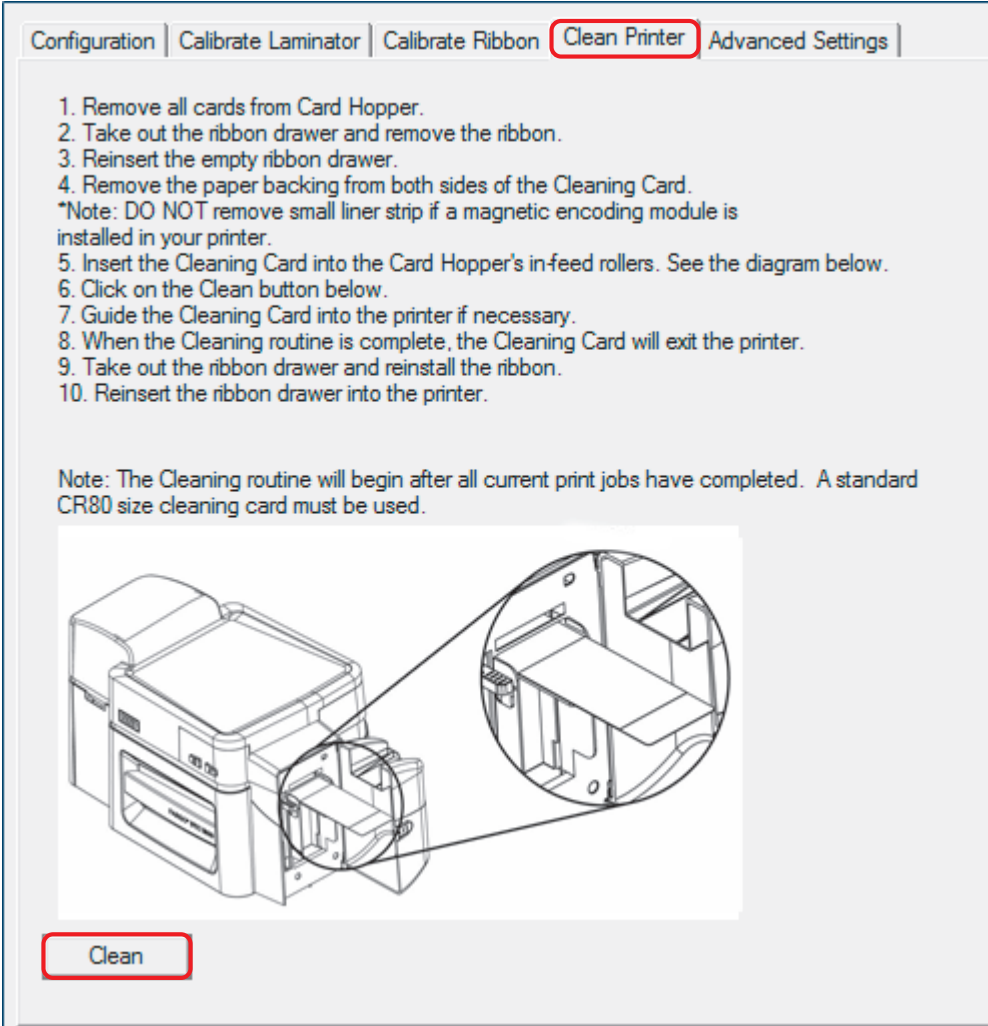
The **Calibrate Ribbon** tab sends the calibrate ribbon command to the printer when you click the **Calibrate** button.

Follow the procedure displayed on this window.



4.1.1.4 Clean Printer Tab


The **Clean Printer** tab launches the cleaning routing when you click the **Clean** button. Follow the procedure displayed on this window.



4.1.1.5 Safety Messages (Review Carefully)

Note: All messages are provided in English and French.

| Symbol | Critical Instructions for Safety Purposes |
|--------|--|
| | <p>Failure to follow these installation guidelines can result in death or serious injury.</p> <p>Information that raises potential safety issues is indicated by a warning symbol (as shown to the left).</p> <p>To prevent personal injury:</p> <ul style="list-style-type: none"> ■ Refer to the safety messages before performing an operation preceded by this symbol. ■ Always remove the power cord prior to performing repair procedures, unless otherwise specified. ■ Make sure only qualified personnel perform these procedures. |

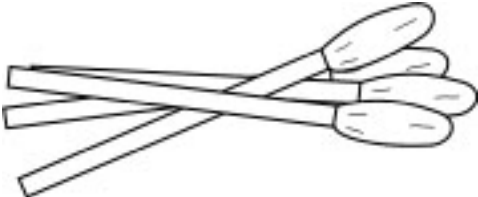


| Symbol | Critical Instructions for Safety Purposes |
|--|---|
| | <p>Attention: Le non respect de ces consignes d'installation peut entraîner la mort ou des blessures graves. L'information qui pose des problèmes de sécurité potentiels sont signalées par un symbole d'avertissement (comme illustré à gauche).</p> <p>Pour éviter toute blessure:</p> <ul style="list-style-type: none"> ■ Consultez les consignes de sécurité suivantes avant d'effectuer une opération précédée par ce symbole. ■ Débranchez toujours le cordon d'alimentation avant d'effectuer les procédures de réparation, sauf indication contraire. ■ Assurez-vous que seul le personnel qualifié est chargé de ces procédures. |
| <p>Caution:</p>  | <p>This device is electrostatically sensitive. It may be damaged if exposed to static electricity discharges.</p> <p>Information that raises potential electrostatic safety issues is indicated by a warning symbol (as shown to the left).</p> <p>To prevent equipment or media damage,</p> <ul style="list-style-type: none"> ■ Refer to the safety messages before performing an operation preceded by this symbol. ■ Observe all established electrostatic discharge (ESD) procedures while handling cables in or near the circuit board and printhead assemblies. ■ Always wear an appropriate personal grounding device (for example, a high quality wrist strap grounded to avoid potential damage). ■ Always remove the ribbon and cards from the printer before making any repairs, unless otherwise specified. ■ Take jewelry off of fingers and hands, as well as thoroughly clean hands to remove oil and debris before working on the printer. |
| | <p>Attention: Ce dispositif est sensibles aux décharges électrostatiques. Il peut être endommagé s'il est exposé à des décharges d'électricité statique.</p> <p>Informations qui soulève des questions de sécurité potentiels électrostatiques est indiqué par un symbole d'avertissement (comme illustré à gauche).</p> <ul style="list-style-type: none"> ■ Pour éviter que l'équipement ou les dommages des médias, reportez-vous aux consignes de sécurité suivantes avant d'effectuer une opération précédée par ce symbole. ■ Pour éviter que l'équipement ou des dommages médias, observer tous décharge établie électrostatique (ESD) des procédures lors de la manipulation des câbles à ou près de la carte de circuit imprimé et assemblées de la tête d'impression. ■ Pour éviter que l'appareil ou un support endommagé, portez toujours un dispositif approprié de mise à la terre personnelle (par exemple, un bracelet de haute qualité à la terre pour éviter les dommages potentiels). ■ Pour éviter que l'appareil ou un support endommagé, retirez toujours le ruban et les cartes de l'imprimante avant d'effectuer des réparations, sauf indication contraire. ■ Pour éviter que l'équipement ou les dommages des médias, prendre des bijoux hors de doigts et les mains, ainsi que les mains propres pour enlever l'huile et les débris avant de travailler sur l'imprimante. |

4.1.1.6 Cleaning Kit



As with any electronic device, internal components of the printer, such as the printhead, may be damaged if exposed to static electrical discharges. To avoid potential damage, always wear an appropriate personal grounding device, such as a wrist strap (with integral resistor) connected to an ESD ground.

This cleaning kit provides you with the specialized cleaning supplies and the required cleaning procedures for you to maintain your card printer/encoder. The following cleaning procedures require less than ten minutes.

| Description | Supplies (pictured) |
|--|--|
| <p>Four (4) Printhead Cleaning Swabs are pre-moistened with 99.99% isopropyl alcohol for cleaning the printhead.</p> |  |
| <p>Three (3) Alcohol Cards are pre-moistened with 99.99% isopropyl alcohol for cleaning the platen and card feed rollers.</p> |  |
| <p>Ten (10) Cleaning Cards with adhesive backing are provided for cleaning the platen and card feed rollers.</p> |  |

4.1.1.7 Printhead Cleaning

1. Turn off the printer and unplug the power cord from the printer.
2. Remove the ribbon cartridge.
3. Open the printhead cleaning swabs. Break it to moisten the tip.
4. Swab the tip back and forth across the top of the printhead.

5. Allow to dry thoroughly before sending a print job.

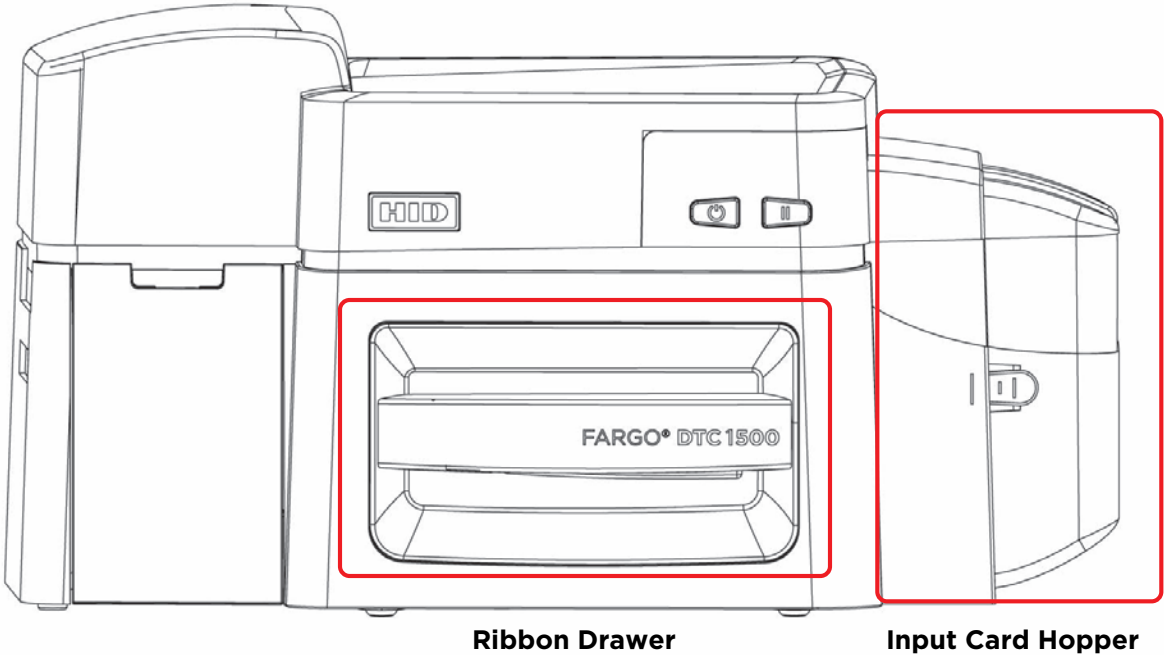


4.1.1.8 Cleaning the Platen and the Card Feed Rollers

Perform this procedure approximately every 1000 prints to maintain a consistent print quality.

Note: The card feed rollers move the card through the print process. Rollers should be kept clean to prevent card jams and card contamination. This cleaning process ultimately leads to better print quality and extended life of the printhead.

- 1. Remove the ribbon drawer, remove the print ribbon, and reinsert the empty ribbon drawer.
- 2. Remove all the cards from the input card hopper.



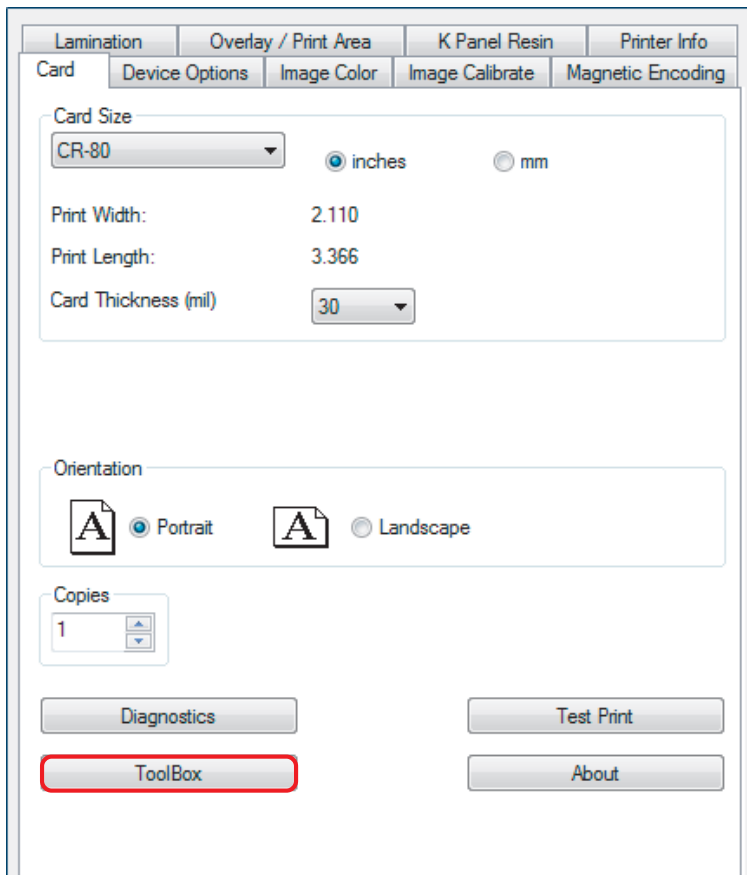
- 3. Use the cleaning card from the cleaning kit and remove the adhesive backing from both sides of the card.

If your printer has a magnetic encoder installed, be sure to leave the small liner strip on top of the cleaning card in place. This small strip is needed to protect the magnetic head from the adhesives on the cleaning card.



- 4. Insert the cleaning card into the single feed card slot until the card stops.
- If the printer is equipped with a magnetic encoder, you must insert the cleaning card with the printed side up and with the small liner strip towards the front of the printer.

- From your computer, open the Printer Driver and select **Printing Preferences > Card tab > ToolBox**.



- Select the **Clean Printer** tab.

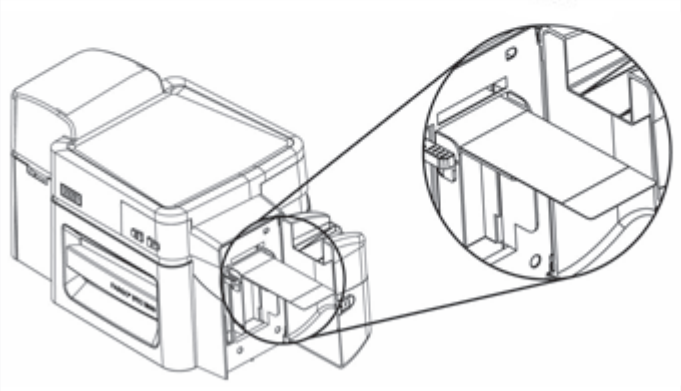
7. Click **Clean**.

- The printer pulls in the cleaning card. The printer performs the automated cleaning procedure.
- This procedure is designed to thoroughly clean the platen and the card feed rollers inside the printer.

Configuration | Calibrate Laminator | Calibrate Ribbon | **Clean Printer** | Advanced Settings

1. Remove all cards from Card Hopper.
2. Take out the ribbon drawer and remove the ribbon.
3. Reinsert the empty ribbon drawer.
4. Remove the paper backing from both sides of the Cleaning Card.
*Note: DO NOT remove small liner strip if a magnetic encoding module is installed in your printer.
5. Insert the Cleaning Card into the Card Hopper's in-feed rollers. See the diagram below.
6. Click on the Clean button below.
7. Guide the Cleaning Card into the printer if necessary.
8. When the Cleaning routine is complete, the Cleaning Card will exit the printer.
9. Take out the ribbon drawer and reinstall the ribbon.
10. Reinsert the ribbon drawer into the printer.

Note: The Cleaning routine will begin after all current print jobs have completed. A standard CR80 size cleaning card must be used.



Clean

4.1.1.9 Cleaning the Exterior of the Printer

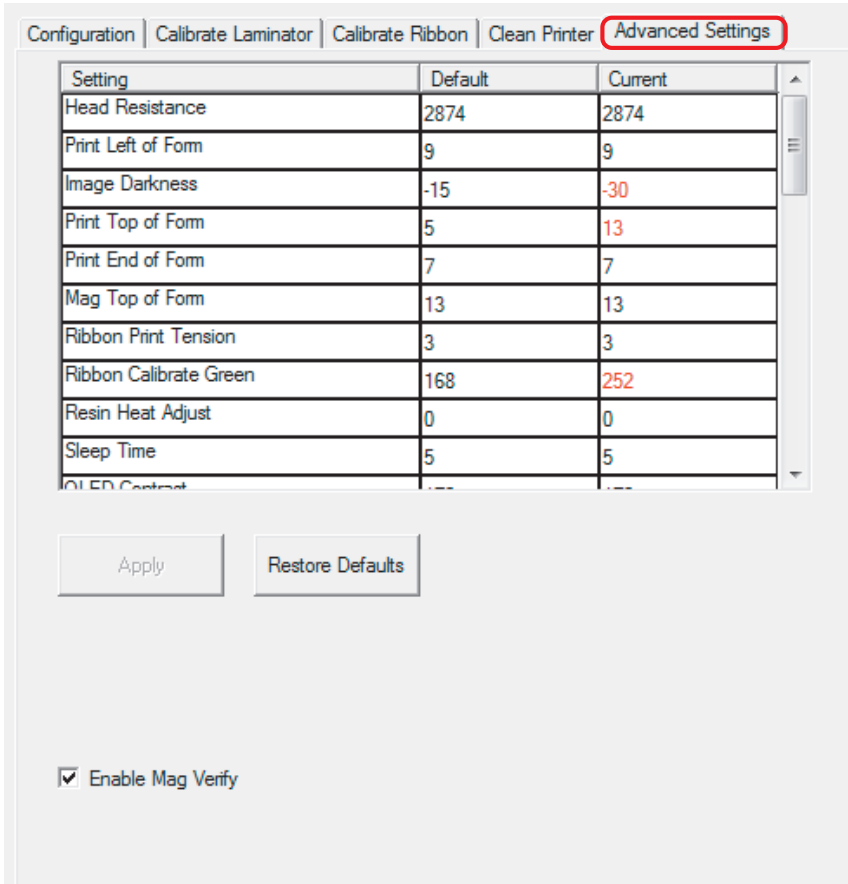
Clean the printer with a microfiber cloth only. Do not drip water into the printer. Dry thoroughly before printing.

Note: The printer has a durable casing that should retain its luster and appearance for many years.

4.1.1.10 Advanced Settings Tab

Use the **Advanced Settings** tab to adjust the internal printer settings, which are customized for every printer at the factory and saved directly within the printer memory.

Note: Select **Restore Defaults** to restore the internal default settings.



| Setting | Default | Current |
|------------------------|---------|---------|
| Head Resistance | 2874 | 2874 |
| Print Left of Form | 9 | 9 |
| Image Darkness | -15 | -30 |
| Print Top of Form | 5 | 13 |
| Print End of Form | 7 | 7 |
| Mag Top of Form | 13 | 13 |
| Ribbon Print Tension | 3 | 3 |
| Ribbon Calibrate Green | 168 | 252 |
| Resin Heat Adjust | 0 | 0 |
| Sleep Time | 5 | 5 |
| OLEF Content | ... | ... |

Apply Restore Defaults

Enable Mag Verify

You can change the values for firmware settings by clicking the fields in the Current column.

| Field | Description |
|--------------------------|--|
| Setting Column | Displays label for the setting. See the following Setting Column Fields table. |
| Default Column | Displays default value for setting |
| Current Column | Displays current value for setting |
| Apply | Applies changed values. |
| Restore Defaults | Restores the default values. |
| Enable Mag Verify | Select the check box to verify that the data is written to the tracks correctly. |

Setting Column Fields

| Field | Description |
|---|--|
| Head Resistance | <p>This is factory set. If the main board or the printhead is replaced, then adjust this number. Locate the Printhead Setting Number on the bottom of the printhead. The number reads R=XXXX.</p> |
| Print Left of Form | <p>Use this option to adjust the vertical position of the printed image on the card; so it appears centered. Maximum Adjustment Range is ± 127. Each increment equals 0.01".</p> |
| Image Darkness | <p>Use this option to set the overall darkness of the printed image by increasing or decreasing the amount of heat (used by the printhead when printing). Note: If the value is set too high, the ribbon may jam or break.</p> |
| Print Top of Form | <p>Use this option to adjust the length-wise or horizontal position of the printed image on the card (so it appears to be centered). Note: If the negative value is set too high, the print ribbon may break.</p> |
| Mag Top of Form | <p>Use this option to shift the starting point where the printer begins to encode the magnetic track data on the card magnetic stripe. Note: If the negative value is set too high, the printer may start encoding before the magnetic stripe reaches the encoding head. Maximum adjustment range is ± 80. Each increment equals 0.01".</p> |
| Ribbon Print Tension | <p>Use the this option to increase or decreases the amount of tension (drag) on the ribbon during printing.</p> |
| Ribbon Calibrate Green | <p>This is a calibration driven value and should not be adjusted. Note: This is factory set and should not be changed unless directed by a technician.</p> |
| Resin Heat Adjust | <p>Use this adjustment for black premium resin text and bar codes if they appear faded, too light or too dark. Maximum Adjustment Range is ± 100. Note: This control can be helpful for fine-tuning the transfer of resin text and bar codes.</p> |
| Sleep Time | <p>This setting adjusts the number of minutes of inactivity before the printer enters a low power sleep state.</p> |
| OLED Contrast (display contrast) | <p>Use this option to increase or decrease the contrast of the printer OLED (if applicable).</p> |
| Ribbon Calibrate Blue | <p>This setting is a calibration driven value and should not be adjusted. It is factory set and should not be changed unless directed by a technician.</p> |
| Cleaning Rate | <p>Use this option to adjust the number of cards printed before the printer displays a message indicating cleaning is needed. The default value is 3000 cards.</p> |
| Mag HI-Co Voltage Offset | <p>This setting is a calibration driven value and should not be adjusted. It is factory set and should not be changed unless directed by a technician.</p> |

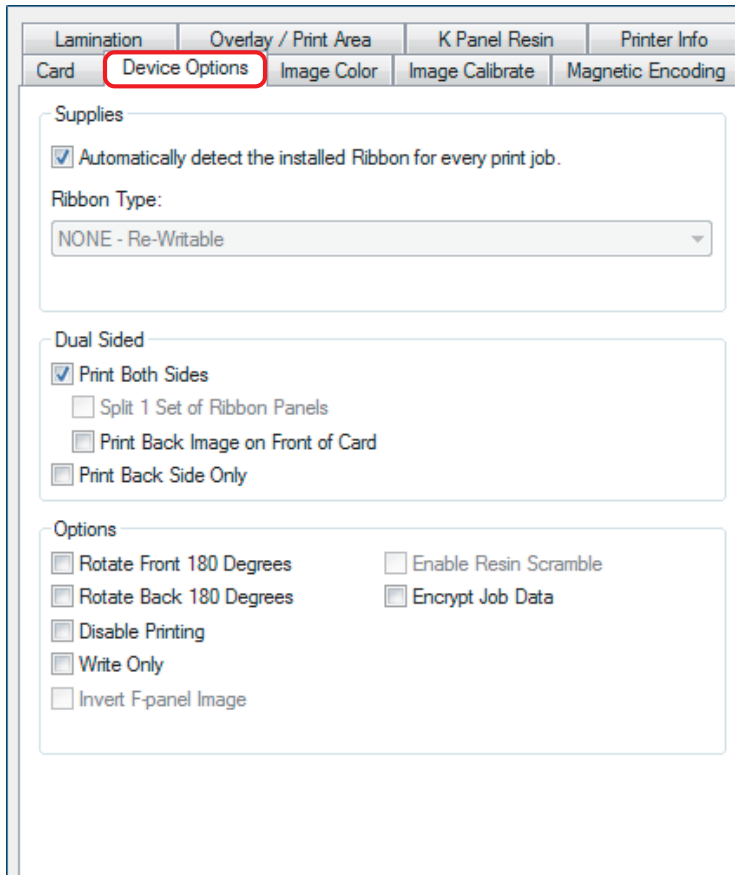


| Field | Description |
|-------------------------------------|---|
| Mag Lo-Co Voltage Offset | This setting is a calibration driven value and should not be adjusted. It is factory set and should not be changed unless directed by a technician. |
| Ribbon Green LED Level | This setting is a calibration driven value and should not be adjusted. It is factory set and should not be changed unless directed by a technician. |
| Ribbon Blue LED Level | This setting is a calibration driven value and should not be adjusted. It is factory set and should not be changed unless directed by a technician. |
| Erase Heat Offset | Adjust the temperature for the rewritable cards as needed. Increase the current setting to cause more heat to be used in the erasing process. OR Decrease the current setting to cause less heat to be used in the erasing process. Note: This setting provides the ability to control the printhead heat level when the erase operation is performed. Appropriate heat levels should be applied for the proper erase process. This setting should be adjusted for proper erasure. |
| Write Heat Offset | Adjust the temperature for the rewritable cards as needed. Increase the current setting to cause more heat to be used in the printing process of a rewritable card. OR Decrease the current setting to cause less heat to be used in the printing process of a rewritable card. Note: This setting provides the capability to control the printhead heat level when the write operation is performed. Appropriate heat levels should be applied for the proper writing process. |
| Flipper Home Offset | This setting is a calibration driven value and should not be adjusted. If the flipper unit is replaced and has not been calibrated, this value may need to be adjusted. This setting is factory set and should not be changed unless directed by a technician. |
| Flipper Eject Height Offset | This setting is a calibration driven value and should not be adjusted. If the flipper unit is replaced and has not been calibrated, this value may need to be adjusted. This setting is factory set and should not be changed unless directed by a technician. |
| Mag Super-Co Voltage Offset | This option changes the voltage going the magnetic head. This setting is factory set and should not be changed unless directed by a technician. |
| Mag Medium-Co Voltage Offset | This option changes the voltage going the magnetic head. This setting is factory set and should not be changed unless directed by a technician. |
| Head Home Offset | This setting is a calibration driven value and should not be adjusted. If the printhead assembly is replaced, then this value may need to be adjusted. This setting is factory set and should not be changed unless directed by a technician. |
| Head Print Offset | This setting is a calibration driven value and should not be adjusted. If the printhead assembly is replaced, then this value may need to be adjusted. This setting is factory set and should not be changed unless directed by a technician. |

| Field | Description |
|--------------------------------------|--|
| Head Contact Offset | This setting is a calibration driven value and should not be adjusted. If the printhead assembly is replaced, then this value may need to be adjusted. This setting is factory set and should not be changed unless directed by a technician. |
| Head Queue Offset | This setting is a calibration driven value and should not be adjusted. If the printhead assembly is replaced, then this value may need to be adjusted. This setting is factory set and should not be changed unless directed by a technician. |
| Head Card Thickness Offset | Adjusts the card handling path to allow for variances in card thickness. |
| Head Smart Card Engage Offset | Adjusts the position of the printhead to allow smart card encoder contact. |
| Head Mag Offset | Adjusts the printhead for magnetic encoding. |
| Overlay Heat Adjust | Adjusts the temperature setting for overlay film. |
| 10 Mil Card Queue Offset | Adjusts the input queue for use with thick cards. |
| Erase Speed | Adjusts the speed of the erasure process. |
| Standard Resin Heat Adjust | Use this adjustment for black standard resin text and bar codes if they appear faded, too light or too dark. Maximum Adjustment Range is ± 100 . This control can be helpful for fine-tuning the transfer of resin text and bar codes. |
| Printhead Smart Cue Offset | Adjusts the card handling path to allow for variances in card thickness. |

4.2 Device Options Tab

Use the **Device Options** tab to select the Supplies, Dual Sided, and Options areas.

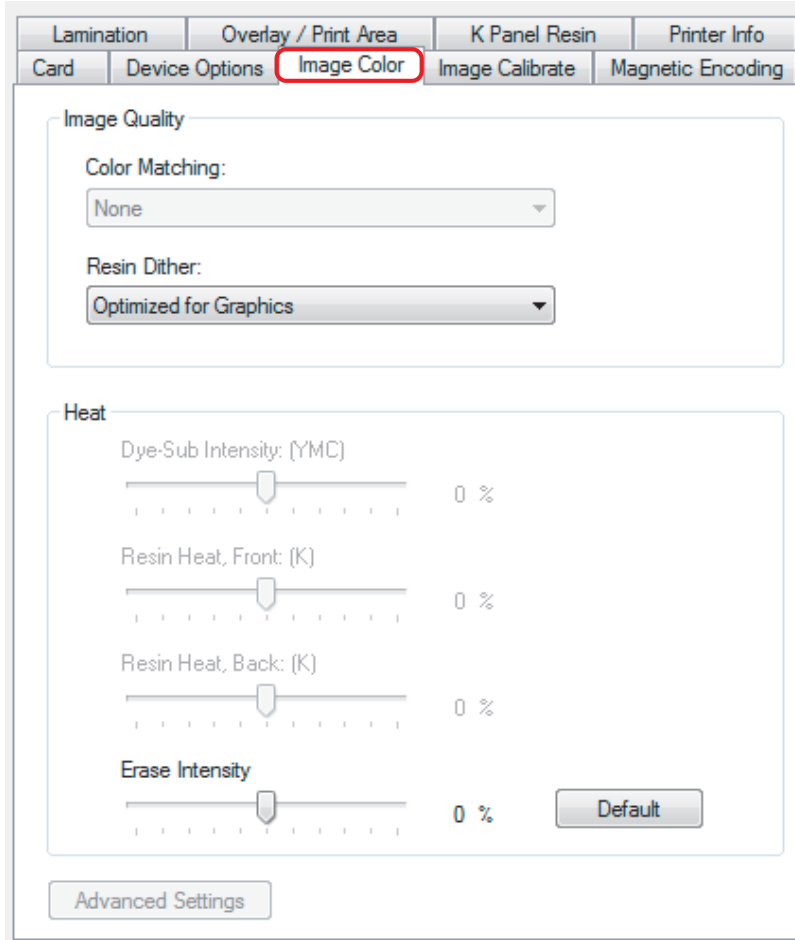


| Field | Description |
|--|---|
| Supplies | |
| Automatically detect the installed Ribbon for every print job | When this box is checked, the printer always sends the job for the ribbon that is currently installed in the printer. When this box is cleared, you can select the ribbon type you want to use to print regardless of what is in the printer. |
| Ribbon Type | Indicates the ribbon that is currently installed in your printer or you can select a ribbon type to create a print job. |
| Dual Sided | |
| Print Both Sides | Split 1 Set of Ribbon Panels: When using a YMCK ribbon, this selection allows you to print YMC on the front of the card and K on the back. Normal operation is to print YMCK on the front and YMCK on the back. Print Back Image on Front of Card: Reverses the order of printing. |
| Print Back Side Only | Prints only the backside image. |

| Field | Description |
|---------------------------------|--|
| Options | |
| Rotate Front 180 Degrees | Rotates the front print image 180 degrees on the card. |
| Rotate Back 180 Degrees | Rotates the back print image 180 degrees on the card. |
| Disable Printing | Sends a print job without any print data. The printer takes in a card and ejects it out. |
| Write Only | Disables the erase pass when using rewritable cards. |
| Invert F-panel Image | Inverts the color for the images printed with a fluorescent panel ribbon. |
| Enable Resin Scramble | Makes the data that is left on a used resin panel harder to read. |
| Encrypt Job Data | Encrypts the job data file. |

4.3 Image Color Tab

Use the **Image Color** tab to improve the quality of the image on the card. Image Color includes two areas, Image Quality and Heat.

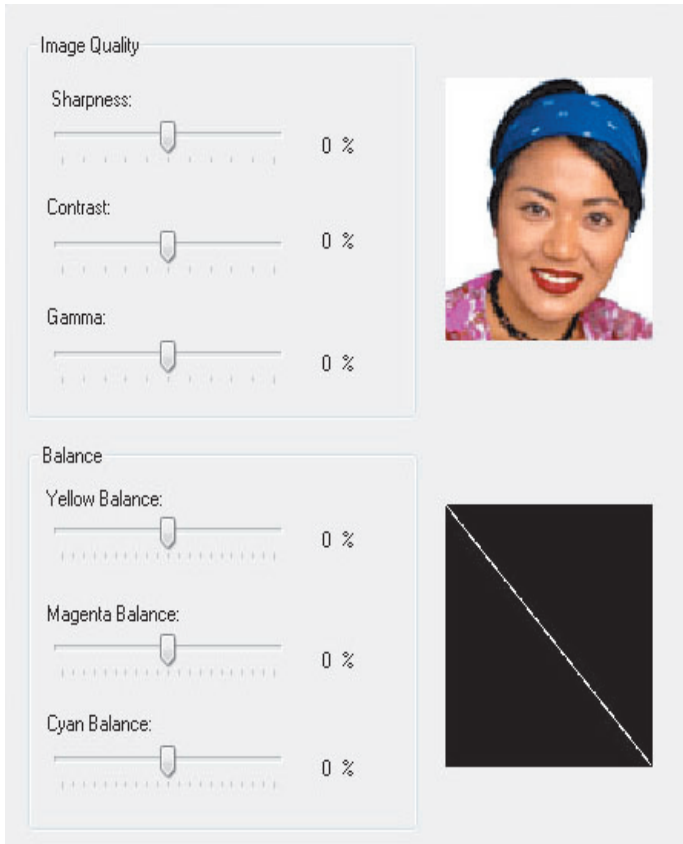


| Field | Description |
|-----------------------|--|
| Image Quality | |
| Color Matching | <p>None: Select this option if any of the following is true:</p> <ul style="list-style-type: none"> ■ if interested in print speed rather than print color ■ if color correcting an image that has been previously printed ■ if using third-party color matching software <p>System Color Management: Select to perform color correction through a complex color-matching algorithm.</p> <p>Note: This option shifts colors so the colors more closely match how they appear on screen.</p> <p>Algebraic: Select to use the Algebraic color-matching algorithm.</p> |

| Field | Description |
|--------------------------|--|
| Resin Dither | Select the appropriate dither method according to the type of image to be printed. Graphics include images such as drawings, clip art, and logos. Photos include images such as photographs and photo-quality images. This option affects objects printed with a resin-only ribbon. |
| Heat | |
| Heat | <p>Dye-Sub Intensity (YMC): Control the overall darkness and lightness of the dye-sub printed image by moving the slider to the left to use less heat in the printing process, resulting in a lighter print. Move the slider to the right to use more heat, resulting in a darker print.</p> <p>Note: This slide only affects those images printed with dye-sublimation ribbon panels (YMC).</p> <p>Resin Heat, Front (K): Move the slider to the left to use less heat in the printing process, resulting in a lighter or less saturated print. Move the slider to the right to use more heat, resulting in a darker or more saturated print.</p> <p>Note: This control can be helpful for fine-tuning the sharpness of resin text and bar codes.</p> <p>Resin Heat, Back (K): Move the slider to the left to use less heat in the printing process, resulting in a lighter or less saturated print. Move the slider to the right to use more heat, resulting in a darker or more saturated print.</p> <p>Erase Intensity: Move the slider to the left to use less heat in the printing process. Move the slider to the right to use more heat.</p> |
| Default | Click the Default button to return all options to their factory settings. |
| Advanced Settings | See the following Advanced Settings section. |

4.3.1 Advanced Settings

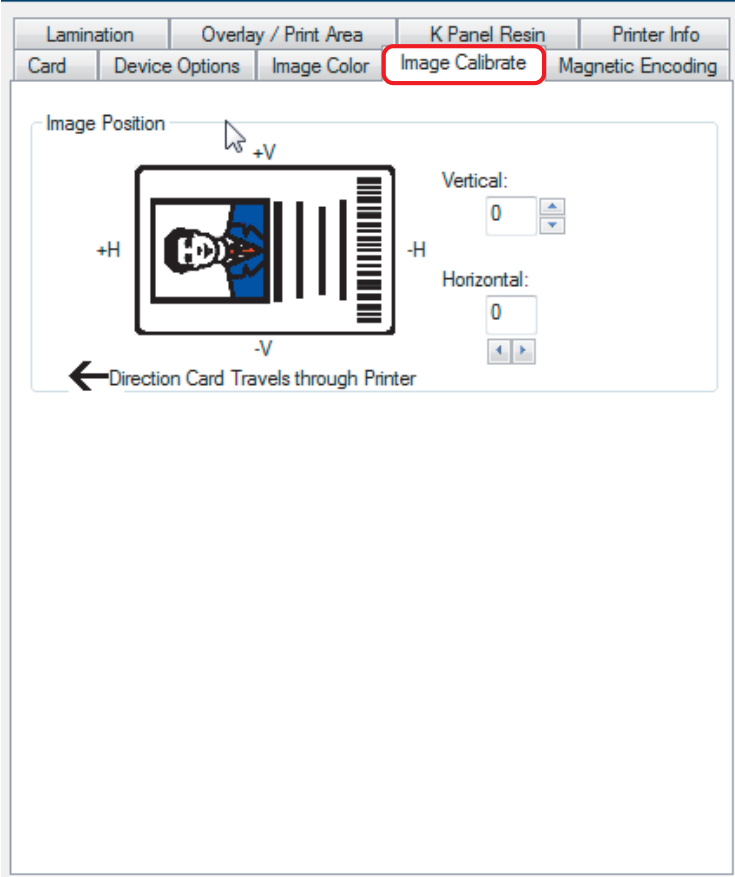
Click the **Advanced Settings** button to display the **Advanced Image Color** window.



| Field | Description |
|------------------------|---|
| Image Quality | |
| Sharpness | Move the slider to the right to sharpen the image. Move the slider to the left to decrease sharpness. |
| Contrast | Move the slider to the right to increase contrast in the image. Move the slider to the left to decrease contrast. |
| Gamma | Move the slider to the right to increase gamma in the image. Move the slider to the left to decrease gamma. |
| Balance | |
| Yellow Balance | Move the slider to the right to increase the amount of yellow in the image. Move the slider to the left to decrease the amount of yellow. |
| Magenta Balance | Move the slider to the right to increase the amount of magenta in the image. Move the slider to the left to decrease the amount of magenta. |
| Cyan Balance | Move the slider to the right to increase the amount of yellow in the cyan. Move the slider to the left to decrease the amount of cyan. |
| Default | Click the Default button to return all options to their factory settings. |

4.4 Image Calibrate Tab

Use the **Image Calibrate** tab to control the position of the printable area in relation to the card.

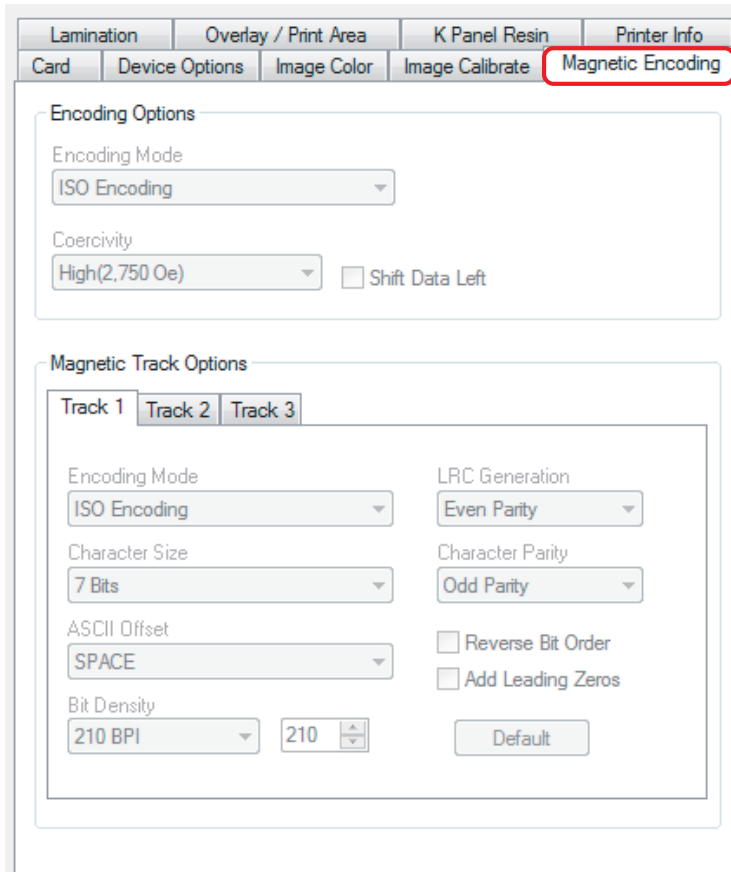


Use the Vertical and Horizontal image position controls to adjust the position of the overall print area to be precisely centered on a card. The maximum value for the Vertical and Horizontal adjustments is ± 100 pixels (10 pixels = approx 0.03%, 0.8 mm).

| Field | Description |
|-------------------|--|
| Vertical | Enter a positive number to move the image toward the rear of the printer, Enter a negative number to move the image toward the front of the printer. |
| Horizontal | Enter a positive number to move the image toward the rear of the printer. Enter a negative number to move the image toward the front of the printer. |

4.5 Magnetic Encoding Tab

Select the **Magnetic Encoding** tab to display options for controlling the magnetic stripe encoding process. You can use these options only if the printer has an optional magnetic stripe encoding module installed.



| Field | Description |
|-------------------------|--|
| Encoding Options | |
| Encoding Mode | You can change the encoding mode and coercivity setting or modify the ISO standards for Tracks 1, 2, and 3. This can be done by correctly modifying these Magnetic Encoding options. |
| ISO Encoding | The ISO Encoding option sends down a formatted set of characters. This selection activates the track tabs. However, all functions on the Track tabs are inactive or gray and display ISO defaults, which are the defaults listed for each track below. The Shift Data Left check box remains clear and inactive. |
| Custom Encoding | If you select Custom Encoding, all options are active. The Default is ISO Encoding . Note: The defaults are the same as the ISO Encoding defaults. All functions on the Magnetic Track Options tabs are active. You can change the Magnetic Track options for Tracks 1, 2 and 3. |

| Field | Description |
|--|---|
| Raw Binary Encoding | The Raw Binary Encoding option sends down a raw binary string rather than a formatted set of characters. The Coercivity drop-down function is active and the Shift Data Left check box is not active. All functions on the Magnetic Track Options tabs are inactive except for Bit Density. |
| JIS II Encoding | If you select JIS II Encoding, specific standards are used. This selection disables all the Magnetic Track Options tabs. It also disables the Coercivity drop-down function and Shift Data Left check box option. The default Coercivity is 600 Oe . |
| Coercivity | Select the Coercivity option (Oersted) that matches the card type. <ul style="list-style-type: none"> ■ High Coercivity 4000 Oersted ■ Fargo's High Coercivity UltraCard IIIs are 2750 Oersted ■ Medium Coercivity=600 Oersted ■ Low Coercivity = 300 Oersted |
| Shift Data Left | Select this option to shift the recorded magnetic data to the left side of the card's Magnetic Stripe. This is useful in situations that require cards to be readable with insert type readers. |
| Magnetic Track Options | |
| The magnetic encoding module encodes onto tracks in accordance with an ISO 7811-2 Magnetic Stripe. For track locations, review the display in <i>Section 4.5.1: Magnetic Track Options</i> . Tabs are available on the Magnetic Encoding tab with options for encoding data on each track. | |
| Encoding Mode | You can change the encoding mode and coercivity setting or modify the ISO standards for Tracks 1, 2, and 3. This can be done by correctly modifying the Magnetic Encoding options. |
| Character Size | 4 Bits to change the bits per character to 4 BPC. 5 Bits to change the bits per character to 5 BPC. This is the default for Tracks 2 and 3. 7 Bits to change the bits per character to 7 BPC. This is the default for Track 1. 8 Bits to change the bits per character to 8 BPC. |
| ASCII Offset | NULL to change the ASCII Offset to NULL. SPACE to change the ASCII Offset to SPACE. This is the default for Track 1. ZERO to change the ASCII Offset to ZERO. This is the default for Tracks 2 and 3. |
| Bit Density | 75 BPI to change the bits per inch to 75 BPI. This is the default for Track 2. 128 BPI to change the bits per inch to 128 BPI. 210 BPI to change the bits per inch to 210 BPI. This is the default for Tracks 1 and 3. Custom BPI , which enables the custom BPI text box. Note: The lower limit is 75 and upper limit is 210. |
| LRC Generation | No LRC to change the LRC Generation to none. Even Parity to change the LRC Generation to Even Parity. This is the default for all tracks. Odd Parity to change the LRC Generation to Odd Parity. |
| Character Parity | No Parity to change the Character Parity to none. Even Parity to change the Character Parity to Even Parity. Odd Parity to change the Character Parity to Odd Parity. This is the default for all tracks. |

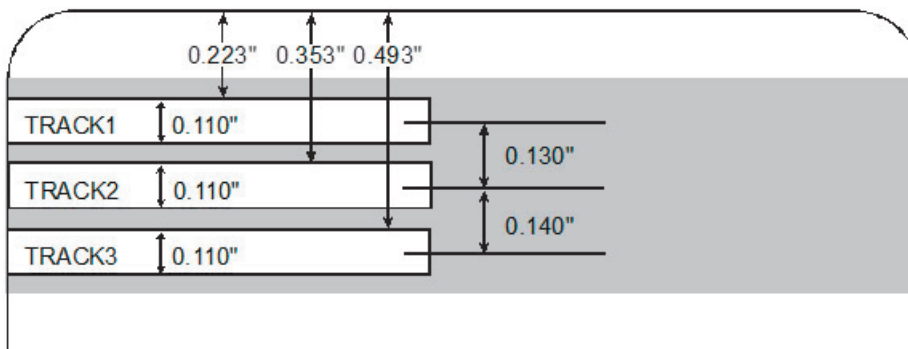


| Field | Description |
|--------------------------|---|
| Reverse Bit Order | Reverse Bit Order is used to reverse the character bits and is used for the encryption of data in specific programs |
| Add Leading Zeros | Add Leading Zeros is used to add a set number of leading zeros to the magnetic string in order to move the starting point of the encoded data in specific programs for encryption of data. |
| Default | Click the Default button to return all options to their factory settings. |

4.5.1 Magnetic Track Options

The magnetic encoding module encodes onto tracks in accordance with an ISO 7811-2 Magnetic Stripe. For track locations, review the following display. Tabs are available on the Magnetic Encoding tab with options for encoding data on each track.

Reviewing the ISO Track Locations



4.5.1.1 Reviewing the Sample String

Track 1: ~%JULIEANDERSON^1234567890?

Track 2: ~2;1234567890987654321?

Track 3: ~3;1234567890987654321?

| Track | Start Sentinel | End Sentinel | Field Separator | Valid Characters | Maximum Number of Characters |
|---------|----------------|--------------|-----------------|---|------------------------------|
| Track 1 | % | ? | ^ | ASCII 32-95 (See the table in Section 4.5.1.2: Sending the Track Data.) | 78 |
| Track 2 | ; | ? | = | ASCII 48-63 (See the table in Section 4.5.1.2: Sending the Track Data.) | 39 |
| Track 3 | ; | ? | = | ASCII 48-63 (See the table in Section 4.5.1.2: Sending the Track Data.) | 106 |

4.5.1.2 Sending the Track Data

Magnetic track data is sent in the form of text strings from the application software to the printer driver.

In order for the printer driver to differentiate between magnetic track data and the rest of the printable objects, specific characters must be added to the magnetic data to be encoded.

These specify the data that is to be encoded the tracks to encode and mark the start and stop of the data string. In some cases, these specific characters are automatically added to the string of track data by ID software applications.

In most cases, the user must carefully add these characters to the string of magnetic track data. If these characters are not added to the track data, the text intended for the magnetic track appears as printed text on the card. To avoid this, track information must be entered as described.

When entering track data, the ~ (tilde) character is entered first, followed by the track number (1, 2, or 3) on which the data should encode. The data to be encoded follows the track number.

The first character of this data string must be the track's specific start sentinel (SS) and the last character must be the specific end sentinel (ES).

The characters or data in between the SS and ES can include all of the valid characters specific to each track.

The number of these characters, however, is limited by each track's maximum character capacity.

Note: When segmenting track data, the appropriate field separator (FS) must be used. The following shows the SS, ES, FS and the valid characters defined for each track.

Reviewing the ASCII Code and Character Table

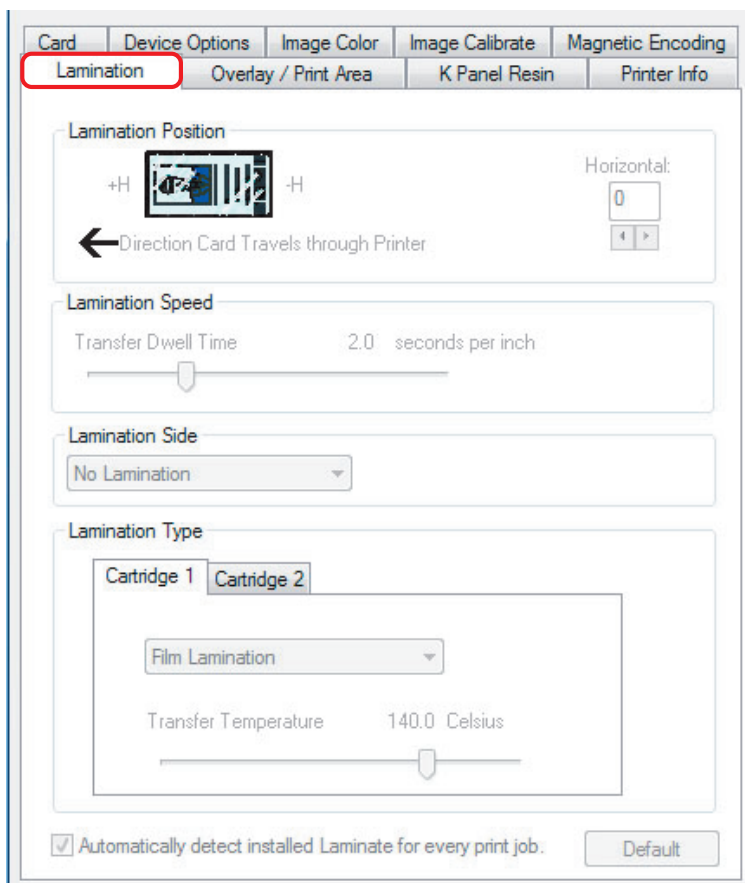
| ASCII Code | Character | ASCII Code | Character | ASCII Code | Character |
|------------|-----------|------------|-----------|------------|-----------|
| 32 | space | 56 | 8 | 80 | P |
| 33 | ! | 57 | 9 | 81 | Q |
| 34 | | 58 | : | 82 | R |
| 35 | # | 59 | ; | 83 | S |
| 36 | \$ | 60 | < | 84 | T |
| 37 | % | 61 | = | 85 | U |
| 38 | and | 62 | > | 86 | V |
| 39 | ' | 63 | ? | 87 | W |
| 40 | (| 64 | @ | 88 | X |
| 41 |) | 65 | A | 89 | Y |
| 42 | * | 66 | B | 90 | Z |
| 43 | + | 67 | C | 91 | [|
| 44 | ' | 68 | D | 92 | \ |
| 45 | - | 69 | E | 93 |] |
| 46 | . | 70 | F | 94 | ^ |
| 47 | / | 71 | G | 95 | _ |



| ASCII Code | Character | ASCII Code | Character | ASCII Code | Character |
|------------|-----------|------------|-----------|------------|-----------|
| 48 | 0 | 72 | H | | |
| 49 | 1 | 73 | I | | |
| 50 | 2 | 74 | J | | |
| 51 | 3 | 75 | K | | |
| 52 | 4 | 76 | L | | |
| 53 | 5 | 77 | M | | |
| 54 | 6 | 78 | N | | |
| 55 | 7 | 79 | O | | |

4.6 Lamination Tab

Select the **Lamination** tab to display options for controlling the lamination process. You can use these options only if the printer has an optional lamination module installed.

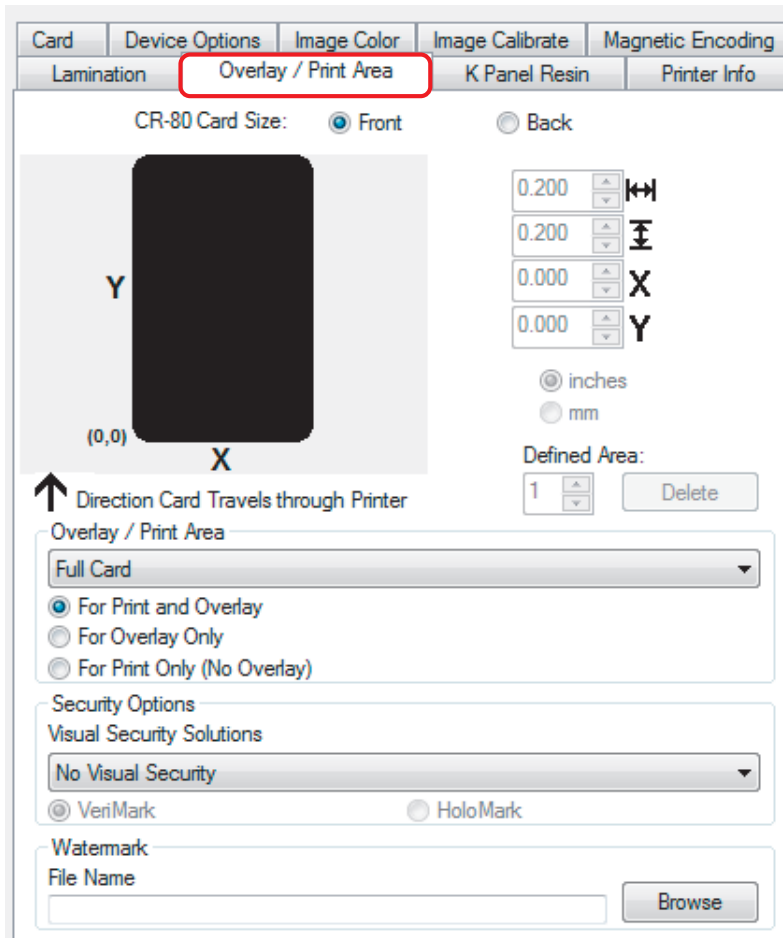


| Field | Description |
|--|--|
| Lamination Position | |
| Lamination Position | <p>Use this control to adjust the horizontal position of the laminate. Only the horizontal position needs adjustment.</p> <p>To adjust the position, click on the horizontal adjustment arrows. (The adjustment arrows point in the direction the patch will move on the card).</p> <ul style="list-style-type: none"> ■ To move the overlamine more toward the printer output side, enter a positive number. ■ To move the overlamine more toward the printer input side of the printer, enter a negative number. <p>The maximum value for the horizontal adjustment is 100 pixels. (10 pixels = 0.03 [0.8mm]).</p> |
| Lamination Speed | |
| Transfer Dwell Time | <p>Adjust this control for the through-put speed of a card in seconds per inch. Default is 2.0 seconds per inch</p> <ul style="list-style-type: none"> ■ Upper Limit - 5.5 seconds per inch ■ Lower Limit - 0.8 seconds per inch |
| Lamination Side | |
| Lamination Side | <p>To specify the side(s) of the card to laminate select:</p> <ul style="list-style-type: none"> ■ No Lamination ■ Laminate Front Side ■ Laminate Back Side ■ Laminate Both Sides ■ Laminate Opposite Sides <p>Select No Lamination if the laminator will not be used.</p> |
| Lamination Type | |
| Lamination Type | <p>Select one of the lamination type options, according to which type of lamination media is currently installed. Two types of overlaminates, film, and PolyGuard are supported by the driver. Custom versions of each type are also available.</p> <p>Selections are:</p> <ul style="list-style-type: none"> ■ Film Lamination: Select if the thermal transfer film overlamine type is installed in the lamination module. ■ 0.6 PolyGuard Lamination: 0.6 is the patch thickness. ■ 1.0 PolyGuard Lamination: 1.0 is the patch thickness. <p>Note: The two PolyGuard Lamination patches require different heat settings and lamination speeds. Select the appropriate option according to the thickness of the PolyGuard material in use.</p> <ul style="list-style-type: none"> ■ Registered Film Lamination ■ Holographic Film Lamination |
| Transfer Temperature | <p>If the check box for auto detection is selected, the temperature is automatically set. The slider can change the temperature if a different one is required.</p> |
| Automatically detect installed Laminate for every print job | <p>Use this check box for auto detection of the lamination installed. In the firmware, the values are updated on initialization and cover closing.</p> |

4.7 Overlay / Print Area Tab

Use the **Overlay / Print Area** tab to control and customize where the Overlay (O) panel and/or the print area appear on the card. By default, this option is set to print and overlay the entire card.

The orientation of the card display area is determined by the orientation specified in your template.



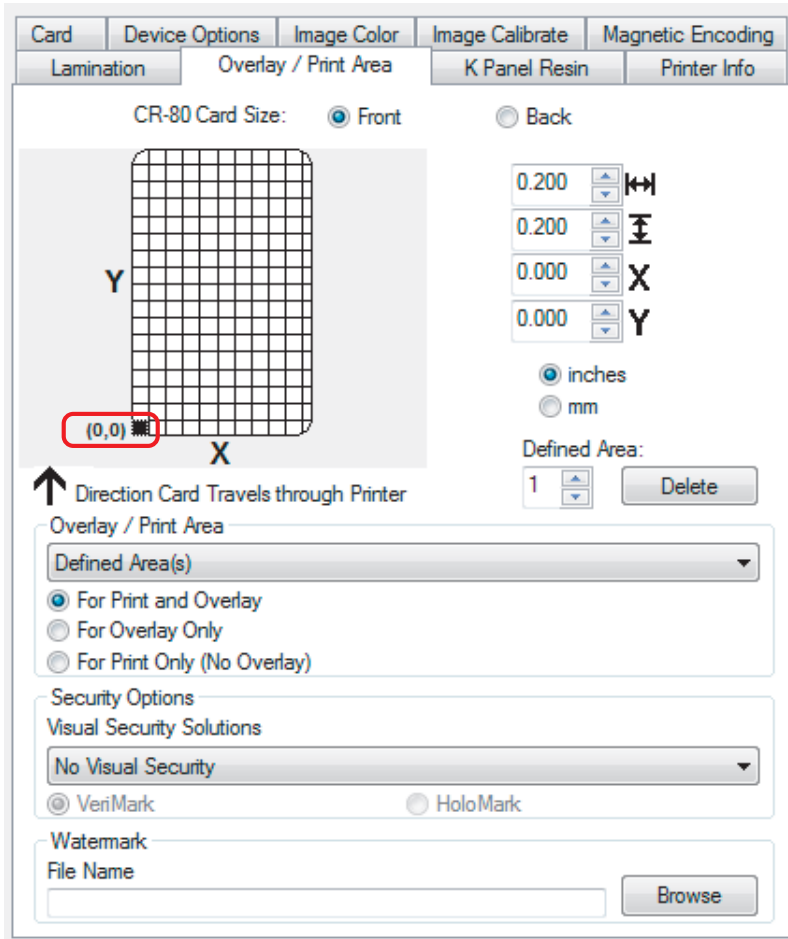
4.7.1 Defining an Overlay or Print Area

To define an overlay or print area:

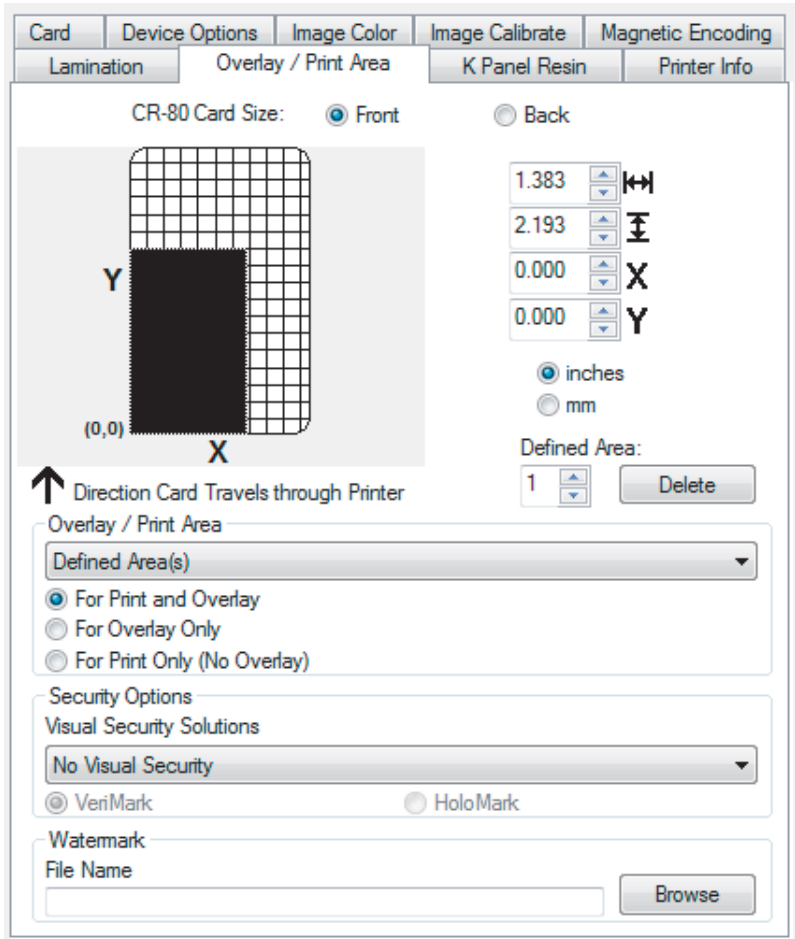
1. Select the **Front or Back** option to specify the side of the card to apply the area definition.
2. From the **Overlay / Print Area** drop-down select the option that serves your purpose.

| Field | Description |
|-----------------------------|--|
| Overlay / Print Area | |
| Full Card | Select this option to overlay and/or print the entire card. |
| Defined Area(s) | Select this option to overlay and/or print only in the selected and define an area(s). |
| Undefined Area(s) | Select this option to overlay and/or print in the space outside the selected and defined area. |
| Omit Smart Chip Area | Select this option to overlay and/or print only in the space outside the standard location of a smart chip. |
| Omit Mag Strip Area | Select this option to overlay and/or print only in the space outside the standard location of an ISO-standard magnetic stripe. |
| Omit Signature Area | Select this option to overlay and/or print only in the space outside the standard location of a signature panel. |

- When an option is selected, a default blackened area appears on the card design area grid.



- Select and drag to enlarge the area and move it to the preferred location on the card. The size and coordinates of the area update the number fields (inches or mm).



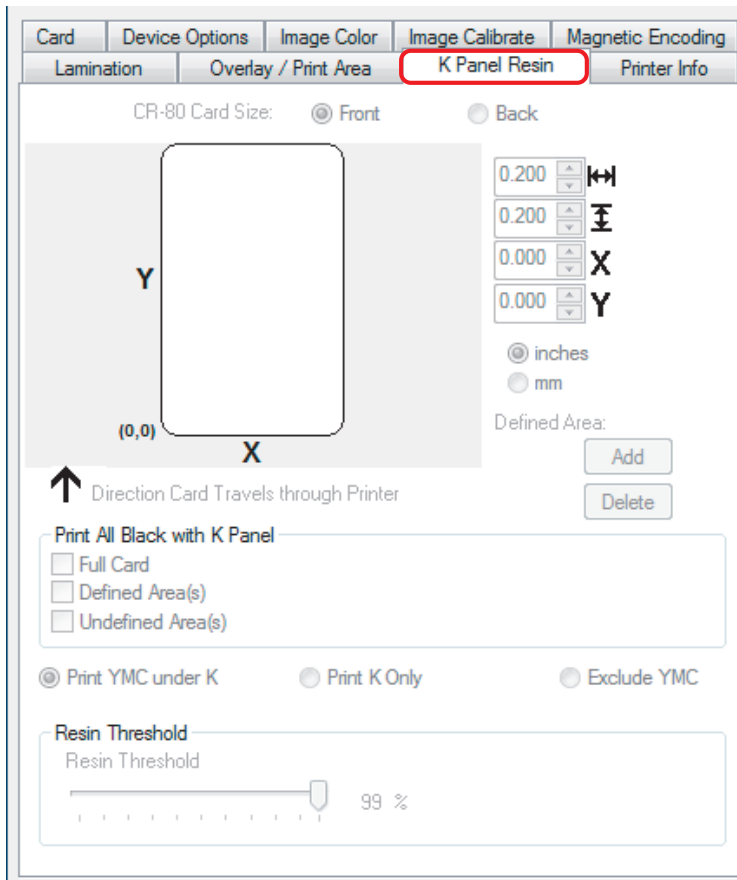
| Field | Description |
|------------------------------|--|
| Overlay/Print Area | |
| Full Card | Select this option to overlay and/or print the entire card. |
| Defined Area(s) | Select this option to overlay and/or print only in the selected and define an area(s). |
| Undefined Area(s) | Select this option to overlay and/or print in the space outside the selected and defined area. |
| Omit Smart Chip Area | Select this option to overlay and/or print only in the space outside the standard location of a smart chip. |
| Omit Mag Strip Area | Select this option to overlay and/or print only in the space outside the standard location of an ISO-standard magnetic stripe. |
| Omit Signature Area | Select this option to overlay and/or print only in the space outside the standard location of a signature panel. |
| For Print and Overlay | This option applies the defined area to both the print and overlay processes. |

| Field | Description |
|------------------------------------|---|
| For Overlay Only | The defined are applies only to the overlay process. The entire card prints and only the overlay is affected. |
| For Print Only (No Overlay) | The defined are applies only to the print process. Overlay is disabled. |
| Security Options | |
| Visual Security Solutions | <p>Use this field to enable and select a visual security option. When one of the options is selected, the Overlay/Print Area feature is disabled.</p> <p>This field presents options based on the orientation of the card in the template. The default value for all cards is No Visual Security.</p> <p>Landscape designs offer:</p> <ul style="list-style-type: none"> A - Upper Left B - Upper Right C - Lower Left D - Lower Right <p>Portrait designs offer:</p> <ul style="list-style-type: none"> E - Upper Left F - Upper Right G - Lower Left |
| VeriMark | Use this option for VeriMark security. |
| HoloMark | Use this option for hologram security. |
| Watermark | This feature allows for an image to be printed using the overlap panel. Bitmap files are the only file types accepted and must be 1011 pixels wide and 644 pixels high. |

4.8 K Panel Resin Tab

Use the **K Panel Resin** tab to control where the resin black (K) panel of a full-color ribbon is printed. If a ribbon without a K resin panel is installed in your printer, these options are grayed out and unavailable.

Note: Orientation of the card display area is determined by the orientation specified in the template. See *Section 4.7.1: Defining an Overlay or Print Area* for information.



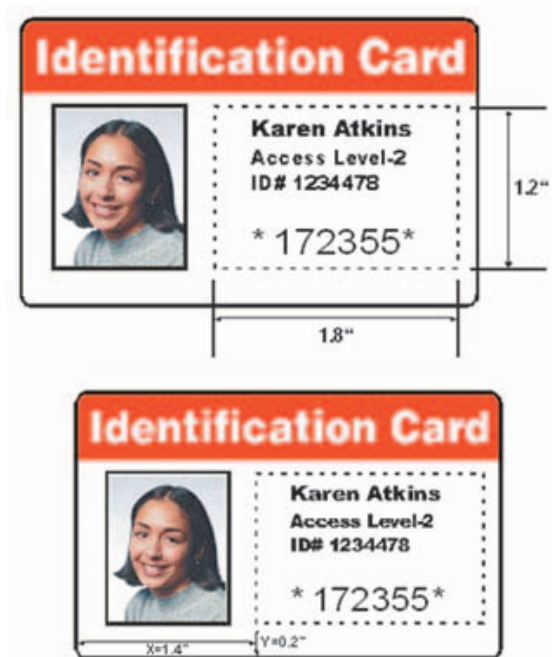
| Field | Description |
|-------------------------------------|--|
| Print All Black with K Panel | |
| Full Card | Select this option to print the resin black (K) panel for all black found within all areas of the image. |
| Defined Area(s) | Select this option to use resin black (K) panel for all black found only in the selected and defined area(s). See <i>Section 4.8.1: Defined Area</i> . |
| Undefined Area(s) | Select this option to omit resin black (K) panel in the selected undefined area(s). |
| Print YMC under K | Select this option to print all black in the designated areas with the yellow (Y), magenta (M) and cyan (C) ribbon panels directly beneath the resin black (K) panel. This combination provides a gradual transition between the resin black text or bar code. |

| Field | Description |
|------------------------|--|
| Print K Only | Select this option to print using the resin black (K) panel onto a white background to maximize the sharpness of printed text and bar codes. |
| Exclude YMC | Select this option to stop the printing of the YMC panels. |
| Resin Threshold | |
| Resin Threshold | Changes the level at which the driver moves a pixel to be printed on a resin panel instead of a YMC. |

4.8.1 Defined Area

The Defined Area option can be used with the K Panel Resin or the Overlay / Print Area tabs to define one or more specific areas.

In the samples, the defined area is indicated by the dashed outline.



4.8.1.1 Method for Defining a Single Area

1. On the **Overlay / Print Area** or **K Panel Resin** tab, select **Defined Area(s)**.
2. Print a card and look at it in the same orientation as when it exits the printer.
3. Measure the total size of the area and enter the dimensions into the dimension boxes.
4. Measure from the lower-left corner of the card to the lower-left corner of the defined area and enter the values into the X and Y boxes.

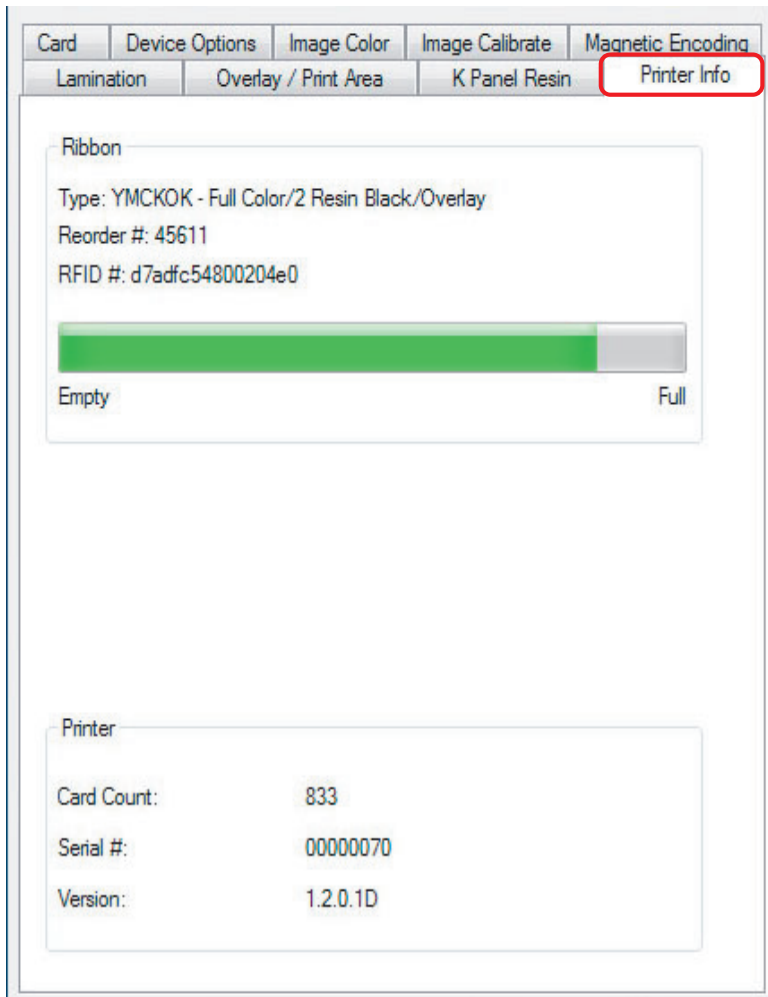
4.8.1.2 Method for Defining Multiple Areas

1. On the **Overlay / Print Area** or **K Panel Resin** tab, select **Defined Area(s)**.
2. Print a card with a defined area and look at it in the same orientation as when it exits the printer.
3. Measure the defined area location based on the printed card.
4. To define another area, click the **Defined Area** up arrow.
5. Use the Defined Area arrows to navigate back and forth from area to area.

4.9 Printer Info Tab

Use the options on this tab to view information about the medias installed in the printer:

- Ribbon
- Card Count
- Printer Serial #
- Firmware Version
- Reorder Number



The screenshot shows the 'Printer Info' tab selected in the HID software interface. The tab is highlighted with a red border. The interface displays information for the installed ribbon and printer details.

| Card | Device Options | Image Color | Image Calibrate | Magnetic Encoding |
|------------|----------------------|---------------|-----------------|-------------------|
| Lamination | Overlay / Print Area | K Panel Resin | Printer Info | |

Ribbon

Type: YMCKOK - Full Color/2 Resin Black/Overlay
Reorder #: 45611
RFID #: d7adfc54800204e0

Empty Full

Printer

| | |
|-------------|----------|
| Card Count: | 833 |
| Serial #: | 00000070 |
| Version: | 1.2.0.1D |

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System Overview—Troubleshooting

5.1 Sequence of Operations

Knowing the sequence of the printer operation helps when troubleshooting the printer.

1. File information is received from the PC.
2. Printer compares the installed ribbon type stored in memory with the ribbon type command that was sent from the printer. If the ribbon type does not match, the Pause button (on the right) flashes.
3. The print stepper motor engages.
4. The card feed sensor detects the leading edge of the card and the headlift stepper engages to disengage the input lever.
5. The card feeds through for the alignment pass.
6. The card feed stepper motor engages to queue card for magnetic encoding (if applicable).
7. The encoded data is written to the card (if applicable).
8. The magnetic encoder verifies while the stepper reverses the card (if applicable).
9. The print ribbon drive engages (if not already at the yellow panel).
10. The print ribbon sensor looks for the yellow panel.
Note: The print ribbon encoder detects the number of revolutions required to use an entire color panel.
11. The print stepper motor engages.
12. The card feed sensor detects the leading edge of card.
13. The print stepper motor queues card to the middle of the platen roller. All stop.
14. The printhead lift motor engages to the print position.
15. The print cover sensor checks for closed state.
16. The print stepper motor engages.
17. The ribbon drive motor engages.
18. The image data is burned by the printhead until the image data is depleted. All Stop.
19. The thermistor engages the printhead cooling fan to maintain proper operating temperature.
20. The headlift motor engages to the queue position.
21. The print stepper motor engages.
22. The print ribbon drive engages.
23. After ribbon advances a few encoder clicks, assume the ribbon is free of card. All stop.








- 24.Repeat Steps 9 through 22 for the appropriate number of color/overlay panels.
- 25.Either the card is ejected from the singled-sided printer or the card feed stepper engages to queue the card for the flipper table for the dual-sided printer.
- 26.All stop.

5.2 Printer Error Buttons

The DTC1500 uses button messages rather than a display message system.

All Printers have two (2) buttons.



1. The **ON/OFF**  button is blue when the printer is ON. When the printer enters the Sleep mode, the button LED is dimmed but still ON.
2. The **Pause**  button illuminates as blue when the printer is capable of accepting a print job and is not in an error state.
 This button LED continues to stay illuminated while the printer is printing as long as there is not an error.
 This button LED is dimmed when the printer goes into Sleep mode.
3. When an error occurs, the **Pause**  button blinks red.
4. Press the **ON/OFF**  button when printer is in an error state to cause the action to be canceled.
Note: If no other error occurs, the Pause button illuminates as blue.
5. Press the **Pause**  button when printer is in an error state to cause the printer to retry.
Note: The button illuminates as blue and retries the failed action.
6. When downloading an upgrade file, both buttons are blue and blink.
7. When a printer display is not available, press or hold the buttons to access the internal tests.
 - To print a card with the Printer Settings, press the **Pause**  button and hold for 4+ seconds when the printer is ready and idle.
 - To print the Alignment or the Self Test, press and hold the **Pause**  button during the power-up sequence.


5.3 Error Messages

This section provides the troubleshooting table for error messages.

- When an error occurs in the printer, the PC shows the error message on the screen with solutions.
- The display blinks in the location requiring attention. Locations can include the printer, input hopper, magnetic encoder, flipper, card path, ribbon, and data/communication device error.

Each table uses a 3-column presentation to display a specific or printer error message, the cause, and the solution.

- This format allows the troubleshooter to identify the error and its cause, and then perform the procedure provided in the solution column.
- This standard mode of identifying the problem and its solution should provide an efficient method of troubleshooting this printer.
- If you encounter problems beyond the capabilities of this error message table, you should contact HID Global Technical Support.

| Error Message | Cause | Solution |
|--------------------------------|--|---|
| # 81 Unable to Feed | The printer is unable to feed a card from the input card hopper. | Check the following: <ul style="list-style-type: none"> ■ Verify the card thickness setting is set to the thickness of your cards. ■ Verify the cleaning roller is properly installed on the ribbon cartridge. ■ Check for card slippage. If necessary, run the printer cleaning routine. ■ Verify that your cards are within the accepted card size range. ■ Verify the cards are not sticking together. Press the Pause  button to continue. |

5.4 Troubleshooting with the Error Message Table

| Error Message | Cause | Solution |
|--------------------------------------|---|--|
| # 2 Head Move Error | The printhead lift has malfunctioned. | Reset the printer and retry. If this problem persists, call for technical assistance. |
| # 8 Head Sensor Error | The printhead temperature sensor is not functioning or connected properly. Or, the printhead is not cooling properly. | Reset the printer and retry. If the problem persists, call for technical assistance. |
| # 9 Reboot Required | An unspecified system error has been detected by the printer firmware. | Reset the printer and retry. If this problem persists, call for technical assistance. |
| # 25 Ribbon not Installed | No ribbon is installed in the printer. | Install a ribbon and retry. |
| # 30 Mag Verify Error | Magnetic encoding verification failed. | Try encoding with a different card. Verify cards have the magnetic stripe. Replace the magnetic encoding module. |

| Error Message | Cause | Solution |
|---|---|---|
| # 31 No Mag Module | The printer is not configured with the encoder data type that you are trying to send. | Ensure that no encoding data is being sent with the print job and reprint the card. Install a magnetic encoding module. |
| # 38 # 39 # 40 EEPROM Corrupt EEPROM Read Error | EEPROM is restored with factory default values. | If changes were made in the Advanced Settings tab in the printer driver, click the Default button to reset these numbers. Reset the printer and retry. If this problem persists, call for technical assistance. |
| # 44 Flipper Jam/ Home Error | A card has become jammed in the printer's flipper table. The flipper failed to position properly while aligning a card or flipping a card. | Clear any cards in the flipper table using the buttons to move the card out. Resume printing. The flipper table should be level when the printer is powered on. If the flipper table is at an angle, open the card output door and manually level it. Then cycle the printer power to reset. Reset the printer and retry. If problem persists, call for technical assistance. |
| # 45 No Flip Module installed | Request to print on 2 nd side of card, but a flipper is not installed. | If a flipper module is present, ensure that the Print Both Sides option in the printer driver is set correctly. Install a flipper module. |
| # 64 # 65 # 66 Reboot Required | Unspecified system error detected by the printer firmware. | Reset the printer and try again. If this problem persists, call for technical assistance. |
| # 68 Card in Printer | A card is jammed in the print station or card flipping area of the printer. | Clear the jam and press the Pause [] button. |
| # 70 Multiple Feed | Multiple cards were fed into the printer. | Verify the card thickness is set to the thickness of your cards, then press the Pause [] button. Check for card slippage. If necessary, run the printer cleaning routine. Verify the cleaning roller is properly installed on the ribbon cartridge. Verify the cards are not sticking together. |
| # 81 Unable to Feed | The printer is unable to feed a card from the input card hopper. | Check the following: <ul style="list-style-type: none"> ■ Verify the card thickness setting is set to the thickness of your cards. ■ Verify the cleaning roller is properly installed on the ribbon cartridge. ■ Check for card slippage. If necessary, run the printer cleaning routine. ■ Verify that your cards are within the perimeters of the accepted card size range. ■ Verify the cards are not sticking together. Press the Pause [] button to continue. |
| # 82 Mag Jam | A card is jammed magnetic station | Clear any cards in the magnetic station using the buttons to move the card out. Press the Pause [] button to continue. |

| Error Message | Cause | Solution |
|--|--|--|
| # 91 Ribbon Out | The print ribbon has run out. | Install a new ribbon. Press the Pause [] button to continue or the ON/OFF button to cancel. |
| # 93 Wrong Ribbon | The print ribbon installed in the printer does not match the ribbon type selected in the printer driver. | Change either the installed print ribbon or the ribbon type selected in the printer driver. Press the Pause [] button to continue or the ON/OFF button to cancel. |
| # 97 Ribbon Search Error | The ribbon is not able to find the next panel correctly. Check for jams/breaks. | Recalibrate the ribbon sensor. If broken, repair by taping the ribbon back on to the take-up core. Replace the ribbon. Press the Pause [] button to continue or the ON/OFF button to cancel. |
| # 99 Ribbon Error | The print ribbon has either broken or jammed. | If jammed, clear the jam. If broken, repair by taping the ribbon back on to the take-up core. Press the Pause [] button to continue or the ON/OFF button to cancel. |
| # 100 Ribbon RFID Error | There is no ribbon or the ribbon tag information is corrupted or incorrect. | Verify the printer driver settings for correct ribbon. Try a new ribbon and continue. Press the ON/OFF button to cancel. |
| # 102 # 103 # 104 #3 Headlift Error | This is a problem with the printhead lift. | Reset the printer and try again. If this problem persists, call for technical assistance. |
| # 106 Job Data Error | The print data sent to the printer is corrupt or has been interrupted. | Check the interface cable. Press the ON/OFF button to cancel this print job and then resend the job. |
| # 107 Printing Error | An error was detected during printing. | Reset the printer and try again. If this problem persists, call for technical assistance. |
| # 109 # 113 Ribbon Release Error | The printer cannot locate the next ribbon panel to release the ribbon from the card. | Ensure that the ribbon is not stuck to the card. Replace the ribbon. Recalibrate the ribbon sensor. If the ribbon is broken, repair by taping the ribbon back onto the take-up core and manually advance to the next panel. Press the Pause [] button to continue. |
| # 110 Card Jam/Align error | A card is jammed in the print station or card flipping area of the printer. | Clear the jam. Press the Pause [] button to continue. |
| # 111 Head Loading | An unrecoverable error has occurred during printing. | Reset the printer and try again. If this problem persists, call for technical assistance. |

| Error Message | Cause | Solution |
|---|---|---|
| # 112 Card Jam/Align error | A card is jammed in the print station or card flipping area of the printer. | Clear the jam. Press the Pause [] button to continue. |
| # 128 # 170 Calibrate Ribbon | The print ribbon sensor is out of calibration or has failed. | Calibrate the ribbon sensor. Check for any material blocking the sensor and try again. |
| # 131 Flipper Jam/Home Error | A card has become jammed in the printer flipper table. The flipper failed to position properly while aligning a card or flipping a card. | Clear any cards in the flipper table, using the buttons to move the card out. Resume printing. Reset the printer and retry. If the problem persists call for technical assistance. |
| # 136 Secure Guard Print Disabled | Printing is disabled by SecureGuard until a password is received. | Reset the printer and retry. If the problem persists, call for technical assistance. |
| # 139 Please Remove Ribbon | Ribbon needs to be removed. | Reset the printer and retry. If the problem persists, call for technical assistance. |
| # 144 EEPROM Corrupt EEPROM Read Error | EEPROM restored with factory default values. | If changes were made in the Advanced Setting tab in the printer driver, click the Default button to reset these numbers. Reset the printer and try again. If this problem persists, call for technical assistance. |
| #202 Encoder not installed | You are trying to send encoding data, but the printer is not configured with this encoder type. iCLASS, Prox, MIFARE, SmartCard | Ensure that no encoding data is being sent with the print job and reprint the card. Install an encoding module. |

Firmware Upgrades

6.1 Upgrade Information

To upgrade the printer's firmware, perform the following steps:

1. Run the **Fargo Workbench Printer Utility**.
2. If running Fargo Workbench Version 3 or greater:
 - a. Select the **Update Manager Workbench Utility**.
 - b. Select the printer(s) to update.
 - c. Click **Select Firmware file...** option to locate or enter this latest firmware file (e.g. FRW-00373_DTCnnnn_vn.n.n.n.frm).
 - d. Browse for the firmware file or enter the firmware file name and click **Open**.
 - e. Click **Begin Updating Firmware** to send the file to the printer(s).
3. If running a Fargo Workbench release prior to Version 3:
 - a. Select the **Application Menu** at the upper left, and select **Upgrade Firmware**.
 - b. Enter the firmware file name or click **Browse** to find and select this latest firmware file (e.g. FRW-00373_DTCnnnn_vn.n.n.n.frm).
 - c. Click **OK** to send the file to the printer(s).
4. Restart the printer if it does not restart automatically.

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HID Global Technical Support

This section provides an efficient, step-by-step procedure to be used when contacting HID Global Technical Support, for this card printer.

You should first contact the company from whom you purchased the printer.

To contact HID Global Technical Support, see www.hidglobal.com/support.

Before contacting HID Global Technical Support:

- Find the sales invoice and serial number of the printer, as described in the following section.
- Position a phone near the printer and computer so the technician can help troubleshoot the printer.
- Have a self-test and a sample card ready.

7.1 Reading the Serial Numbers on a Fargo Printer


To determine when the card printer was manufactured, see the serial number (affixed to the bottom of the card printer).

For example: **Serial Number B7050028 (2017)**

- The first two digits in the serial number indicate the year the printer was built (B7 indicates the year 2017).
- The third and fourth digits in the serial number indicate the week the printer was built (05 indicates week 5 of that year).
- The last four digits indicate the sequence number for the numeric order in which the printers were built.

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