Card Stock Requirements Guide

Entrust Sigma DS Desktop Card Printers

January 2024

528460-001, Rev. A

Notice

Please do not attempt to operate or repair this equipment without adequate training. Any use, operation or repair you perform that is not in accordance with the information contained in this documentation is at your own risk.

Trademark Acknowledgments

Entrust, Sigma and the hexagon design are trademarks, registered trademarks and/or service marks of the Entrust Corporation in the United States and other countries.

Datacard is a registered trademark and service mark of Entrust Corporation in the United States and other countries.

MasterCard is a registered trademark of MasterCard International Incorporated.

Visa is a registered trademark of Visa International Service Association.

All other product names are the property of their respective owners.

Proprietary Notice

The design and information contained in these materials are protected by US and international copyright laws.

All drawings and information herein are the property of Entrust Corporation. All unauthorized use and reproduction is prohibited.

Entrust Corporation
1187 Park Place
Minneapolis, MN 55379
Phone: 952-933-1223
Fax: 952-933-7971
www.entrust.com

Revision Log

Revision	Date	Description of Changes
A	January 2024	First release of this document.

Contents

Chapter 1: Introduction

1

About This Guide

This document provides guidelines for the plastic card stock to be used with the Entrust Sigma DS series printers. These guidelines are based on current knowledge of card materials and printer performance.

The guidelines are provided to help minimize problems when using the Sigma DS series printers. However, they are not a guarantee of performance. Work with your card supplier to identify cards that meet the printing requirements of your site.

Technical Support

Use the following information to contact Entrust Technical Support.

Americas	1-800-328-3996 or 952-988-2316 Email: CustomerCare@entrust.com
EMEA (Europe, Middle East, Africa)	+44 1489555627 Email: emeacustomerservice@entrust.com
Asia Pacific	+852 2821 0126 Email: dcap.admin@entrust.com

Chapter 2: Card Stock Considerations

2

This chapter covers information that can help you work with cards used in the DS series printers.

Overview

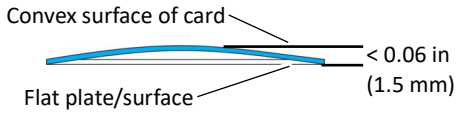
Cards are manufactured in ways that drastically impact print performance. For instance, significant differences in a card's print performance are seen in the quality of raw materials used to construct cards, how the individual card layers are assembled and molded together, the surface topography and uniformity of the printable surface, and/or how embedded electronics are incorporated into a card (i.e., smart card chips, chip & antenna, etc.). These factors, amongst others not listed, will significantly contribute to the print quality of a finished card.

For optimal print performance, select cards that are manufactured from high quality raw materials, have a consistent internal construction, are completely flat, and have an edge-to-edge polished, perfectly planar surface receptive to direct-to-card printing. For any new and/or unknown card, it is highly recommended that a thorough print performance assessment be completed before program implementation using the actual card design and printer.

Card Size

Sigma DS printers accept ISO ID-1 (CR80) and (CR79) cards as per ISO 7810. Allowable card thicknesses are 10–40 mils.

The allowable bow in the card (card warpage) is defined by the ISO 7810:2019 specification (Section 8.10). As stated, "the maximum distance from a flat rigid plate to any portion of the convex surface of an ID-1 size card shall not be greater than 1.5 mm (0.06 inch), including card thickness". However, it is *highly* recommended that cards have no bow/warpage for optimal print performance. If cards do have bow/warpage, it is recommended that they are placed into the input hopper in a convex orientation (as shown below).



Card Material

The material used in the composition of the cards affects print quality. Because cards are manufactured in different ways, it is difficult to predict printing performance. Test each type of card that you plan to use and work with your card supplier to obtain the best quality. Refer to "Card Composition" on page 6 for more information about card materials.

Card Surface

For best results, direct-to-card printing requires a completely flat card, with a polished and perfectly planar edge-to-edge surface that is receptive to direct-to-card printing.

Any non-uniformity on the card surface that is being printed upon WILL cause card defects. Non-uniformities of a card surface entail, but are not limited to, smart card chips and the surrounding card surface, burred edges, pockmarks, dust and debris, the magnetic stripe, the signature panel, holograms, the back side of the smart card chip and magnetic stripe, surface irregularities caused by an embedded RF antenna, and/or any other card feature that disrupts the edge-to-edge planarity of the card surface.

For any new and/or unknown card, it is highly recommended that a thorough print performance assessment be completed before program implementation, using the actual card design and printer.

Cards must have a smooth surface finish for optimal print quality. Cards with a polished finish typically work the best. Print quality will suffer with a satin or matted finish.

Cards might have a magnetic stripe and signature panel on the back side of the card, and a smart card chip on the front side. These elements also affect printing performance.

The following sections discuss card surface elements that affect print quality. These criteria are inherent to the thermal printing technology and thus applicable to all direct-to-card thermal printers, regardless of printer manufacturer.

Card Irregularities

The thermal printhead (TPH) must not lose close contact with the card for proper ink transfer to occur. Large surface irregularities on a card (such as bumps, pits, or burrs) might cause a loss of close contact, and result in print voids.

Even the highest quality manufacturing materials and processes sometimes yield cards with surface irregularities that are large enough to cause print voids. Many surface irregularities are unavoidable (for example, magnetic stripe edges, signature panel edges, or smart card chips). Work with your card supplier to determine the number and location of unacceptable surface irregularities in any batch of cards.

Refer to Appendix A: "Card Stock Specifications" for information about how to measure surface irregularities.

Card Die Cutting

The orientation of cards during the manufacturing die cutting process may impact print quality. The side of the card where the die cutter enters or exits the plastic during the manufacturing process may be deformed. Specifically, the side of the card where the die cutter enters the plastic during the manufacturing process will have the edges turned down while the side of the card that the die cutter exits will have those edges turned up. The side of the card with the edges turned up is referred to as the “burr edge”.

The “burr edge” side may show print voids because the TPH will lose contact with the card surface on the very edges. Conversely, the side opposite the “burr edge” may show defects because the edges are turned away from the TPH. While these edge defects are not typical, it is possible that the printing process may be impacted by the card orientation in the die cutting process near the card edges.

Work with your card supplier to manage the card manufacturing and packaging to ensure the correct orientation of the die-cut cards before shipment. Operators also must be aware that they need to load the cards in the correct orientation into the card printer.

This is an issue only when using cards with blank white surfaces on both sides since the burr side is not obvious after the card is removed from the card tray. Label trays of blank white cards to indicate the burr side.

Cards with a smart card chip and/or magnetic stripe and signature panel should be loaded in the printer as shown in the input hopper diagrams on the printer.

Smart Cards

The location, size and shape of the chip varies from different card manufacturers and will affect how the TPH interacts with the card surface, often resulting in unwanted print voids around the chip perimeter.

Additionally, the back side of the card might have a depression (or dimple) at the location of the smart card chip (opposite the front card side). Because the TPH might not come into contact with the depression’s surface, unwanted print voids might also occur.

On occasion, there have been cards produced by manufacturers that met the ISO specification for both card and chip flatness. However, unacceptable print voids were still present. In these cases, card and chip flatness may need to exceed the ISO specification.

Specific factors are listed in the Appendix below.

If possible, modify the back side card design so that no printing occurs near the chip location.

Contactless smart cards also may have surface irregularities that affect printing. Contactless chips do not have a standard location and vary by manufacturer.

Test your card stock regularly to make sure that surface defects do not degrade print quality.

Refer to Appendix A: "Card Stock Specifications" for smart card specifications.

Cards With a Signature Panel

Signature panels also present print quality issues. Consider the following when a card has a signature panel:

- Signature panels do not have a standard location, size, or composition.
- Signature panels add thickness to the card, preventing the TPH coming into contact with the card surface near the signature panel. When this occurs, print voids near the signature panel will occur.
- Signature panels might transfer material to other cards during storage, causing contamination issues. Transferred material from the panel may result in print voids.

Surface Reflectivity (Bar Code Applications)

Another aspect to be aware of is the surface reflectivity of the card. This is especially important when printing a bar code on the card.

The card surface must provide an acceptable reflectivity profile for the card and bar code combination. The clear surface material used in making cards (e.g., the overlay) can dramatically change the reflectivity, especially in the bar code spaces, which affects the bar code quality and readability. A thorough assessment of printed bar code quality before program implementation is highly recommended.

Refer to Appendix A: "Card Stock Specifications" for reflectivity measures.

Card Composition

How cards are manufactured, the materials used in the card, and how they respond to the printer affect the print quality and durability of the printed card.

Perform print tests on candidate cards before you commit to a specific card stock.

PVC Cards

Cards made of polyvinyl chloride (PVC) or a vinyl chloride/vinyl acetate copolymer commonly are used with the DS printers. The material can be clear or pigmented.

- The surface material must be free from additives that might migrate to the surface of the cards (called blooming). Additives make the card surface oily, resulting in poor appearance and poor print durability. The additives normally are added to aid the manufacturing process.

  A material known to be unacceptable is a stress plastic overlay, which contains a solid barium/cadmium stabilizer in a fatty acid carrier.

- The temperature at which the plastic card material softens (the Vicat softening point) affects print quality. Use cards whose surface material has a Vicat softening point of less than or equal to 82°C to minimize print voids.
- Cards with a higher Vicat softening point may work, but they are much more sensitive to machine and supply variations. Avoid using cards whose surface material has a Vicat temperature greater than 82°C.

PVC Composite Cards

Common composite cards have PVC outer layers and at least some amount of a durable material, such as polyester, in the core of the card. Test your card stock to verify that the print quality is acceptable.

Non-PVC Cards

Non-PVC card surfaces may work with DS printers. PET-G cards may be used, but printing is typically lighter to PET-G surfaces than to PVC surfaces. Further, because of the variability of PET-G card surfaces from supplier-to-supplier and even the variability within lot-to-lot from the same supplier has provided printing challenges in the past. A thorough testing of PET-G surfaces with the desired printer is strongly recommended.

Printing to polycarbonate card surfaces is not possible with direct-to-card printing without a special receptive coating being applied to the card surface first. A thorough assessment of printability and durability of the receptor with the polycarbonate card is strongly recommended.

For all other non-PVC card surfaces, it is highly recommended that a thorough evaluation be completed before implementation.

Test all non-PVC card surfaces to determine if they meet print quality expectations in the printer.

Non-First Use PVC Cards (Environmentally Friendly Cards)

Non-First Use PVC cards are a new class of PVC cards. More specifically, these cards typically have a core composed from recycled PVC while the outer, printable skins are newly manufactured PVC.

As with all other card stocks, select cards manufactured from high quality raw materials, have a consistent internal construction, are completely flat, and have an edge-to-edge polished, perfectly planar surface receptive to direct-to-card printing. For any new and/or unknown card, it

is highly recommended that a thorough print performance assessment be completed before program implementation using the actual card design and printer.

Notched Cards

Cards that have notches on the side opposite the chip are intended for use with people with sight impairments. Per ISO/IEC 7811-9, 3 distinctly shaped notches are incorporated into a card edge.

As with all other card stocks, select cards manufactured from high quality raw materials, have a consistent internal construction, are completely flat, and have an edge-to-edge polished, perfectly planar surface receptive to direct-to-card printing. For any new and/or unknown card, it is highly recommended that a thorough print performance assessment be completed before program implementation using the actual card design and printer.

Translucent Cards

In addition to a completely planar and polished surface that is receptive to direct-to-card printing, an IR blocker that meets the opacity requirements of ISO7810 is necessary for the transport of translucent/clear cards. Without an IR blocker, clear cards will not be transported in DS printers.

As with other card stocks, it is highly recommended that a thorough print and transport assessment be completed prior to program implementation, using the actual card stock and printer.

Non-Traditional Card Types

Cards that have dimensions other than CR79 and CR80 cards approved for use in DS printers ought be thoroughly tested and validated prior to program implementation. Examples of such cards are the Mastercard MC2 cards and Visa Mini cards. Further, any non-traditional cards in any aspect should be thoroughly validated prior to use.

Particulate Matter

Particulate matter on cards often consists of small plastic shavings, flakes of magnetic stripe, flakes of the signature panel material, airborne particulates, and anti-block powders used in card manufacture. The debris, if large enough, causes print voids if the debris particles become trapped between the card and the TPH. This creates a visual defect and becomes a site for premature wear of the card surface. The cleaning sleeve in the printer removes much of this debris, but some debris might remain on the card.

Work with your card supplier to determine the amount of card debris that is acceptable in any batch of cards.

Also, clean your printer according to the printer cleaning schedule found in your printer's *User's Guide* and the *Sigma Series Printers Cleaning Guide*. Cleaning the printer removes any additional debris that may be in the printer itself.

Card Handling

Use the following guidelines when handling unprinted cards.

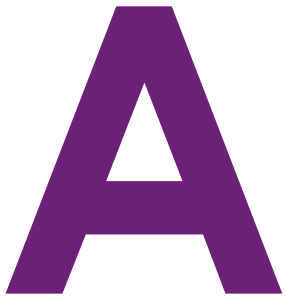
- Debris or particles on blank card stock reduces print quality and damages the system.
- Grease or oils, such as oils from your fingers, reduces print quality. Keep cards completely clean. Do not touch the print surface of a card with your fingers or hands.
- Handle blank card stock by the edges only, or wear approved card inspection gloves.
- Avoid using latex or neoprene gloves as they can transfer material to the card.
- Always place cards on a clean surface when removing them from the printer (for example, during cleaning).
- Do not use a rubber band to bind blank cards together.
- If you drop a card on the floor, clean it using a lint-free cloth before using it in the system.
- Never use solvents to clean the surface of the card. However, when absolutely necessary, use isopropyl alcohol and a lint-free soft cloth to clean the surface of the card.

Card Storage

These guidelines apply to both blank card stock and processed cards.

- Use cards that are at room temperature. If cards are stored in a cooler environment than the printer, allow them to reach room temperature before using them.
- Stack cards so that they will not shift and rub against each other.
- Make sure that the magnetic stripe on one card does not come in contact with the magnetic stripe on another card.
- Make sure that cards with magnetic stripes are stored away from magnetic objects.
- Store cards in a cool, dry, and dark place. Excessive light might cause yellowing of cards on exposed edges.
- Avoid storing the cards in locations exposed to direct sunlight, or with high temperature and high humidity.
- Store cards in their original packaging.

Appendix A: Card Stock Specifications



This appendix contains card stock specifications that users and service personnel should provide to suppliers and use to evaluate the card stock before purchase.

The following information provides technical measurements and specifications for card stock. These are to the best of our knowledge and current understandings. Actual results may vary.

- **Surface Finish**

  Use cards with a polished surface finish.

  Surface finish is measured by using a surface profilometer with a 2.5 µm radius stylus. Use a short pass filter cutoff length of 25 microns to eliminate the effect of waviness and card flatness.

  The acceptable surface roughness average (R_a) is 1.00 µin maximum.

- **Surface Topography**

  Surface irregularities that occur during the card manufacturing process will result in unwanted print voids. Surface irregularities that reduce the polished, perfectly planar card surface include, but are not limited to, scratches, bumps, pits, and edge burrs. Larger irregularities result in larger print voids and smaller irregularities result in smaller print voids.

  Sigma DS printers have been tested to accommodate pits and bumps that rise or fall 0.001 inch (0.025 mm) over 0.200 inch (5 mm). Exceptions to this generalization may still occur because of unknown factors. Work with the card manufacturer to ensure a polished and planar card surface.

  Measure suspect surface irregularities using a surface profilometer.

- **Smart Cards**

  The height of the chip on a contact smart card and the depression (or dimple) on the back of the card opposite the chip affects printing quality. Use the following measurements to evaluate smart cards:

  - The contact plate height limit of the smart card chip should not exceed +/-0.001 inch (0.025 mm) relative to the surface of the card. Besides chip height, other critical parameters of the chip embedding process that can drastically reduce print performance to a card include, but are not limited to, card body and card surface deformation, chip perimeter burrs, glue deposition overrun, chip non-planarity, and surrounding card surface damage.
  - The back side dimple depth should not exceed +/-0.001 inch (0.025 mm) relative to the surface of the card.

    When evaluating the back side dimple, look at the following:

    - Depth
    - Local surface slope
    - Milling depth
    - Remaining material thickness
    - How the milled pocket is filled (or not filled)
    - Waviness in the dimple

    Unacceptable surface irregularities are defined in Appendix A: "Surface Topography”.

- **Surface Reflectivity**

  Bar code printed cards should pass all ANSI bar code requirements as tested using an ANSI X3.182-compliant bar code analyzer with both 660 nanometer and 940 nanometer light sources. This means the clear card surface material should be limited to a maximum thickness of 0.002 inches (0.05 mm).

  Testing card stock regularly is the best method to ensure print quality.