3M MAXSecure Printer Module Maintenance Manual

Manual No. 980286-001 Rev. A

FOREWORD

This manual contains service and repair information for 3M MAXSecure Printer Modules manufactured by the 3M Corporation,St. Paul, Minnesota. The contents include maintenance, diagnosis and repair information.

TECHNICAL SUPPORT

For technical support, users should first contact the distributor that originally sold the product—phone +1 (800) 344 4003 to locate the nearest 3M Distributor.

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TRADEMARKS

FCC NOTICE:

This equipment has been tested and found to comply with the limits of 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 instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

CSA NOTICE:

This equipment does not exceed Class A limits per radio noise emissions for digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications. Operation in a residential area may cause unacceptable interference to radio and TV reception requiring the owner or operator to take whatever steps are necessary to correct the interference.

Ce matériel ne dépasse pas les limites de Classe A d’émission de bruits radioélectriques pour les appareils numériques telles qu’établies par le ministère des Communications du Canada. L’exploitation faite en milieu résidentiel peut entraîner le brouillage des réceptions radio et télé, ce qui obligerait le propriétaire ou l’opérateur à prendre les dispositions nécessaires pour en éliminer les causes.

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GENERAL DESCRIPTION

1.1 PRINTER MODULE DESCRIPTION

3M MAXSecure Printer Modules can operate as stand-alone card imaging devices or, as shown above, become part of a larger system that can also include a 3M Lamination and Die Cutter Module. 3M MAXSecure can also include a Magnetic Stripe Encoder Module (not shown).

3M MAXSecure can produce either two- or three-layer cards composed of either a Clear Card and a White Card or a white card sandwiched between two Clear Cards. Clear Card imaging occurs first. A Clear Card can receive full color CMY (cyan, magenta, yellow) and/or black resin imaging. Imaging on the White Card can occur next. The White Card can receive Kr (Black Resin) monochrome images. A second Clear Card serves to prolong card life and protect any image placed on the White Card. Notably, an image placed on the White Card ends up on the side opposite the Clear Card image. Security imprints appear on the side of the White Cards that receive no image by the Printer Module. On the finished cards, however, these images underlie the Clear Card image.

After imaging, the Printer Module assembles and delivers a Clear and White Card to the Laminator and Die Cutter Module. For three-layer cards, a second Clear Card follows. An attached Laminator and Die Cutter Module fuses the Clear and White Card material and die cuts the result to a standard credit/debit/etc card size.

Because the image on the Clear Card faces the White Card, scratches and ultraviolet radiation have little affect on this image. Resin images offer substantial resistance to wear factors without needing added protection, but for three-layer cards, an additional Clear Card maximizes wear resistance. These features result in cards that can accept a fair amount of abuse and, with reasonable treatment, can remain in service for 10 years.

Figure 1-1 shows the Printer Module assemblies visible with the cover raised.

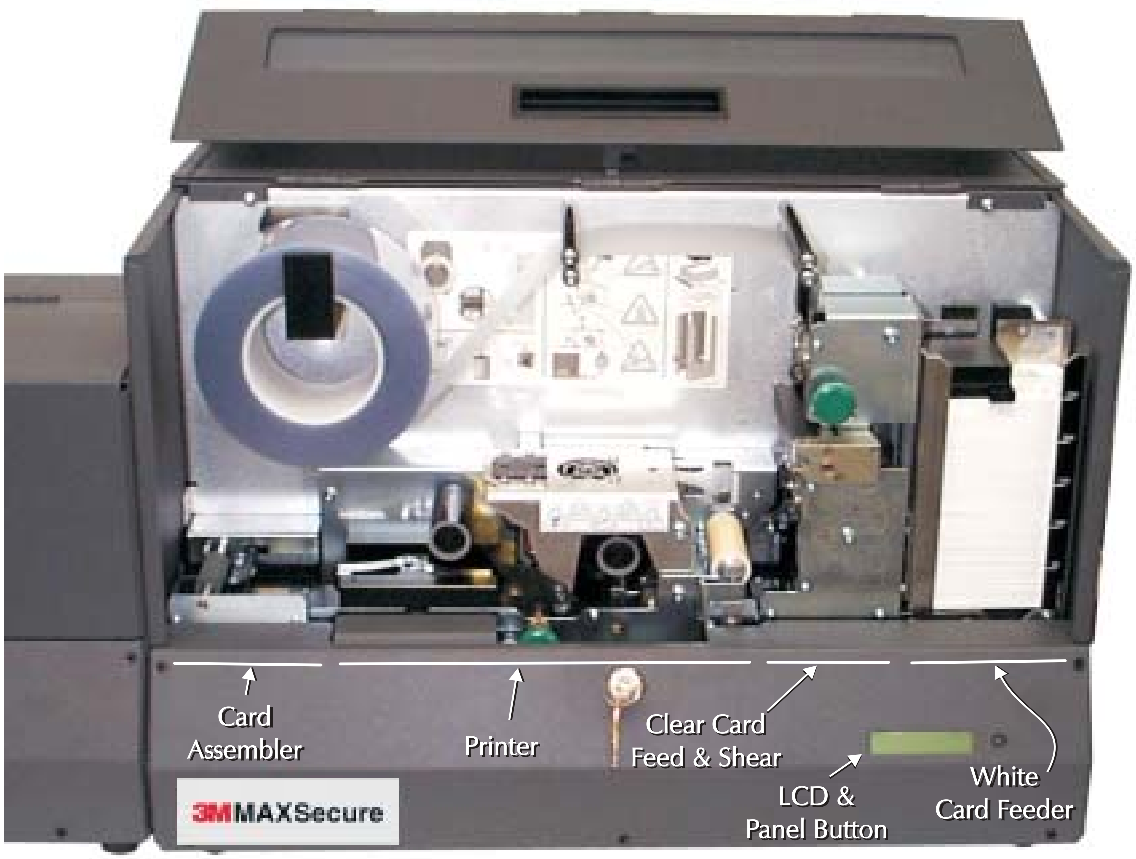


Figure 1-1. Major Assemblies

1.1.1 Clear Card Material Feed, Shear, and Flip-Over

The upper part of this assembly contains a motor and a shear. The middle part has two sensors—one for signaling the shear point and another to sense splices. The lower part implements flip-overs of a second Clear Card.

All three parts of the assembly have rollers that move the material, due either to a manual advance or by a motor powered drive roller. Clear Card material feeds off of a roll and into a slot in the top of this assembly and then down vertical card guides.

The motor moves card-sized segments beyond the shear. A shear occurs when an associated sensor detects material. As more media enters the upper part, the sheared segment enters either the flip-over or the horizontal card guides. The assembly ultimately delivers Clear Cards to the horizontal drive rollers.

Only one Clear Card surface has a bonding agent. So that the bonding material on the second Clear Card can face the White Card, a solenoid-operated gate directs Clear Cards for a flip-over before directing their entry into the horizontal guides.

Rolls of Clear Card material contain splices that require operator removals. A sensor in the guides detects the splices, which results in related LCD messages to the operator.

1.1.2 Print Station

The printer first receives a Clear Card segment. Associated color imaging results from multiple passes across the Print Head. Because the imaging occurs on the side opposite the viewed side, Clear Cards receive mirrored images.

A motor-driven cam controls the position of the Print Head. Imaging occurs with a card and the ribbon sandwiched between the lowered Print Head and the platen roller below. Card transports not related to imaging occur with the Print Head raised sufficiently to allow freer movement of cards, typically at faster rates.

Ribbon, having dye- and sometimes resin-coated panels, feeds from the supply to the take-up spindles. During imaging, the coated side contacts the card, and the non-coated side contacts the Print Head. Incremental ribbon advances accompany associated incremental advances of a card across the Print Head. Card increments correspond to 300 dpi (dots-per-inch) image resolution, which duplicates the density of elements across the Print Head.

Each dot imaged occurs from a ribbon dye transfer due to heat produced by an associated Print Head element. For color, each element can produce 32 different heat levels, which correspond to 32 different dye densities. When dots get superimposed on other dots to produce a YMC-blended color, 32K combinations become possible. This imaging process is typically called Dye Sublimation.

Resin imaging occurs at only one dot density. Resin, while excellent for bar codes and other solid imaging, only responds well when transferred using a single temperature. An associated Print Head element is either fully on or completely off. Solid imaging occurs for all internally generated bar codes, text, and graphic elements. Users wishing to produce gradients of gray while using resin imaging must resort to dithering and deliver an associated bit map. Because dithering creates a pixel (picture element) using a small dot matrix, reduced picture resolution results. This resin imaging process is called Thermal Transfer. In contrast, users can create 32 levels of gray using YMC blends without loosing any image resolution.

By the time a card is fully imaged, a whole set of ribbon panels is used. Users can obtain ribbon media in several configurations, each offering a cost optimization for a particular set of card design requirements. For example, YMC ribbons cover the need for only Clear Card color imaging without resin. The need for YMCKr ribbons occurs when resin imaging, of say bar codes, must also appear, YMCKrKr ribbons serve those instances when black resin imaging must occur on both the Clear and White cards.

After completion of the Clear Card imaging and the card moves to the Card Assembler Station, a White Card feed occurs. The feed injects the White Card directly into the horizontal card guides. White Cards can only receive black resin images. Also, as stated previously, imaging depends on a remaining unused Kr ribbon panel. A second Clear Card, when used, receives no image.

A standard feature of all 3M Card printers lets users print bar-codes using any of the 10 printer-resident formats. An associated image results from entry of a single command line, where a related set of parameters precedes the data. Data refers to the alphanumeric string that a bar code reader decodes when scanning the card. Associated parameters format the bar code, specify size and position, and determine whether or not an associated text string appears under the bar code.

Sensors in the Printer assembly include one that detects incremental advances of the ribbon, one that detects the presence of a card entering the horizontal card guides, and one that finds the yellow ribbon panel following an operator initialization. All synchronized card and ribbon movement within the Printer Station depends on these sensors. Two microswitches form sensors that signal when the Print Head has reached an either fully up or fully down position.

Motors in the Printer assembly include a stepper for precise control of card positioning in the card path and dc motors to advance ribbon and raise and lower the Print Head.

1.1.3 White Card Feeder Station

This assembly delivers White Cards placed in the Feeder to the horizontal card guides of the Printer assembly. Included are a dc motor that powers two feed rollers and a Card Gate that lets only one card feed at a time. White Card thickness for two-layer cards measures 0.022 inches, while those used for three-layer cards measures 0.015 inches.

Cards easily pass through a gate opening one and one-half times the card thickness without allowing multiple feeds or rubbing against the upper restraint. When cards fail to feed, a user typically finds a card with excessive warping. The front panel LCD indicates OUT OF CARDS if a card fails to appear at the Printer assembly before a related time out occurs.

1.1.4 Card Assembler Station

After imaging, a Clear and a White Card come together in the Card Assembler. The card path deepens here, so that a White Card can rest on top of a Clear Card. The assembly includes a motor, a solenoid, and two sensors. After these card components come to rest in this assembly, as signaled by the lower of the two sensors, the solenoid-coupled roller raises to push the cards against the motor-powered drive roller. The powered roller then delivers these two layers to the exit opening of the Printer Module. An attached Laminator and Die Cutter Module would sense this event and draw the cards into its card path. The upper sensor signals the presence of cards at the output. Until these cards are taken away, no new cards should enter for card assembly. An attached Laminator and Die Cutter Module waits for a second Clear Card, in instances where the Layer Lever is set to 3 Layer.

The sensors can detect two error conditions. The CLEAR AT EXIT error signals that a second Clear Card has entered the assembly instead of the expected White Card. The WHITE AT EXIT error signals that a second White Card has entered the assembly prior to removal of a previously assembled set.

1.2 OPTIONS AND ACCESSORIES

A Full Complement of Card and Ribbon Supplies—distributors of 3M Products stock these items in order to assure that 3M MAXSecure users can obtain supplies that consistently produce the best possible results.

1.3 ABOUT THIS MANUAL

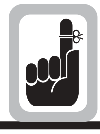
3M Products has directed the Information contained in this manual at returning Printer module functions to normal operation in the shortest time possible. With this in mind, service personal should focus on items listed in the recommended spares list. Avoid lower level replacements whenever possible. Service personnel should keep a log of the repairs made in support of the concept of continuous product improvement. Chapters include: General Description, Installation and Operation, Theory of Operation, Troubleshooting, Part Replacement Procedures, and Maintenance and Adjustments. Appendix A describes software developed for testing 3M MAXSecure printers.

Follow the instructions as closely as possible. When unsure of any procedure, please contact either a 3M Products Service Representative (contact 3M Product Management for nearest representative) or 3M Products Technical Support at 1-800-344-4003 or 805-578-1800.

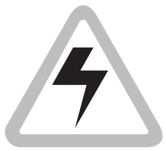
3M Products stocks all commonly used replacement parts for 3M MAXSecure printers. A list of the recommended spares appears in this Chapter. For depot repairs, contact 3M Product Sales to place orders and to establish a program for bulk purchases and credited returns of warranted parts.

1.4 CAUTIONARY NOTES

Exercise reasonable care when servicing the printer, as follows:



Other than prescribed operator maintenance, only qualified personnel should remove the case or otherwise attempt to repair this equipment. 3M Products offers training to those wishing to service this equipment.

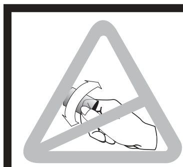


Servicing personnel must avoid touching exposed circuitry. Inputs to the Power Supply operate at power line voltages. Any removal of protective insulation can expose dangerous voltages. Always remove the power cord when effecting repairs.

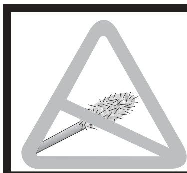
During printing, the Print Head operates at an elevated temperature. Exercise caution when touching the parts on or near these areas.

Servicing Personnel should avoid any rough handling of the printer or its component parts. The Print Head in particular requires careful handling. Never lower the Print Head onto any object other than the card and ribbon media.

An electrostatic discharge (ESD) of energy can damage or destroy the print head and other electronic Printer Module components. People can acquire such charges while moving around. ESD problems increase as the humidity drops.



Users should not twist the Ribbon Take Up spindle manually. Doing so unnecessary stresses the associated belt. Any slack left after a ribbon installation gets removed during the initialization produced by pressing the panel button.



To avoid deposits, clean only with fiber free Cleaning Swabs and 99-percent or better pure alcohol.

Part Replacement Spares

Recommended Quantity (Per 100 Printers)	Item	Part No.
A/R	Lock Set for Enclosure	105901-067
5	Kit, Print Engine	105901-203
5	Kit, White Card Feeder	105901-205
5	Kit, Clear Material Cutter	105901-207
5	Kit, Clear White Material Entry Assembly	105901-208
5	Kit, Printer Exit	105901-063
5	Kit, Electronics, Printer	105901-233
10	Kit, Roller, Card Feeder	105901-226
1	Kit, Power Supply Fuse (Set of 10)	105901-013
3	Kit, Main Circuit Board, Printer	105901-218
1	Kit, Head Up/Down Sensor Switch	105901-018
1	Kit, Cleaning Roller Clip	105901-019
9	Kit Pressure Roller (Set of 5)	105901-029
A/R	Kit, M4 x 8, Flat Head Phillips Screws (Set of 100)	105901-032
A/R	Kit, M4 x 8, Pan Head Phillips Screws (Set of 100)	105901-033
A/R	Kit, Printer Enclosure (Light Gray)	105901-211
A/R	Kit, Printer Enclosure (Dark Gray)	105901-212
A/R	Kit, Rubber Foot, Base	105901-037
2	Kit, Printer Input/Output Extension Board	105901-042
2	Kit, Printer AC Power and Filter	105901-050
1	Kit, AC Power Switch (Set of 5)	105901-051
A/R	Kit, Forcep, Curved	105901-052
2	Kit, Solenoid	105901-055
2	Kit, Ribbon Sensor	105901-057
2	Kit, Ribbon Spindles	105901-058
1	Kit, Clear Material Shear	105901-231
2	Kit, Clutch Assembly	105901-241
15	Kit, Exit Pressure Roller Assembly	105909-005
10	Kit, Upper Cleaning Roller	105909-010
2	Kit, Power Supply Assembly 120/240 Auto Ranging	105909-020
5	Kit, DC Motor	105909-021
1	Kit, Stepper Driver IC (L6219 at U12)	105909-024
2	Kit, Flag Sensor	105909-026
1	Kit, DC Motor Driver IC	105909-028
2	Kit, Cleaning Roller Bearing	105909-033
10	Kit, Ribbon Take Up O-Ring Belt	105909-038
2	Kit, Rear Main Drive 0.08P, 40Deg, 63T	105909-040
2	Kit, Belt, 0.080P, 40Deg, 88T x 3(1/8)	105909-043
2	Kit, Belt, 0.080P, 40Deg, 63T x 3(1/8) (Set of 5)	105909-044
2	Kit, Front Right Encoder Roller Drive, Belt 50T x 3 (1/8)	105909-045
2	Kit, Front Left Encoder Roller Drive, Belt 95T x 3 (1/8)	105909-046
5	Kit, Cam, Printhead Lift	105909-058
2	Kit, PCBA, LCD Display	105909-089
2	Kit, Timing Belt, 105T x 1/8 (Feeder)	105909-098
2	Kit, Fan, Print Head	105909-099
5	Kit, Stepper Motor	105901-230
10	Kit, Replacement Print Head—Style 2	105909-112
2	Kit, Knob, Max	105901-087

Spare Accessories

Recommended Quantity (Per 100 Printers)	Item	Part No.
A/R	Kit, Cleaning Core	105901-001
A/R	Interface Cable	300055-001
A/R	Power Cord (Domestic)	300020-001
A/R	Power Cord (Europe)	300020-002
A/R	Kit, Feeder, Weight	105901-036
A/R	Kit, Cleaning Card	105901-056
A/R	User's Guide	980279-001
A/R	Windows Drivers (NT and 95)	105901-047
A/R	Kit, Cleaning Swab	105909-057
10	Kit, Ribbon Take Up Core	105909-035
A/R	Kit, Cleaning Core Spindle Assembly	105901-061
A/R	Kit, Foam and Box (Printer or Laminator)	105901-054
A/R	Kit, Maintenance Manual	105901-227

1.5 PACKAGING CONSIDERATIONS

The factory cartons include a printer placed inside a protective ESD (Electrostatic Discharge) bag and suitable form-fitting foam cushions. Testing of this packaging has confirmed its ability to withstand the forces required by equipment transporters. If any other shipping materials are used, related shipping damage may not be covered by the warranty. If necessary, order replacement factory-approved shipping materials from a 3M MAXSecure distributor.

1.6 PREPARING A STATIC-SAFE WORK AREA

To avoid component damage while performing troubleshooting and repair procedures, service personnel should prepare a static-safe working area. This area should include a properly grounded, conductive, cushioned mat to rest the Printer Module on and a conductive wrist strap to ground the servicing technician. (Most electronic supply stores carry ESD protective devices. For a local supplier, contact 3M Corporation at 1-800-328-1368 or 512-984-1800).

1.7 ENVIRONMENTAL AND SHOCK PROTECTION

Avoid extremes of temperature and humidity or mishandling. These conditions can damage most electronic equipment.

When moving the printer from a cool, dry location to a warmer, more humid location, allow the printer to temperature stabilize for at least 30 minutes before opening the protective ESD bag. Otherwise, moisture can condense on the surface of many components. Moisture can degrade performance or even damage some components.

Avoid rough handling. Careful handling can avoid possible mechanical damage that might otherwise result from dropping or impacting the printer on a hard surface.

CHAPTER 2
INSTALLATION AND OPERATION

This chapter includes information on the following:

- Unpacking
- Attaching a Laminator and Die Cutter
- Printer Module Cables
- Printer Controls and Indicators
- Ribbon Installation
- Clear Card Installation
- White Card Installation

Similar descriptions also appear in the associated User's Guide and other manuals shipped with the printer. The intent here is to make this manual as complete as possible for the targeted service provider. Operations related to software applications and the Windows Driver do not appear in this manual. Installation and operation of the Test Software appears in Appendix A.

2.1 INSTALLATION

2.1.1 Unpacking

Figure 2-1 shows the packaging materials used to ship the Printer Module.

Note that customers should keep these materials on hand for future shipping needs. The product warranty may not cover a printer damaged during shipment using other shipping materials. If necessary, users should order replacements before shipping the Printer Module.

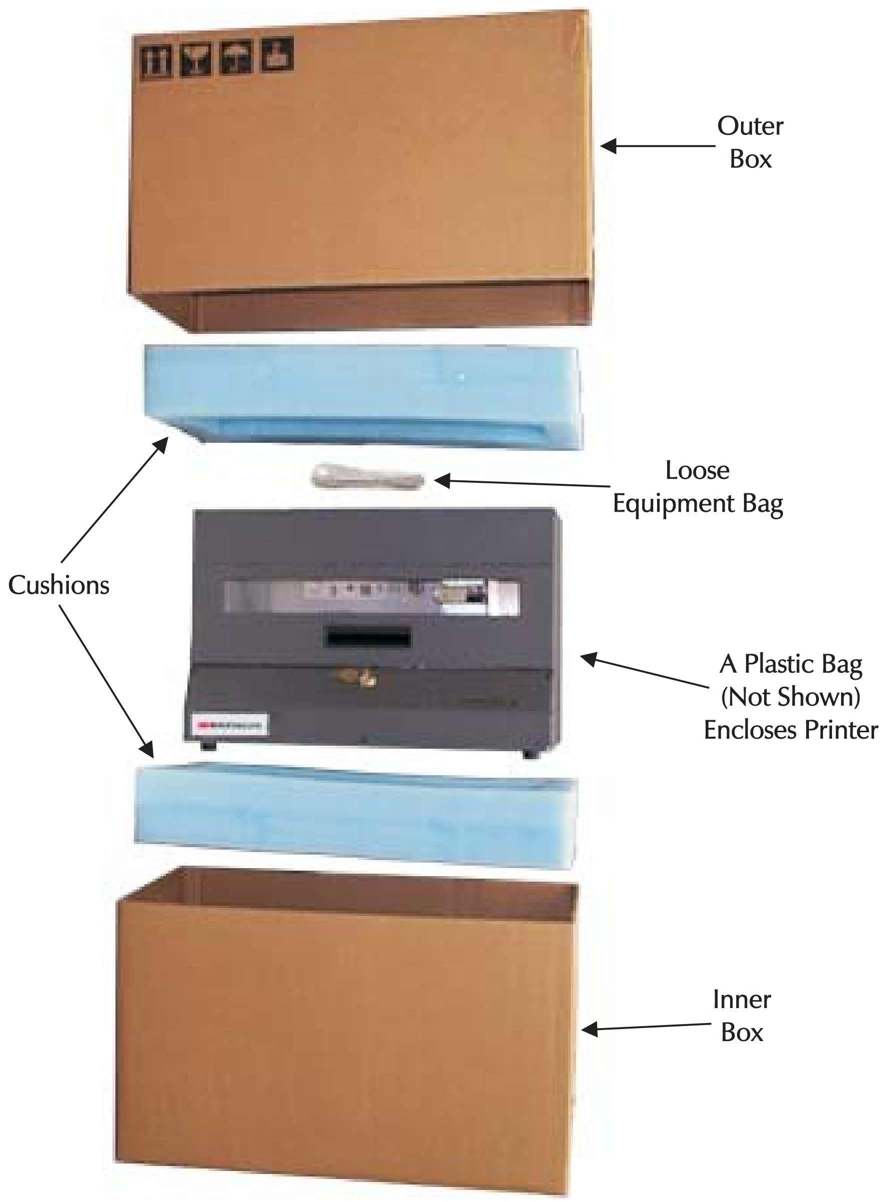


Figure 2-1. Packaging Materials

2.1.2 Location Concerns

Users should avoid locations with heavy concentrations of airborne contaminates. Until ready to use, keep Clear Card material and White Cards in their cartons. Such care also applies to Cleaning Roller Sheaths. Handle all ribbon and card media in a way that avoids contamination. Fingerprints and other such contaminants can lower image quality. Select a location that offers easy access to all sides and unrestricted air flow for ventilation. Avoid locations that experience extremes in temperature and/or humidity.

2.1.3 Adding the Laminator and Die Cutter

Figure 2-2 shows how the Printer Module and Laminator and Die Cutter fasten together. CAUTION: To avoid damage, separate the Modules prior to any move to a new location.

Step 1. As shown, align the left side of the Printer Module with he right side of the Laminator and Die Cutter Module.

Step 2. Lift the Laminator and Die Cutter Module to engage the hooks with the Printer Module slots. Make sure that the pin on the Laminator Module aligns with the slot in the Printer Module.

Figure 2-2. Laminator Installation.

2.1.4 Attaching Cables

Figure 2-3 shows the Rear Panel of the Printer Module. This panel has the following:

- Power ON-OFF Switch
- Power Connector
- Parallel Port DB-25 Connector (e.g., LPTx) With ferrites at each end.
- Module Interconnect DB-9 Connector

Figure 2-3 shows the cables to the host computer and the cable that interconnects the Printer Module to a Laminator and Die Cutter Module. The internal power supply automatically adjusts to most of the outlet voltages encountered world wide. Always connect the Power Cable last.

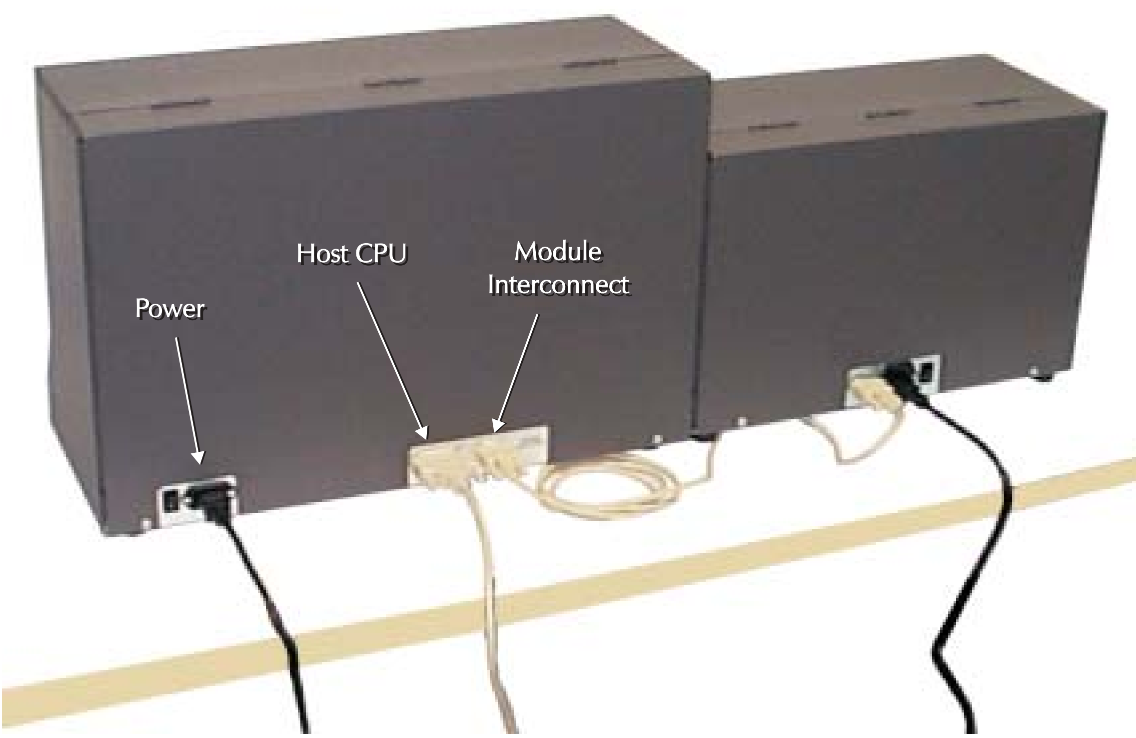


Figure 2-3. Cables.

2.1.5 Cable Diagrams

Figure 2-4 shows the cable wiring.

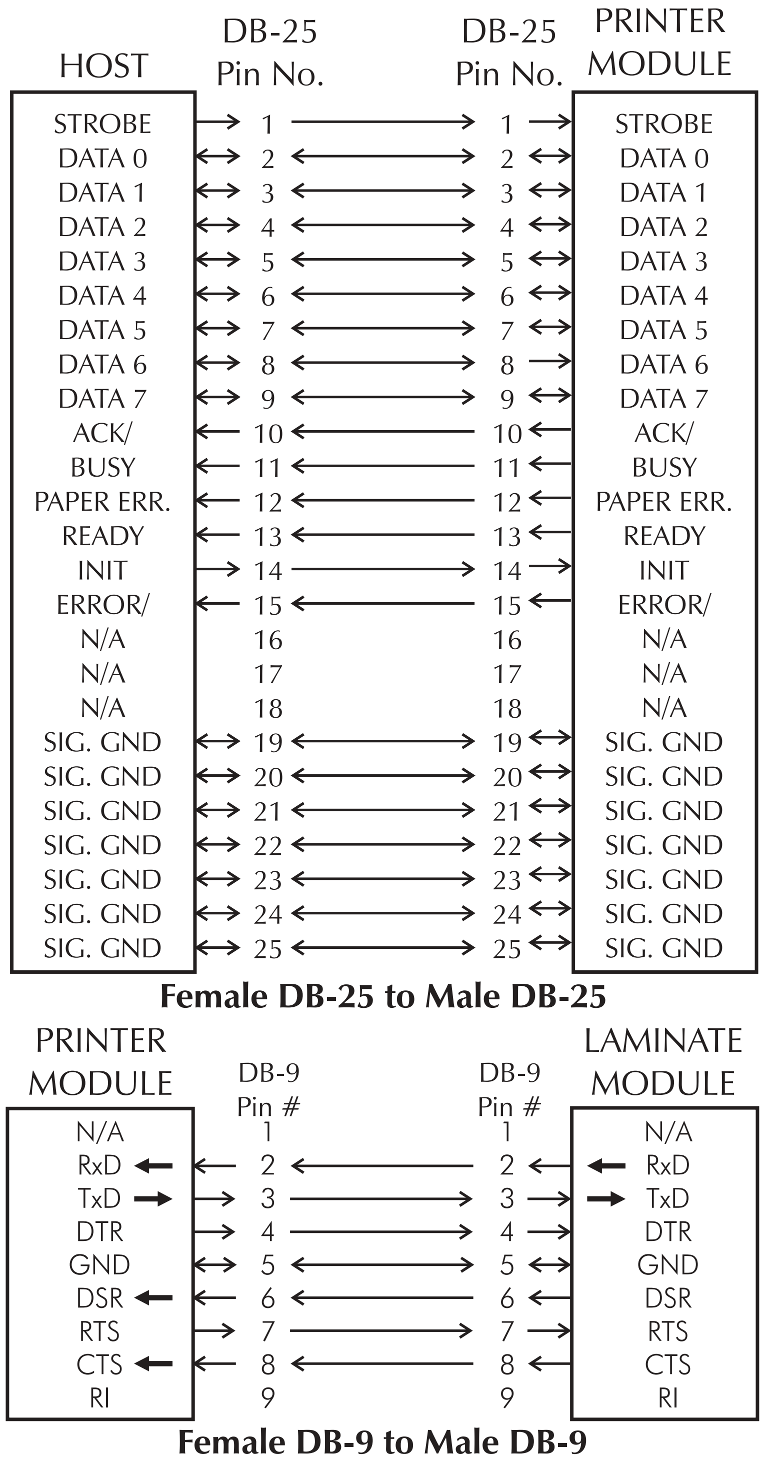


Figure 2-4. Cable Wiring.

2.2 OPERATION

2.2.1 Controls and Indicators

Figure 2-4 shows the Push Button and LCD (liquid crystal display) that appear on the front of the Printer Module as well as the rear-panel-mounted Power Switch. As shown, the LCD communicates operational status to users.

After ribbon installation, users press and hold the Panel Button for about three seconds or until hearing the ribbon begin to advance. This initialization positions a yellow panel for subsequent printing. Users also press and can immediately release the button to proceed after correcting an error condition. For example, the system can sense a card jam and suspend operation but cannot sense the removal and discarding of the offending card. Until a user presses the Panel Button, system operation remains suspended and waits for this signal to resume.

The Panel Button can also initiate Test Prints. To initiate a Test Print, hold the Panel Button pressed while turning power on. Resulting Test Prints contain information on the configuration of the associated printer. Test Prints also offer an easy-to-obtain printer output for servicing personnel that wish to see image anomalies or the effect produced by a printer adjustment.

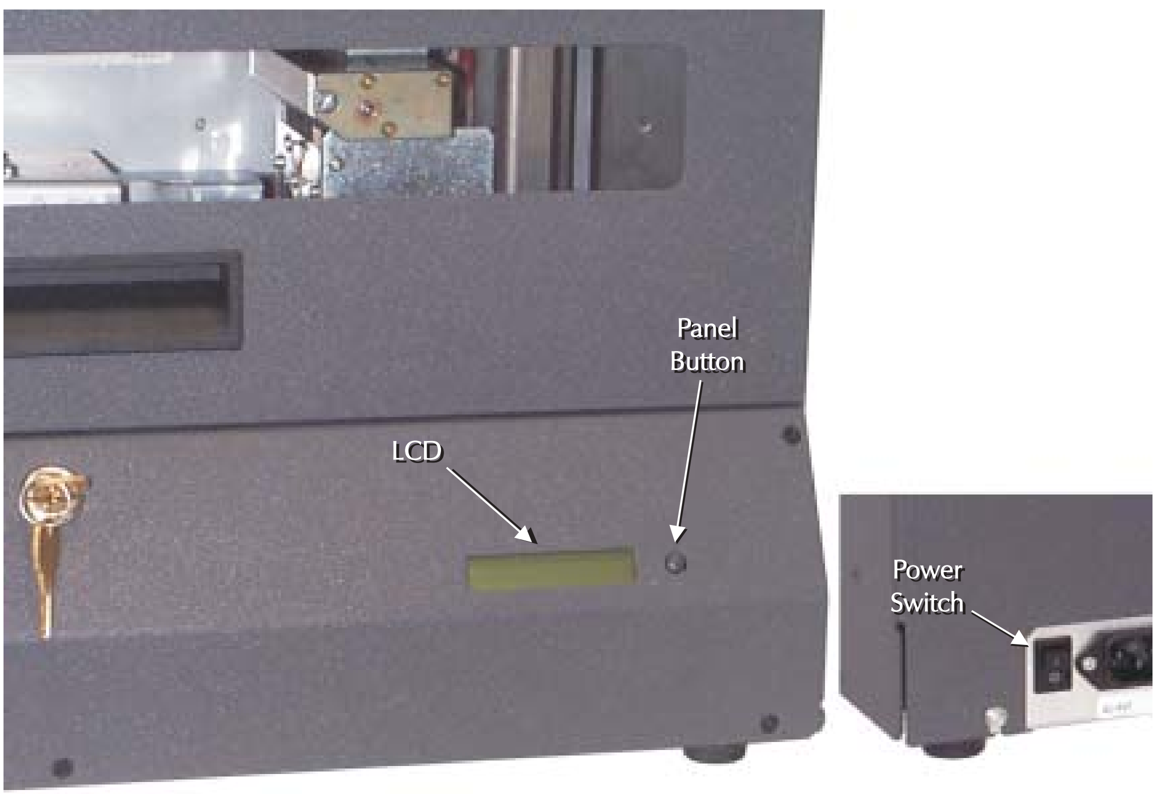


Figure 2-5. Printer Controls and Indicators.

2.2.2 LCD Messages Related to Printer Module

LCD Message	Description
INITIALIZING	Power-On Initialization in progress
READY	Ready to Receive Commands
PRINTING	Printer Busy
CLEAR FEEDER ERR	No Response from Clear Card Feeder During Power-ON Checks
WAIT TEMPERATURE	Print Head Cool-Down in Progress
REMOVE SPLICE	Clear Card Splice Detected—Removal at Card Assembly Station Required
OUT OF CLEAR	Install Clear Card Roll
OUT OF WHITE	More White Cards Required
OUT OF RIBBON	New Ribbon Required
SELECT WHITE	Wrong Layer Selection for White Cards in Hopper
CLEAR AT EXIT	Attempt to Place 2nd Clear in Exit
WHITE AT EXIT	Attempt to Place 2nd White in Exit
EXIT FAILURE	Error Sending Cards to Laminator
MECHANICAL ERR	Card Jam Sensed
DOWNLOADING	Printer Receiving Data
CLEAR TURN ERROR	Error During Flip-Over of Third Layer
CUTTER ERROR	Error at Clear Card Cutter
CLEAR AT ENTRY	Remove Clear at Cleaning Roller
WHITE AT ENTRY	Remove White Card at Cleaning Roller
SELF TEST	Test Print in Process

2.2.3 LCD Messages Related to Laminator Module

LCD Message	Description
WARMING UP	Printer Waiting for Laminator
LAMINATOR BUSY	Printer Waiting for Laminator
WAIT LAMINATOR	Error Reprint Wait–Laminate Finishing
LAMINATOR ERR	Error During Lamination

2.2.4 LCD Messages Related to Encoder Module

LCD Message	Description
ENCODER BUSY	Encoder is Busy; Printer Waiting to Send Card
ENCODING ERR	Error During Encoding
WAIT ENCODER	Error Reprint Wait–Encoder Finishing
CARD ENCODER	A Card is in the Encoder
NO CARD ENCODER	No Cards in Encoder
MAGNETIC ERROR	Communications Error Between Printer and Encoder
CLEAN MAG HEAD	Clean Magnetic Encoder

2.2.5 LCD Messages Related to Adjustments, Testing, and Microcode Downloads

LCD Message	Description
COMMAND ERROR	Command Not Recognized by Printer
PARAMETERS ERROR	Command Received has Imporper Parameters
REMOVE CLEAR	Can appear During Improper Sensor Adjustment
ERR NO SPLICE	Cannot Detect Splices due to Sensor Adjustment
NO ACCESS	Printer Password Required for Command Sent
FLASH ERROR	Error Detected During Firmware Download
KEY TO EXIT	Offers Exit Opportunity During Testing—Press Button

2.2.6 LCD Messages Related to Cleaning

LCD Message	Description
CLEANING PRINTER	Time to Clean Printer—Press Panel Button when Ready to Begin
REMOVE RIBBON	Remove the Ribbon Before Continuing
REMOVE CARD	Cleaning Card at Exit Requires Removal
NO CLEANING CARD	Place New Cleaning Card at Clear Material Load Point
REMOVE CLEAR	Remove Cleaning Card
CLEANING CUTTER	A Clear Card Shear Cleaning/Sharpening Sequence is Running (Follows Splice Removal After OUT OF CLEAR Message)

2.2.7 Print Head Latch and Release Levers

Figure 2-6 shows the Latch and Release levers for the Print Head. Users open the Cover and raise the Print Head for Cleaning Procedures and Ribbon Loading. The Print Head and Cover must both remain down for card imaging and other printer operations.

Users should keep the cover closed as much as possible to reduce the exposure of internal components to airborne contaminants. Any contaminants that find their way onto cards traveling along the card path have a good chance of adversely affecting print quality.

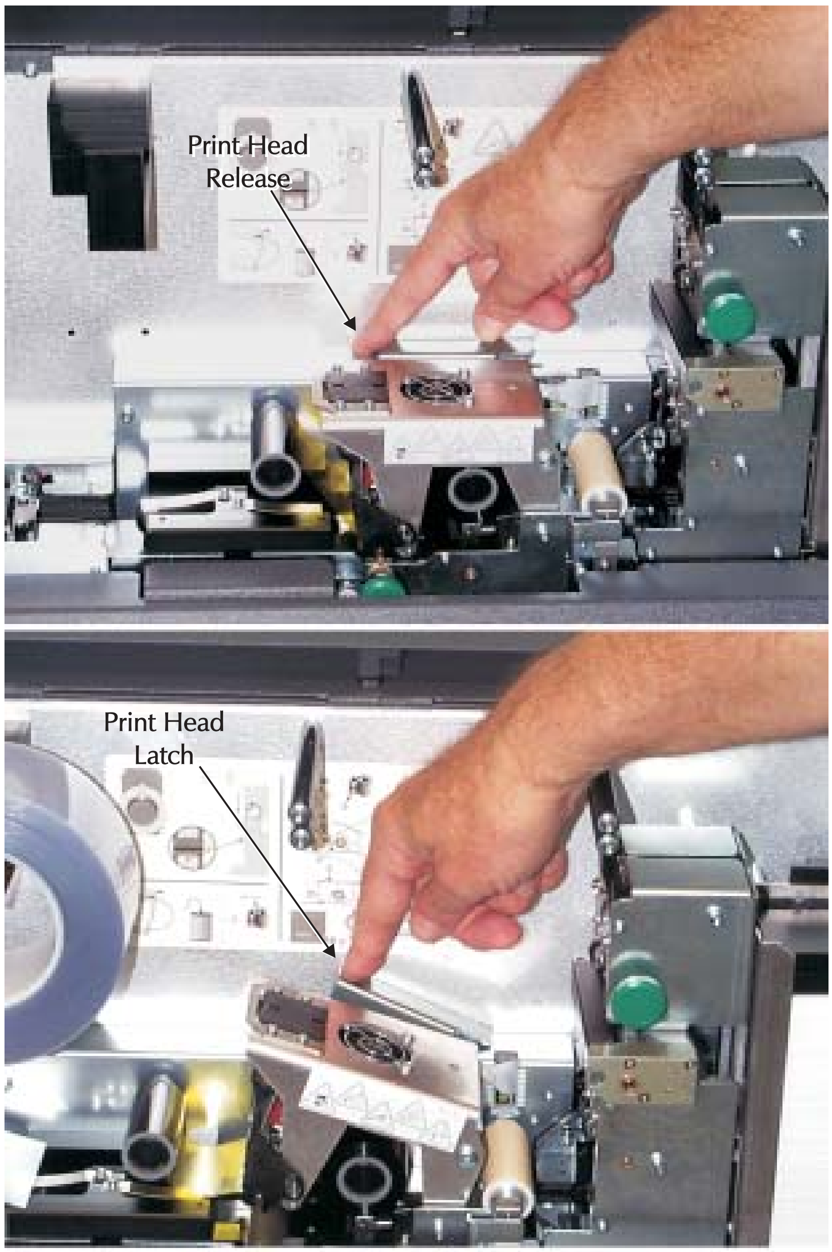


Figure 2-6. Print Head Latch and Release Levers.

2.2.8 Ribbon Installation

Refer to Figure 2-7, and proceed as follows:

Step 1. Open the Cover, raise the Print Head, and remove any ribbon and ribbon core still remaining in the printer.

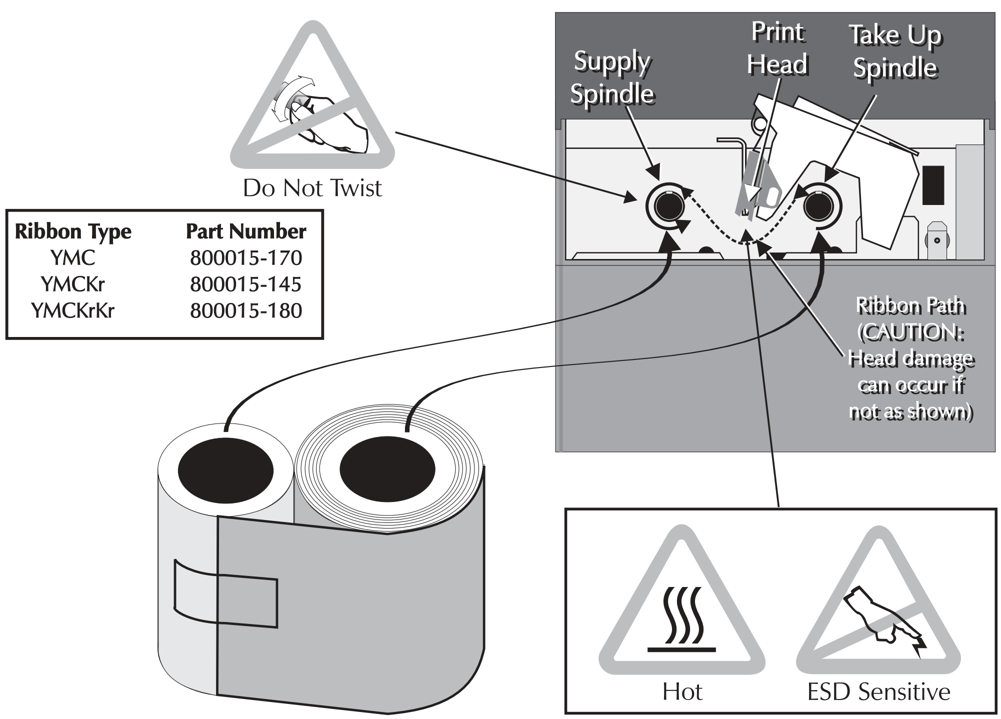
Step 2. To prepare a new ribbon for installation, undo the tape keeping the ribbon from unraveling. Then, rest both the ribbon and an empty core on end, on a flat surface, and touching. Tape the loose ribbon end onto the empty core, and wind some ribbon onto the core. For extra cores, order Part Number 105909-035. Users needing to switch back and forth between different kinds of ribbons will need more than the spare shipped with the printer.

Step 3. Push a prepared ribbon and ribbon core onto the supply and takeup spindles, respectively. Note that the ribbon feeds off the top of the Supply Spindle and onto the top of the Take-Up Spindle. This is very important. Damage to the Print Head can occur if the ribbon side with dye ever contacts the Print Head. Therefore, be very sure to install the ribbon properly.

Step 4. Latch down the Print Head, and close the printer cover.

Step 5. Remove any unfinished card from the exit mechanism.

Step 6. Press the Panel Button to initialize.



Ribbon Type	Part Number
YMC	800015-170
YMCKr	800015-145
YMCKrKr	800015-180

Figure 2-7. Ribbon Installation.

2.2.9 Card Media

3M Products offers the following Card media:

Description	Part Number
Kit containing Clear Card roll and White Cards for 2-Layers	104523-055
Kit containing Clear Card roll and White Cards for 3-Layers	104523-060

2.2.10 Clear Card Material Loads

Refer to Figure 2-8, and proceed as follows:

Step 1. Place a roll of Clear Card Material onto the holder such that the loose end feeds from the bottom of the roll.

Step 2. With power on, feed the loose end through the two sets of guide rollers and then into the top of the Clear Card Feed Station. When sensed, the Printer Module automatically advances the material to a point below the Shear.

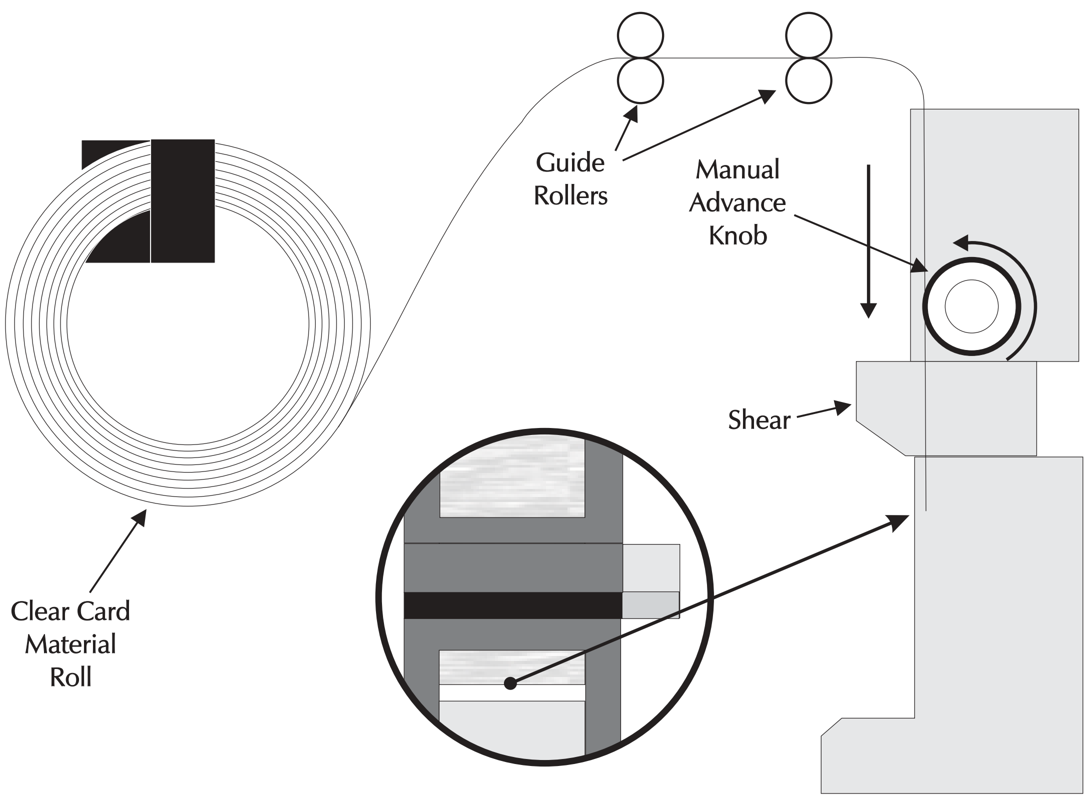


Figure 2-8. Clear Card Material Loads.

2.2.11 White Card Feeder Loading

Refer to Figure 2-9, and proceed as follows:

Step 1. Park the Card Weight at the top of the White Card Feeder.

Step 2. Place cards in the Input Tray. Note that cards can stick together for various reasons, and users should effect a shuffle-like action on the stack prior to placing cards into the White Card Feeder. Note that Magnetic Stripes, if present, should face up and be nearer the back of the Feeder than the front. Preprinted Secure Card imaging must face down.

Step 3. Place the Card Weight on top of the cards. Note that the Card Weight increases the gripping of the Card Feed Rollers. Also, note that any accumulation of contaminants on the Card Feed Rollers can lead to card feed slippage. Clean the Card Feed Rollers when signaled by the LCD or after experiencing card feed failures.

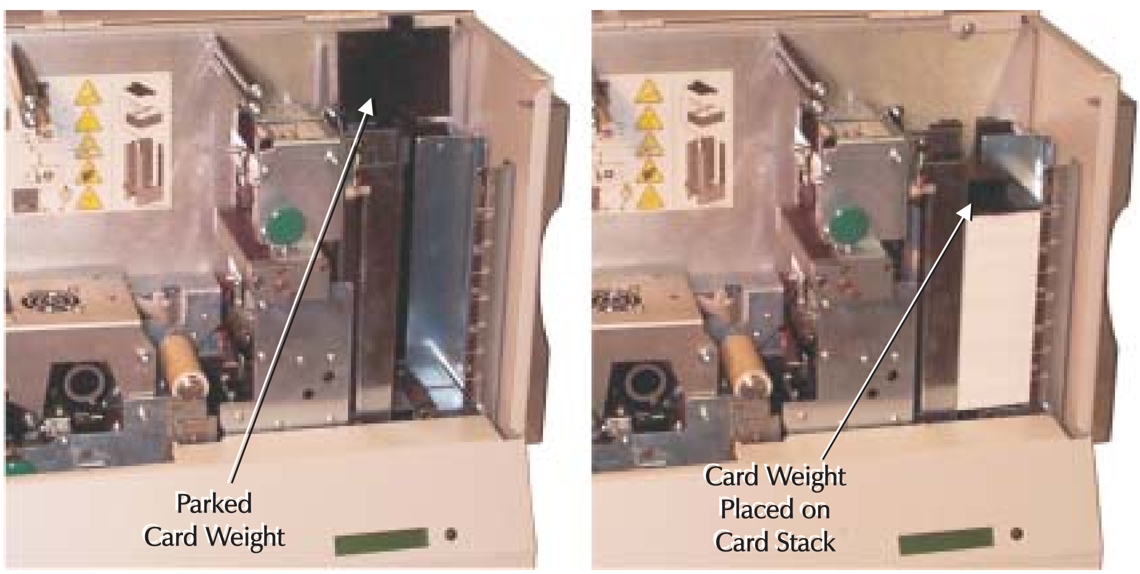


Figure 2-9. White Card Hopper Loading.

2.2.12 Two- verses Three-Layer Selection

Figure 2-10 shows the lever that sets the Printer Module for either two- or three-layer operation. Be sure that the lever setting matches with the card thickness selected for use, as follows:

- 2-Layer Setting requires 0.022-inch card thicknesses.
- 3-Layer Setting requires 0.015-inch card thicknesses.

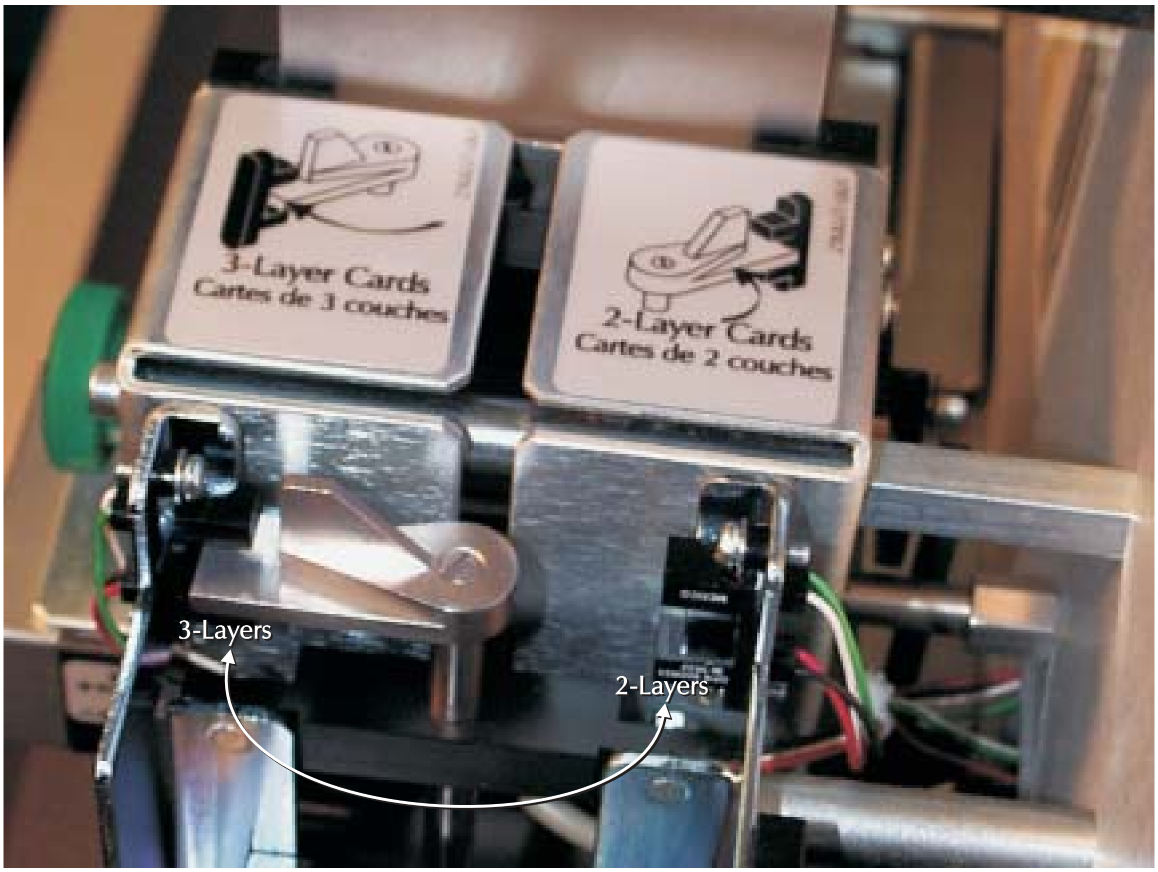


Figure 2-10. Card Layer Selection Lever.

CHAPTER 3
THEORY OF OPERATION

This chapter includes three major topics:

- Color Fundamentals
- Printer Module Card Path Elements
- Circuit Description

3.1 COLOR FUNDAMENTALS

Color refers to the hues seen in the visual spectrum. This spectrum consists of all the colors seen in a rainbow or by the dispersal of white light through a prism. The extremes of this spectrum are red (the longest wavelength perceivable) and violet (the shortest wavelength perceivable). The remaining orange, yellow, green, etc., shades lie between the red and violet extremes. Spectrums above and below the visual are called ultra violet and infrared, respectively.

Saturated colors are colors in their purest state. This means they contain no white (as in pastels) or black (contrast reduction) components. A so-called trained observer can discern about 450 pure shades. If these colors are diluted by black, the ability to discern shades diminishes. However, white dilution increases the number of colors discernible.

When computers get involved in the color process such things as memory capacity and data compression become factors. Fifteen-bit color yields $32x10^3$ shades and a requires 15-bits for each pixel in the desired image. Twenty-four bit color yields $16x10^6$ shades. Thirty-two bit color yields $4x10^9$ shades. Note that the memory required for images expands substantially with the number of shades. Compression attempts to reduce the memory requirements. Some compression schemes only attempt to identify repeating colors. Others, such as JPEG, can treat various amounts of change as if they were the same repeating colors. Carried to an extreme, a posterized result would occur, and the color changes would step unnaturally.

In the color printing process, particular shades of color derive by mixing quantities of the basic colors cyan, magenta, yellow, and sometimes black (usually referred to as CMY or CMYK—where K designates black). When users choose some other color definition from their application—e.g., hue saturation intensity (HSI) or red green blue (RGB)—a conversion to CMY/CMYK must take place to support a printer. Mixing occurs at the level of each pixel. Pixels serve as the basic elements of images. Pixels can comprise either one dot (the smallest printable element) or a small matrix of dots, depending on the methodology used to form the images.

Offset printing and Dye Sublimation can produce a substantial range of colors within just one dot. Color Monitors produce their range of colors using a red, green, and blue (RGB) three-dot matrix. Scanners and digital cameras employ charge-coupled devices (CCDs) that deliver RGB outputs.

Thermal Transfer and most Ink Jet printers produce their range of colors using larger dot matrixes—typically up to four-by-four or equivalent dots—where each dot color can be a fundamental (CMY), or the combination of fundamentals (RGB and black). Therefore, these particular devices limit their dot colors to cyan, magenta, yellow, red, green, blue, black, and the media color (usually white). The color perceived results from the optical mixing of the eight possible color components contained in the matrix.

With eight dot colors possible, a four-by-four dot matrix can produce in excess of 4 billion combinations ($(4 \times 4)^8$). However, as long as the color components remain the same, the dots in a matrix can be shuffled into any pattern without changing the color perceived. For example, a matrix containing all-white dots except for one red dot produces the same shade of pink no matter where in the matrix the red dot lies. Therefore, a matrix containing n dots can produce each color in n different ways. This makes a four-by-four matrix capable of producing more than 268 million different shades ($(4 \times 4)^8/16$ + white). For monochrome printing, which is the only matrix-based printing that users might want to apply to a 3M MAXSecure printer, this same matrix can produce 16 different gray shades plus white ($(4 \times 4)^2/16$ + white).

Mixing of dot colors in Offset Printing and Dye Sublimation occurs by controlling the amount of each dye or ink that gets applied to each dot. Mixing in monitors occurs from control of beam intensity, with three beams acting on the individual phosphors applied to CRTs (cathode ray tubes).

Of all these methods, Dye Sublimation produces the best quality printouts, because as is the case for all 3M MAXSecure printers, each dot can have the full range of 15-bit color (32K shades) at full 300 dpi resolution. In fact, even with resolutions equal, Dye Sublimation still has an advantage over offset printing. Dye Sublimation creates a dot color by varying the density of the CMY dyes. Offset printing creates a dot color by varying the diameter of the CMYK ink dots, which can make individual dots more observable and subject to moiré pattern generation. With Dye Sublimation, users achieve essentially the continuous-tone quality of photographs.

Moiré patterns can become a factor when users generate either print files or hard copy separations for offset printing. Users should ask the people that do their offset printing which separation angles best reduce these patterns before risking a distorted result. Many applications offer Print dialog options for these settings.

All the non Dye Sublimation print methods work because people perceive individual dot colors only to the point the dots remain individually discernible. At sizes or distances where individual dots cannot be seen, optical mixing occurs. To see individual dot intensities or colors, view the monitor or printed page using an eye loupe or other such magnifier. Not all images require high dot densities. The need for high dot density decreases as the viewing distance increases. For example, a large roadside sign may require separations screened at only four lines-per-inch. Note that press men use lines per inch, because of the screens used to vary dot size, and computer users use dots per inch, but both refer to picture resolution.

Because a monitor and a printer produce color using different methods, users can expect somewhat different results. A monitor uses an additive process, meaning a particular color derives from intensity control. For example, a color moves toward the green by intensifying excitation of green phosphors. Printed images, on the other hand, use a subtractive process. These images display their color through reflected light—unlike monitors, which become a light source created by excitation of phosphors. To create a particular printed color, the process must subtract (that is, filter out and not reflect) the spectrum parts of the source illumination that do not contribute to the color desired.

The light reflected off of the surface of a white card passes through the colored dyes deposited on the surface of the card, both going and coming. The dyes used to form printed images serve as filters of light that would otherwise reflect off of what is typically a white print media. In printed images, complete filtration (or what serves as the maximum subtraction capability), results in black. The absence of filtration results in the media color. In monitors, maximum beam intensities (maximum additions) result in white, and minimum intensities produce black. Because light reflected from print media depends on ambient lighting, users may get darker images from a printer than they see on a monitor, particularly a monitor with a high intensity setting.

Print illumination (generally from room or outdoor lighting) affects color for all printed images. When a light source emits less in certain parts of the visual spectrum, a print illuminated by this source by necessity reflects less of the associated colors. This is true even though the corresponding light reflecting capability remains inherent in the print. Imagine, for example, the effect of placing a color filter in front of a light source. Only the visual spectrum parts passed by this filter reaches the print. Viewers can sometimes see subtle effects of this by observing the same print under sunlight, incandescent lights, and fluorescent lights.

Sunlight radiates fairly evenly over the entire visual spectrum, having only a slight increase at the center. Incandescent lights radiate far more on the red side than on the blue side of the visual spectrum. Fluorescent lights radiate differently depending on their phosphor blends. Such classifications as “Cool Light” and “Warm Light” refer to blue-rich and red-rich enhancements, respectively.

When close concern for color is important in displaying prints, users should find a similar ambient setting for a color check. If a color is closely related to identifying a printed feature, users may find themselves dealing with this level of concern, with skin tones typically offering the greatest challenge. However, most applications tend to require a less critical evaluation. Usually, what looks good in one setting tends also to look good in another setting, despite any subtle differences in ambient lighting.

In scientific terms, the question “How white is my source?” is resolved by a side-by-side comparison between a source in question and a heated black body radiator. The term “black body” refers to a material that produces no color other than that which results from heating. Imagine such a material first appearing reddish and then gradually appearing white hot followed by bluish white as its temperature increases. These are the whites to which comparisons are made. In the Graphic Arts industry, the following standards for white exist:

Region	Black Body Temperature
US.	5000°K
Europe	6500°K

Note that a color image created for a U.S. print media will appear different when printed on a European print media. Any white media used will have measurable color spectrum characteristics that can accent or attenuate particular colors. Consider, for example, what might happen to an image printed on a media having a bluish tinge.

Color is very much a function of the device either sensing or producing the color. A computer monitor, for example, can produce very bright images, typically brighter than those produced by a television set. A television set typically can produce a broader range of colors than can a monitor. Television manufactures emphasize color range over brightness; monitor manufacturers emphasize brightness over color range. While the forgoing compromises generally hold true, each device manufacturer, in fact, takes a different perspective when deciding which formulations to use in the red, green, and blue CRT phosphors.

Further complications arise with the addition of a color scanner to a system. These devices also differ between manufacturers. WYSIWYG (what you see is what you get) from scanner to monitor to printer gets complicated because of different device color ranges (Gamuts) and by the different color systems used. A printed color outside the range of a scanner cannot make it to a monitor. Users that attempt to use a computer application to edit an image received from a scanner may add colors beyond the range of their printer. Notably, some applications issue gamut warnings. Both monitors and scanners use the RGB system, while color printers use the CMY/CMYK system.

An important concern is how a device handles colors beyond its range. If a device just substituted the best color available, objects filled with blends, starting from inside the gamut and ending at some point beyond the gamut, would loose their desired appearance. For example, an object blending from say an orange to a red beyond the red range would abruptly stop blending at the point the device could no longer produce a deeper shade of red. The remaining blend would then have the same color. Some devices avoid this effect by compressing (re mapping) the gamut. While compression maintains the desired effect, too much compression produces posterizing. When this occurs, color changes appear unnaturally abrupt in some parts of the image.

3.2 PRINTER INTRODUCTION

3M MAXSecure color imaging requires three passes of a Clear Card media across the Print Head. Clear Card media shuttles back and forth across the print head during this process. The ribbon feeds between the image head and the card media and during printing advances from its supply to its take-up reels in step with the advancing print media.

Heat, when generated at an image head element, transfers ribbon dye in a measured quantity onto the print media. In color printing, the ribbon advances from one color panel to the next between each imaging pass. A card exits to the Card Assembler following the last pass. Monochrome printing for each black resin image requires additional passes.

3M MAXSecure printers employ an image head with a single row of 672 print head elements, 300 to the inch. Note that the capability for card coverage exceeds the needs of a standard card size by 0.115 inch, or about 34 dots. This excess supports both programmable centering and full bleed imaging. Each element can generate 32 different heat levels for color and a single heat level for monochrome.

Figure 3-1 shows two views of a 3M MAXSecure Printer Module. Refer to the upper view for components that transport the card and ribbon media and the labeling of major components. Refer to the lower view for elements that sense media positions.

Motors and Solenoids

Printer Stations have two dc motors: one for the ribbon take up, and another to drive the cam that raises and lowers the print head. For the required imaging precision, a stepper motor drives the rollers that transport card media. A dc motor in the White Card Feeder and a steppper motor in the Clear Card Feeder insert related card media. Another dc motor in the Card Assembler station delivers card components to the exit slot.

Timing belts couple the upper two sets of rollers in the Upper Clear Card Feed and Shear Station, including the related Manual Advance Knob. Timing belts also couple the two rollers in the White Card Feed Station. Also note that the Printer Station stepper powers a set of rollers in the Lower Clear Card Feed and Shear Station. An associated timing belt extends stepper drive across the two stations.

A solenoid exists in the Card Assembler. When this solenoid releases, card components raise to engage the upper roller, where dc motor drive can transport cards to the exit slot. At this point, cards await their removal, either manually or by an attached Laminator and Die Cutter Module.

An additional solenoid in the Clear Card and Shear Station directs Clear Cards either directly to the horizontal card guides or to the lower section for a flip-over. The second Clear Card of a three-layer card transitions through the lower section.

Sensors

During a print cycle, LED-Photo transistor sensors monitor the positions of the cards and the advance of the ribbon. Note that two types exist—a beam interrupt type and a beam reflection type. Switch sensors also exist that operate off of the cam that raises and lowers the Print Head. These switches sense completion of head-up and head-down transitions.

Two ribbon sensors exist. One ribbon sensor can receive a beam reflection through the yellow ribbon panels. Users can initialize the ribbon to these positions by pressing the Panel button. This ribbon panel sensor also senses out-of-ribbon conditions. Operating in association with the Flag sensor, the need for ribbon advance corrections is sensed. The number of flag slots counted verses the sensing of the yellow panel for each color image produced serves as the basis for these corrections. As more ribbon accumulates on the Take Up spindle, a reduction in the amount of take up occurs to keep line advances sufficiently even.

Three sensors exist in the Clear Card Feed and Shear Station—two sense reflections off of the Clear Card material and one senses transmissions through the Clear Card material. Properly setup, the transmission sensor can signal the presence of a splice. The reflection sensor signals when a shear should occur to produces a card segment. The upper reflection sensing sensor signals the presence (or absence) of Clear Card material in the card path.

Two more reflective sensors appear in the lower part of the Clear Card and Shear Station. The upper-most sensor signals the need to switch from Clear Card Station drive to Printer Station drive. The lower-most sensor signals the need to reverse Printer Station drive. As this drive continues, the Clear Card enters the horizontal card path with its bonding agent facing down. Note that the previous Clear Card entered the horizontal card path with its bonding agent facing up, and a White Card entered between the two Clear Cards with its security imprints facing down.

Two Card Assembly Station sensors exist—an upper beam interrupt type and a lower beam reflection type. The upper sensor indicates when cards appear at the output slot. The lower sensor produces a reflective signal that indicates the presence of a White Card. These sensors can also signal errors caused by too many cards in the Card Assembly Station.

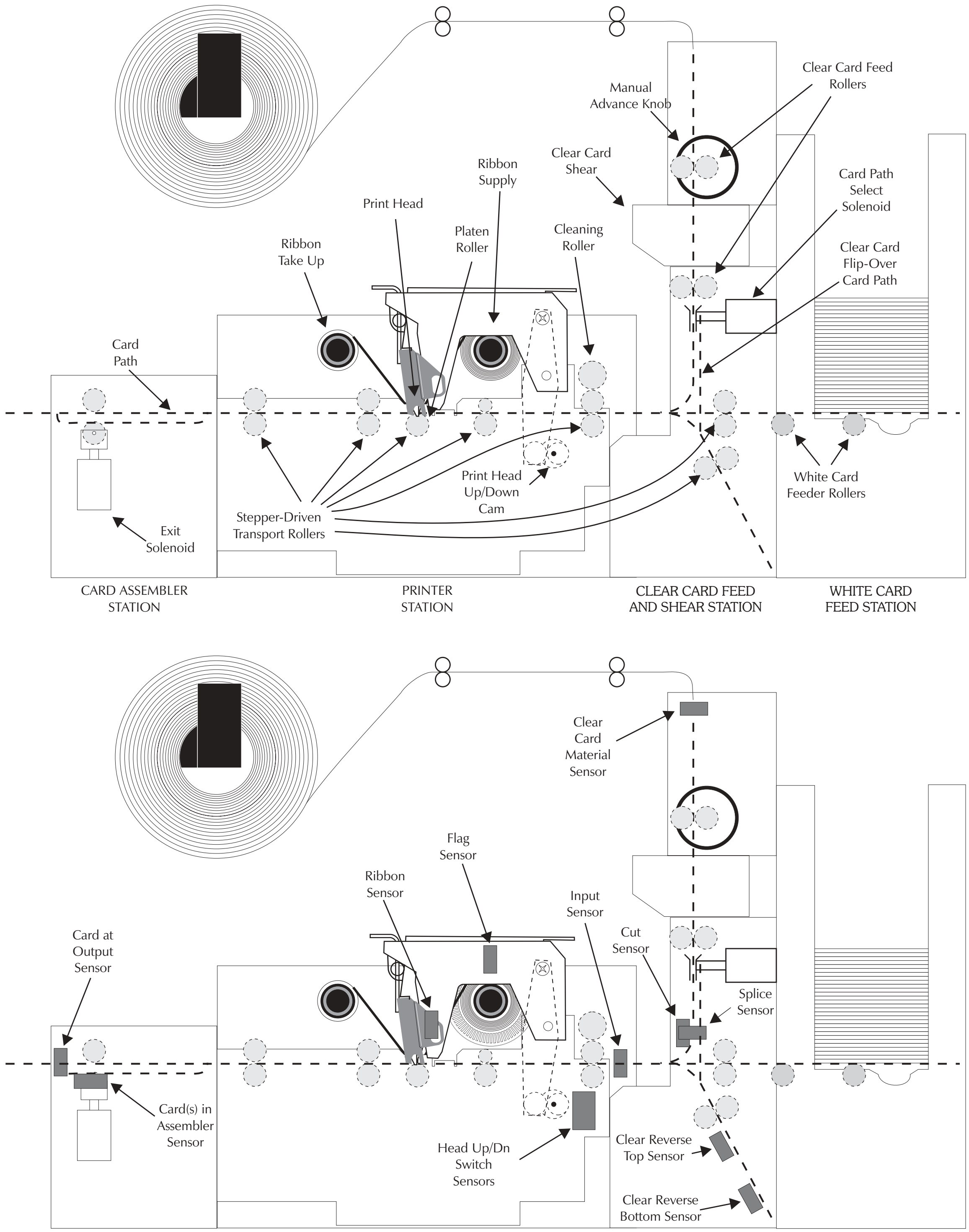


Figure 3-1. 3M MAXSecure Card Path.

3.3 CIRCUITRY

As shown in Figure 3-2, the printer has the following circuits:

- Print Head Circuitry
- Motor Control Circuitry
- Status Circuitry
- Host and Module Interconnect Ports
- Operator Panel Circuitry

If possible, spend some time with this figure. The intent is to offer another perspective to descriptions given in other parts of the manual.

Printer Modules have three printed circuit boards—a Main CPU board, an Extension board, and a second Processor board that controls Clear Material feeds. The figure depicts soldered-in circuit blocks without shading. The lighter shading indicates socketed ICs. The darker shading indicates external assemblies connected to the circuit boards by cabling.

The Microcontroller determines all operations through data and address busses and control signals. Flash memory contains the associated micro-code. Note also that the Address bus primarily serves transfers involving the Flash and DRAM chips. Most other data transfers occur with a chip enable or other Microcontroller signal.

Two types of status are collected—sensor and parameter. Analog comparators receive inputs from the LED-Photo transistor detectors. The D/A Converter allows the Microcontroller to trigger an integration signal sent to the comparators placed on the Extension board. Comparators operate using single-slope integration as a basis for checking sensor levels. Single-slope integration times the interval between the start of a sawtooth wave and the point an analog comparator switches state.

Motors exist in two types—dc, and stepper. The solenoid and all dc motors, including the one in the Shear, receive 24-volt dc power. This same supply powers a dc-to-dc converter that delivers 5-volt power to the remaining circuitry.

Print data, still in compressed bit-map form, enters the RAM. After reception, the Microcontroller sends the data to the Print Head Drive circuitry. Decompression occurs after the Microcontroller retrieves data and before its delivery to the Print Head Drive circuitry.

Word-by-word, the data shifts into the 672 print head registers that feed the elements of the print head. Print Head registers receive the data in two serial streams from the Print Head Drive circuitry. For Clear Card color printing, the Microcontroller loads the 672 registers five times, each time followed by a different pulse width that enables delivery of data to the Print Head elements. Each pulse width produces a different heat for those elements that have received an active data bit. Each element can, therefore, deposit up to 32 different dye densities on a card for each of the ribbon panel colors. When expanded to include all ribbon panels, 32K possibilities exist. This process continues for each line of imaging and through all panels of the installed color ribbon. In contrast, monochrome imaging only employs one pulse width per line of imaging.

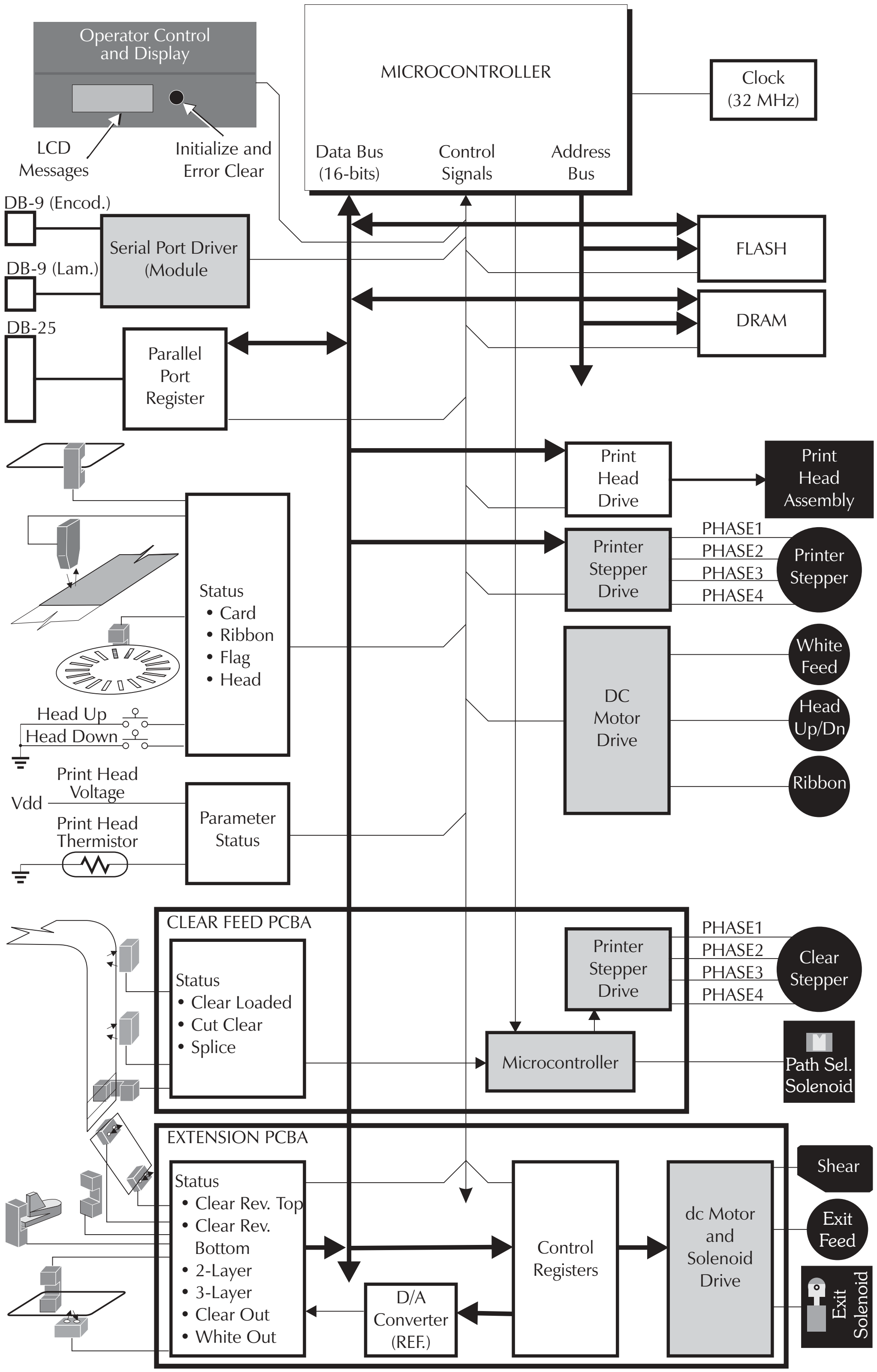


Figure 3-2. Block Diagram.

A Parallel cable extends the data bus of the Main CPU board to the Extension board. Centronics™ (i.e., LPTx) port signals from the Main CPU board serve as a Host I/O. A serial (RS-232C) port interconnects the Printer Module with a Laminator and Die Cutter Module. Another serial port interconnects the Printer Module with the Encoder Module. An associated Receiver/Transmitter IC contains a charge pump, so that serial signals can have ±10-volt swings.

A serial data line and an associated clock line transfers data to the Clear Card Controller. After reception of commands from the CPU Board Controller, this controller opperates indepently to control the feeding of Clear Card Material. The material feeds through control of a stepper motor. Card path selection occurs through control of a solenoid. Signaling key points in the feed process are the Clear Loaded, Cut Clear, and Splice sensors. A single line back to the CPU Board Controller signals completion of an operation.

The Microcontroller monitors the Card Sensor during card feeds. Once a card reaches the Card Sensor, the Stepper Motor takes over card positioning control. Pulses sent to the Stepper produce accurate bi-directional step increments that position the cards for printing and delivery to the Card Assembler Station.

Users press the button on the front of the printer to advance a multiple-panel ribbon to the point imaging can begin. The Ribbon Sensor produces a signal at the yellow panel in support of this positioning.

Printing requires an advancing ribbon and a Print Head lowered to the surface of the card, both resulting from associated dc-motor drives. The motor that lowers and raises the Print Head drives a cam that works against a spring-loaded Print Head. Limit switches indicate the Head Up and Head Down conditions. During printing, the spring maintains the required downward pressure of the Print Head on the ribbon and card.

CHAPTER 4
TROUBLESHOOTING

Typically, troubleshooting begins with an attempt to relate a problem to an associated component or system function. In this phase, servicing personnel may attempt to duplicate the problem and then use various means to test for a malfunction or improper system setup.

This chapter hopes to aid in this process by presenting Flow diagrams that lead to some areas related to an observed problem. Those with replacement components on hand can often speed up the repair process by swapping related components. This process either narrows the possibilities or eliminates the problem. Trial-and-error works particularly well with easily accessible components, such as those accessible by opening the cover or removing the rear case.

Only a symptom-related list of possibilities appears. When the suggestions presented fail to effect a repair, CPU and Extension Board replacements, if not prescribed, should nevertheless be tried. Also, check for broken or disconnected cables and any loss of either ac or dc power. Beyond this, 3M Products offers Technical Support and factory repair as options.

4.1 DIAGNOSING BASIC PRINTER PROBLEMS

Figure 4-1 shows a diagnostic flow diagram designed to reproduce problems related to card images and card transports. Two tables follow that offer associated details and section references.

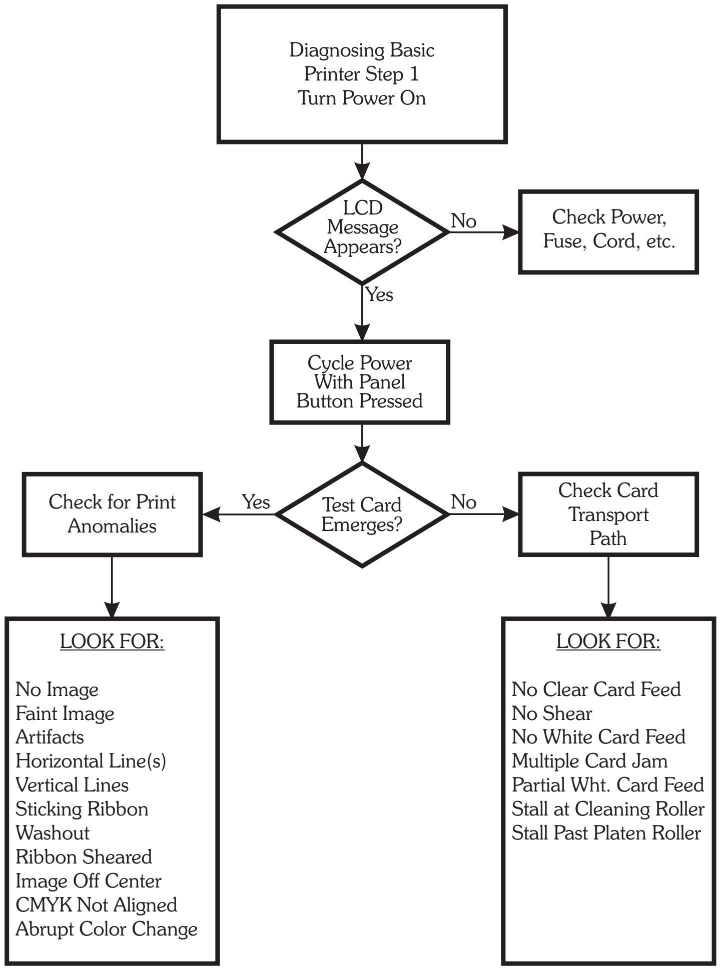


Figure 4-1. Problems Duplicated by a Test Print.

Problems Associated with Print Anomalies

Symptom	Possible Causes	References	
		Adjustment or Cleaning	Replace-ment
No Image	CPU Board Head Up/Dn Motor Switch Sensors		5.2.20 5.2.16 5.2.16
Faint Image	Low Print Head Voltage Dirty Print Head	 6.2.1	5.2.23
Artifacts	Particles on Feed or Transport Rollers	6.2.3	
Horizontal Lines	Dirty or Damaged Print Head Element	6.2.1	5.2.10
Multiple Evenly-Spaced Horizontal Lines	CPU Board Print Head Registers		5.2.20
Vertical Lines	Stepper Transport Belts Too Tight	6.3.5	
Sticking Ribbon	Peel Bar Adjustment	6.3.2	
Washout	Peel Bar Adjustment	6.3.2	
Sheared Ribbon	Image Not Centered	6.3.3	
Image Off Center	X- and Y-Offset Values	6.3.3	
CMYK Not Aligned	Erratic Card Feed due to Belt Tension or dirty rollers	6.3.5, 6.3.6 6.2.3	
Abrupt Color Change	Initialization Flag Sensor Clutch Pads Ribbon Take-Up Motor/O-Ring		2.2.1 5.2.16 5.2.17 5.2.16

Problems Associated with Card Transport Failures

Symptom	Possible Causes	References	
		Adjustment or Cleaning	Replacement
No Clear Card Feed	Clear Card Material Not Below Shear	2.2.10	
	LED Indicates SPLICE	2.2.2	
	Clear Card Feed Station Rollers Dirty	6.2.3	
	Clear Card Feed Motor, Belt, or pulleys		5.2.6, 5.2.7
	Clear Station PCBA or IC		5.2.22
No Cut and Clear Card Material Feeds Past Cut Point	Lower Clear Card Feed Station Sensor		5.2.7
No White Card Feed	Card Weight Not on Card Stack	2.2.11	
	Warped White Card		
	Dirty Card Feed Roller	6.2.3	
	Card-Feed Motor		5.2.3
	Card-Feed Belt		5.2.3
	Layer Lever Set for 3-Layers	2.2.12	
Multiple Card Jam	Card Sensor		
	Card Sensor Adjustment	Appendix A	
	Layer Lever Set for 2-Layers	2.2.12	
	Card Weight Not in Place	2.2.11	
Partial Card Feed	Rear Stepper Motor or a Transport Belt	6.3.5	5.2.16
	Card Sensor		5.2.19
	Broken Belt or Slipping Pulley	6.3.5, 6.3.6	5.2.14, 5.2.16
Stall at Cleaning Roller	Card Sensor		5.2.19
	Cleaning Roller not or improperly Installed	6.2.2	5.2.13
Stall in Printer Station	Card Transport Belt		5.2.14, 5.2.16

4.2 DIAGNOSING COMPUTER INTERFACE PROBLEMS

Figure 4-2 shows a flow diagram that checks the interface to the computer. For additional information, see:

- Cabling—
- Theory—
- Replacements—

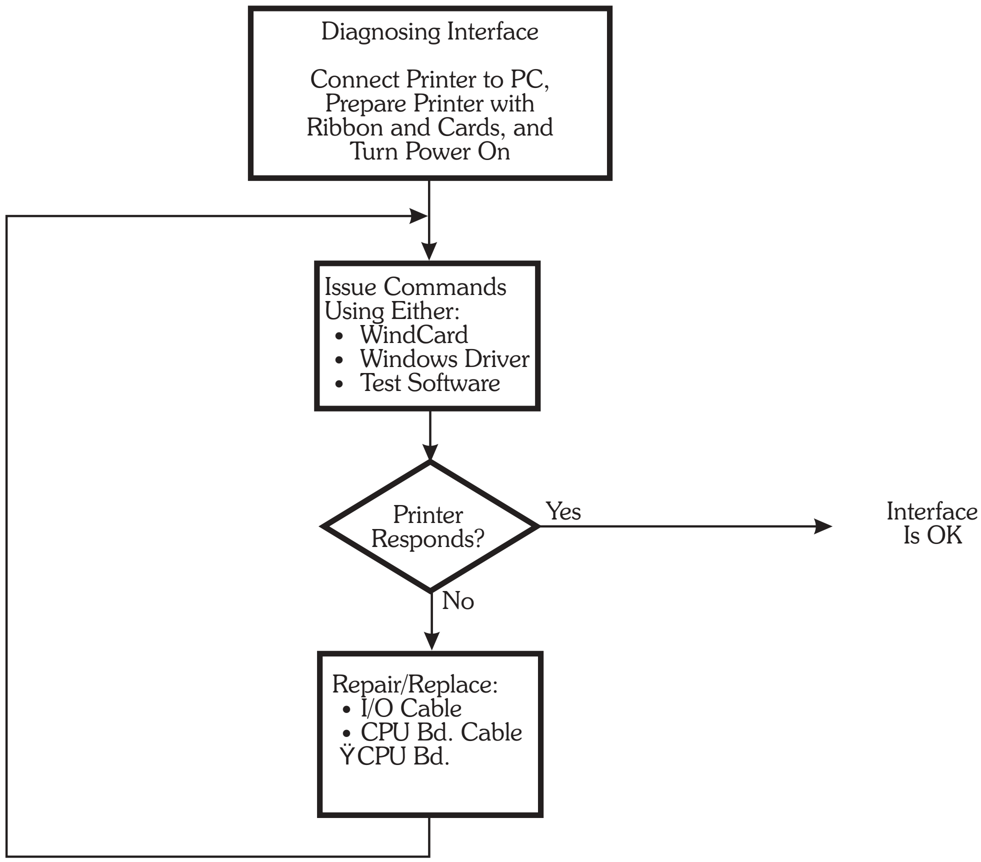


Figure 4-2. Interface Diagnostic Flow.

CHAPTER 5
REPLACEMENT PROCEDURES

This chapter consists of part replacement procedures for those items either found or suspected of malfunctioning. These procedures cover the items checked during the troubleshooting presented in the previous chapter. However, this manual does not cover all components and only represents an attempt toward identifying a potential set of components. As a result, servicing personal may discover additional items that warrant procedures.

3M Products encourages servicing personal to report these and any other problems in support of continuous product improvement, publication of Tech Notes, and revision of this manual. For servicing beyond the scope of this and the other 3M Max Secure publications, 3M Products offers factory repair and Technical Support assistance as options.

As with all well-designed products, most parts should remain operational well beyond a typical product life. Therefore, product abuse may cause most failures. In this regard, the operating environment most likely acts as the prime factor influencing card-image quality, with airborne particles the chief cause of problems. Servicing personnel should advise users to adjust cleaning frequency to the rate airborne particles accumulate inside the printer and make sure that someone at the site understands the use of the various cleaning materials. Users should replace the outer sheath of the Cleaning Roller on a regular basis and anytime image problems appear. Also, users should not ignore the CLEANING message for extended periods. Users should plan a shut-down for cleaning as soon as possible.

Descriptions show how the various components fasten to the printer and the best sequence for their removal. This makes the procedures reversible, meaning installation of a new component typically occurs by reversing of the removal procedure.