



Secure MICR Printer

ST98xx & ST99xx Series

Secure MICR Printers
Implementation and Programming
Guide

Notice

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Notice

This manual serves as a reference for Source Technologies' Secure MICR printer. This manual should be used as a reference for learning more about MICR technology and developing MICR printing applications. This guide was produced to assist IS technicians and engineers in the integration of Source Technologies' programmed printers with their custom MICR applications. The guide also contains information on MICR related error messages that are posted to the operator panel.

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Chapter 1- MICR Overview

MICR stands for Magnetic Ink Character Recognition. All MICR documents have a MICR line with numbers and symbols printed in a unique MICR font with magnetically chargeable ink or toner. Each character of the MICR font has a unique waveform when sensed magnetically. Financial institutions and the Federal Reserve use the MICR line to identify and sort checks. The automated processing of checks and other financial documents depends on the accuracy and the integrity of the data printed in the MICR line. Your new Source Technologies Secure MICR Printer is specifically designed to produce high quality MICR documents.

The Check Clearing System

The Check Clearing for the 21st Century Act (or Check 21 for short) was signed into law on October 28, 2003. Prior to Check 21, checks traveled through the bank's high-speed reader/sorter equipment an average of nearly seven times in the Check Clearing process. Some checks could be read up to 30 times or more by these machines.

In today's environment high and low speed check readers can capture a picture or image of the check allowing for images to be exchanged between financial institutions, the Federal Reserve, and other clearing houses. This new law, Check 21, defines what is called a "Substitute Check", and removed barriers that existed in converting physical paper checks to check images for clearing between financial institutions. The original physical check can now be truncated by the first institution that converts the check to image. The original check can now be destroyed.

United States and International MICR Standards still require the printed MICR line information to be of the highest quality, durability and be printed with magnetic ink or toner. Additionally, issues related to check fraud continue to place high importance on print quality. For these reasons, the quality and durability of information printed with Source Technologies' Secure MICR Printers remains a key product development criterion.

MICR Printing Standards in the United States Today

Congress established the Federal Reserve System (FRS) in 1913. Today most commercial banks in the United States belong to the FRS. Many other depository institutions provide banking and checking account services to the public. These other institutions, such as some credit unions, savings and loan associations and non-member banks, are not formally part of the FRS. However, they have access to the payment services it provides and are subject to many of the FRS regulations.

In 1958, because of the explosive growth of check usage, the American Bankers Association selected the E-13B MICR font and the MICR system as the technology for high-speed check processing. Today, check standards are determined by the Accredited Standards Committee X9B Checks and Backoffice Operations Subcommittee of which Source Technologies is a voting member. The latest versions of the standards and technical guidelines are available from:

Accredited Standards Committee X9
275 West Street, Ste 107
Annapolis, MD 21401
Phone: 410-267-7707
Fax: 410-267-0961

SOFTCOPIES @
www.X9.org – ANSI webstore
or <http://webstore.ansi.org>

The key standards that address check documents are as follows:

ANSI X9.100-10	Paper for MICR Documents
ANSI X9.100-20	Print and Test Specifications for Magnetic Ink Character (MICR)
ANSI X9.100-30	Optical Background Measurements for MICR Documents
ANSI X9.100-110	Document Imaging Capability
ANSI X9.100-140	Image Replacement Document - IRD
ANSI X9.100-160	Placement and Location of MICR Printing

For those with an interest or need there are also US standards that address Deposit Tickets, Check Endorsements (the back of the check), image interchange file formats, and other MICR areas.

Users of our Secure MICR Printers are not required to have access to the above standards. Our Technical Support staff maintains current knowledge of the standards and changes that affect the check industry in the US and other countries with unique requirements.

Chapter 2 - MICR Check Design

General Features of Check Design in the United States

To be a legal and negotiable document, the necessary data elements required on a check are the date, amount, payee name, payer's bank name, and payer's signature.

Other elements included in a good check design are the amount in words, account title, check serial number, fractional routing number and MICR line.

A good check design contains security features and is formatted to be easily read by both machines and the human eye. If the format is complicated, the depositor, bank employee or reader/sorter machine may make an error in reading the data.

Position and Dimension Gauge

A MICR position and dimension gauge, like the one available from Source Technologies (part number 105860), is a valuable tool for use in designing checks. During check design, check your output against this gauge to determine if the data elements (date, amount, payee name, payer's bank name, and payer's signature) are correctly positioned on your document.

Design Elements in Detail

Paper

The ideal paper for check production is 24 to 29 lb. laser bond. Source Technologies' MICR lab has evaluated paper stock from most major manufacturers and has compiled a list of products that produce superior results. Contact your sales representative for this information. For a fee, Source Technologies will evaluate your paper for proper MICR adherence and durability performance. There are also many security features available to aid in the overall security of your MICR documents. Please refer to Chapter 5, Security Issues, for more information on check stock specifications and security features.

Size

The size of check documents in the United States must be:

- 6.00 inches to 8.75 inches in length
- 2.75 inches to 3.66 inches in height

We recommend standard 8.5" X 11" letter size stock or 8.5" X 14" legal size stock for proper feeding through your ST Secure MICR Printer. The number of checks per page is determined by your application. Custom size stock other than letter or legal can be done with proper planning and application programming within the paper size specifications for the base printer.

MICR Clear Band

The MICR clear band is an area at the bottom of the check where the MICR line prints. No other magnetic printing should appear in this area on either the front or back of the document. The clear band is an area 0.625 (5/8) inches high from the bottom of the check running the entire length of the check. Exact MICR line placement in this

area is especially important. Please refer to Figure 3.1 for more information on MICR line placement.

Data Elements

Date

The date is a required data element for a check. It represents the day upon which or after which the transfer of the check amount may take place. The date is usually placed in the upper right portion of the check, so it does not interfere with the convenience amount field. The usual format is Month, Day, and Year; however, the military format of Day, Month, and Year is also acceptable.

Amount

The amount of the check is a required data element for negotiation. The amount usually appears at least twice on the check. The amount printed in numbers is called the convenience amount. The amount printed in words is sometimes referred to as the legal amount; this is the amount that applies if there is a difference between the two amount fields. The amount may also be printed a third time on the check in a secure font, intended to make alteration of the amount field difficult. Please refer to Chapter 6 and Appendix B for information on Source Technologies' Secure Numeric Font.

Convenience Amount

The convenience amount location is specified in ANSI X9.100-110. The basic location is illustrated in Figure 3.1. Since this amount can be machine scanned, its location and design should be kept within the specifications. The amount beginning with the dollar sign should be left justified within the scan area with numbers spaced normally to the right. The dollars and cents should be separated by a decimal point with the cents printed in the same size font as the rest of the field. Embedded commas should not be used. The convenience amount background should have good reflectance, so it does not interfere with optical scanning.

The convenience amount should be printed in a simple, fixed pitch font. We recommend our ICR Secure Numeric Font (see Appendix C). It was designed to be easily read by image capture equipment and is also a fraud deterrent. A fixed pitch courier font, or if available, OCR-B, are also acceptable fonts to print the convenience amount.

Note: The Source Technologies' Secure Numeric Font (see Appendix B) should not be used in the convenience amount since it is not a machine-readable font.

Amount in Words

The amount in words (sometimes called the legal amount) is normally located either above or below and to the left of the convenience amount. The area for the number in words should be entirely filled to make alterations difficult. The amount should start at the far left of the line with the words placed immediately adjacent to each other. The cents need not be written out. They may be expressed as a fraction (60/100) and

should be placed immediately to the right of the dollar amount and followed by a line or other space filler to inhibit alteration.

Example: One hundred forty-four and 62/100-----DOLLARS

Given the available area on the document, you may need to use a smaller font when printing larger value amounts.

Payee Area

The payee is a necessary data element for a negotiable document. The payee area is generally to the left side of the document either above or below the amount in words. It is often preceded by the words "Pay to the Order Of." The payee data should not enter the MICR clear band which extends 5/8 of an inch above the bottom of the check. Some financial institutions have established specific print requirements for the Payee Name and optional address. Consult your bank for details on their print requirements.

Signature Area

A signature is a required data element for a negotiable document. The signature or signatures authorize the bank to honor the check; therefore, it must match the bank's records. The signature area should be beneath the convenience amount area, but the signatures should not enter the convenience amount area or the MICR clear band. This is especially true if you print the signature with MICR toner.

Drawee Institution Name

The name of the institution where the maker's account is located is referred to as the drawee institution. The bank's name, city, and state are required.

Account Title

The account title is normally printed in the upper left corner of the check. It includes the name of the account holder and other information such as addresses, telephone numbers, and logos. The data in the title should be legible and sufficiently complete so that if the MICR data account number is destroyed, the drawee institution can refer to the account title to trace the account number.

Memo Line

This line is in the lower left quadrant of the check and is not required. Data printed here does not contain any legal significance. Printing in this area with magnetic toner should not extend downward into the MICR clear band which is 5/8 of an inch above the bottom of the check.

Check Serial Number

The check serial number is generally printed in the upper right quadrant of the check. Although the check number is not required for the check to be negotiable, the account holder and financial institution use these numbers to reconcile statements and execute stop payments. The check serial number should also appear a second time in the MICR line, and these numbers should match. The number of digits in the

check serial number is controlled by the financial institution and the MICR line format. Consult your banking institution for their requirements.


Fractional Routing Number

The fractional routing number should be printed in a fractional format in the upper right quadrant of the check. This number is assigned to identify the Federal Reserve District and drawee institution. Consult with your bank for the proper routing number and format for each of your accounts.

MICR Line

Accurate processing of your checks by financial institutions is enabled by the accuracy and integrity of the data in the MICR line. Refer to figure 3.1 for the location of the following MICR line fields. The MICR line is read from **right-to-left** with position one being the right most position proceeding to position sixty-five on the left. The MICR line must be printed at exactly eight characters per inch.


Auxiliary On-Ups Field—Positions 65 to 45

This field usually contains the check serial number for commercial size checks and possibly account control information. It is bounded by On-Ups symbols . It is not included on 6 inch in length personal sized checks.


External Processing Code (EPC) Field—Position 44

This one-digit field is position 44 of the MICR line. This field is usually left blank. The use of this field is reserved and is controlled by the ASC X9B Standards Committee.

Routing Field—Positions 43 to 33

The routing field is bounded by Transit symbols  in positions 43 and 33. It contains fixed format information about the drawee institution. Consult with your bank for the specific data field to be placed here for each of your accounts.


On-Ups Field—Positions 32 to 14

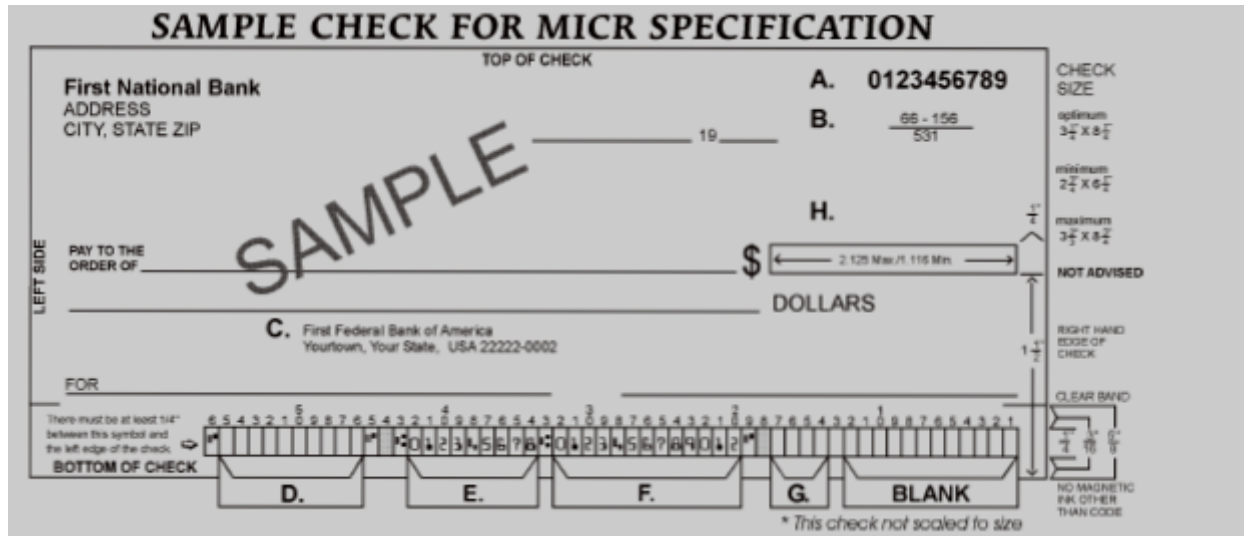
The On-Ups field contains the makers' account number. The structure and content of this field is left to the drawee bank. On personal checks this field also contains the check serial numbers. The On-Ups field may not consist of more than 19 characters. An On-Ups symbol  must appear immediately to the right of the account number.

Blank Field—Position 13

Position 13 is always left blank.

Amount Field—Positions 1 to 12

The amount field is the right most field in the MICR line. It is not required to be preprinted on a paper check when issued. When the check enters the banking system, the bank of first deposit reads the data in the convenience amount field and might encode the amount data to this field. Now that checks are converted to images the Amount Field is optional. If present it must be bounded by Amount symbols .



- A. **Serial Number:** Must be in the upper right corner and match the serial number information in the MICR line (see D for further explanation).
- B. **Fractional Routing Transit Number:** As shown in this example to be in the upper right corner, the field should duplicate the data the routing number in the MICR line except for the state prefix number (ex. 66 = NC, 67 = SC, 64 = GA, etc.) and any preceding zeros.
- C. **Bank Name, State, City:** The bank logo is optional. Name of bank, city, and state where the account will be assigned/opened are required fields.
- D. **Aux On-Ups (46-55):** This is a required field if the customer desires the services offered by the bank which require a serial number. The serial number format is controlled by the payer's bank. A & D information should match.
- E. **Routing Number (34-42):** Designates the Federal Reserve district and financial institution. Each city, state, or region that the bank serves has a unique institution identifier.
IMPORTANT: positions 35-42 are the Routing Numbers; position 34 is the check digit for the field.
- F. **Account Number:** This is a unique number assigned to the customer's account.
- G. **Optional Serial Number:** Used for personal sized checks, this normally is a 4-digit, zero-filled field that matches the serial number in the upper right corner. As shown in this example, the field is to the right of Account Number F. Some depository banks may require this Serial Number to be to the left of field F.
- H. **Convenience Amount Area:** should be in the general location shown above in the diagram. The illustrated box in the diagram is optional and if used, should conform to ANSI X9.100-110. A single vertical stroke dollar sign is required.

Chapter 3 - MICR Quality Control

A high quality MICR document can be read by bank reader/sorter equipment many times with no readability issues and does not result in damage to bank equipment. This quality is the result of a well-designed printer, an originally manufactured MICR toner and high-quality check stock.

MICR Printing Supplies

The ST98xx and ST99xx families of Secure MICR Printers has two replaceable MICR supplies components relative to printing MICR documents. Both components must be MICR capable units and be installed in the printer as a paired set.

MICR Cartridge

ST MICR cartridge has a normal and high-capacity version. A new printer ships with a normal version installed, except for the ST9817 and ST9917 which ships with a 1.5K (1500) page starter cartridge. Both normal and high-capacity versions can be ordered for replacement and both work in all ST98xx and ST99xx Secure MICR single and multipurpose printer models.

The cartridge yield claim is based on printing pages at an average print coverage of 5% in continuous printing mode. The yield claim has been certified by the procedures governed by the International Standard ISO 19752.

The actual cartridge page yield in a customer's printing environment will vary depending on the actual print coverage percentages being higher or less than the 5% coverage estimate, and to a lesser degree by the average pages per print job. Printing applications that are more transactional vs. production type printing incur a slight increase in toner waste. Actual coverage percentages and job size data is internally tracked in each printer and is available in the Device Statistical information that can be printed out or displayed through the printer's internal webpage. The same tracking data is also used to calculate the supplies usage gauge available at the printer's operator panel.

Our ST98xx and ST99xx printers also use this actual internal toner usage tracking data to control when the Toner Low alarm level occurs. Prior to the ST98xx we used a percentage remaining to indicate when to issue a Toner Low message to the operator panel or to any central site printer management system. A preset percentage of 10% remaining might be a 1 to 2-day warning or as much as a 1 to 2-month warning based on the normal daily print volume.

By adding calendar data to the tracking data, we now can provide a 10-day Toner Low alert forecast to when the cartridge will be empty and needs to be replaced. The alert is totally based on the customer's actual usage, by printer, by location. The alert method is called "Smart Notification." The last 32 days of actual data is used in the method allowing us to respond to increases to decreases in daily page volumes over time.

When the printer senses the cartridge is actually empty, it will stop and indicate the printer needs a new cartridge. It will also calculate and indicate the number of pages that remain until the cartridge **MUST** be replaced to continue printing. The pages remaining are again based on the internal usage data and a safe amount of toner that can be depleted from the Image Unit's internal toner reserve. These pages remaining will count down to zero and be visible on the operator's panel. When the count reaches zero pages remaining, the cartridge must be replaced.

Note: Replacing the cartridge before the count reaches zero does not waste any toner. The cartridge was empty when the countdown began, replace it at your convenience.

MICR Imaging Unit or IU

The imaging unit contains most of the components needed to transfer an image to paper. The unit also contains a Refuse Bin for storing any waste toner cleaned from the photoconductor or OPC. In terms of component wear and waste capacity, the IU useful life should be near 45K or 45,000 pages or sides. The 45K is based on an average print coverage of 5% and an average print job size of three pages or page sides. Lower actual average print coverage and/or a larger average page count per job may slightly increase the useful life of the IU. Higher actual average print coverage above 5% and/or a smaller average page count below three will shorten the useful life. Internally, the printer automatically adjusts unit alarms or replacement alerts based on the actual printing factors. If the actual print averages extend the useful life beyond the 45K page forecast, the printer will not exceed 50K due to wear factors for the OPC. The printer will stop printing and request a new unit to be installed to continue printing.

The actual first Warning to replacing the IU is based to the actual printing coverage, pages printed and actual average pages per print job. The maximum number of pages allowed to when the IU **MUST** be replaced is 5K pages beyond the first Warning. At the first Warning, selecting Continue will allow additional pages to print. To understand this better, assume the actual first Warning occurs at or near 43,000 pages due to the printer's actual print job data. Selecting Continue will allow another 5K to be printed, an actual maximum of 48K to when the IU **MUST** be replaced, not the 50K maximum mentioned above. Further, a highly transactional print environment that averages near one page per job might trigger the initial Warning before 40,000 pages due to excessive transport rotations per page and wear factors. Selecting Continue will still provide an additional 5K to a total near 45K to when the IU **MUST** be replaced.

The actual print environment in terms of actual print coverage percentages, job size averages, and pages printed are all used to determine the initial End-Of-Life Warning and used to determine the usage gauge accuracy. If the gauge looks like the IU is about one half used, that is an accurate assessment based on current data.

Interchanging MICR and non-MICR Components

For non-MICR print jobs the MICR cartridge and IU could be replaced with standard Lexmark components. Both units must be swapped as a pair. A "mismatched cartridge and imaging unit" error will occur if only one component of the pair is interchanged. Extra care should be taken with protecting components from damage when not

installed in the printer. All internal end-of-life tracking information is kept separate for all components in the printer and on data chips in the individual units.

Note: The ST9815 only supports MICR components in our standard configuration.

Printer Features

Your secure MICR printer is equipped with features to ensure high-quality MICR documents.

Paper Type

When the printer senses the presence of a Source Technologies' MICR toner cartridge, internal operating points that affect the print engine and fuse grade are optimized for MICR documents and the MICR toner. For the optimum MICR quality we recommend that the printer paper trays with check paper have the Paper / Texture / Weight settings set to Bond / Rough / Heavy, or to Custom / Rough / Heavy. See the base printer's User's Guide regarding paper tray settings.

Print Density

For optimum MICR quality and maintaining compliance to the check printing standards, the Print Density should be set to density 8, the default value, when printing MICR documents. If the Print Density is changed, our Density Control feature will return the value to the default 8 setting.

MICR Toner

Use only Source Technologies' MICR toner when printing MICR documents. It is specifically designed to print quality MICR documents with your printer. The printer's MICR toner sensor is designed to work with Source Technologies' MICR toner cartridge to prevent printing checks with regular toner present.

Source Technologies does not recommend the use of refilled or remanufactured MICR toner cartridges. Refilled cartridges may result in expensive printer repairs and bank check reject fees due to an inferior MICR toner formulation.

MICR Check Stock

Check stock has a significant impact on the resulting quality and security of your MICR document. Here are a few features that should be considered when selecting a check stock. Please see Chapter 5: *Security Issues* for more information on check stock security features.

Quality

Quality MICR check printing with your Source Technologies' secure MICR printer requires check stock that matches the printer's requirements. We have a Check Stock Guideline document that we maintain that is detailed and includes recommended paper manufactures. Contact your Sales Representative or our Tech Support for a

copy. Source Technologies can supply paper specifically made for our printers. If you wish to order check stock from other suppliers, please show the following requirements to your sales representative. We will evaluate other supplier papers for a nominal fee.

Layout

Layout your check design before any paper is purchased or layout your design to existing check stock. Keep perforations, orientation, special logos, and any color elements in mind. The printer can print just about anything if it is black.

Weight

We recommend 24 lb. - 29 lb. paper.

Stiffness

We recommend Taber M.D. 2.5 and C.D. 1.1 minimum.

Smoothness

For the best toner fusing, we recommend rougher surfaces within the base printers' specifications, and the Paper Specifications for Checks, X9.100.10. We recommend a smoothness range of around 100 to 200 Sheffield.

Paper Grain Direction

When using 24 lb. - 29 lb. bond paper we generally support either long or short paper grain. Overall performance in the bank's MICR equipment is best when the resultant grain direction is left to right when viewing the check.

Perforations

All perforations in the stock should be Laser-Cut or Micro-Perfs (20 or more cuts per inch). Larger perforations can produce excessive paper chaff that might result in damage to the toner cartridge or IU resulting in print quality problems. Perforations should be ironed or flatted by the paper supplier to reduce nesting and potential double-feeding from the printer's paper trays.

Moisture

The paper moisture content should be between 4.7 and 5.5%. Storage conditions have much to do with the final moisture content of most papers. Store your check stock in a cool, dry, environmentally stable, and secure area. Protective wrappings should be removed just prior to use.

Other Paper Concerns

Some 24 lb. bond papers have chemical additives to produce high reflectance levels. We recommend reflectance be kept at a maximum of 92% for any paper used in a MICR printing application. i.e., Checks, Deposit Tickets, or other MICR documents

Chapter 4 - Security Issues

Printing negotiable documents from blank paper on desktop MICR laser printers makes security a top priority for any company embarking on a desktop check printing project.

Combating fraud is a moving target. As soon as a new weapon is developed, malicious forces are at work to devise workarounds to it. Good security programs integrate hardware, software, your employees, processes, and your financial institution into a secure check production system. The ultimate liability for fraudulent documents rests with the banks and their customers, and there can be many vulnerable points throughout the overall system. Customers must have systems designed and documented to show "Ordinary Care and Good Faith Effort" is in place to avoid liability. In the past, financial institutions generally credited corporations when fraud was discovered. Today, regulations attempt to define who may have been negligent in the transaction and put the liability on that party or parties. If a fraudulent occurrence can be traced to a corporation's lack of security procedures or the design of their negotiable documents, the regulations will protect the banks, or in the best case the loss will be shared.

The following internal and external security measures will help minimize your risk of check fraud.

- A. Stay abreast of current check fraud methods and the latest in fraud detection. Many financial institutions offer seminars to educate corporate clients.
- B. Financial institutions should train tellers to look at the check, not the person presenting the check. The check, not the person, is the item that must be verified.
- C. Incorporate security features into your base check stock and utilize printed security features that address both alteration and counterfeiting of original items. We have found the following check stock security features to be of merit:

Artificial Watermarks - White on white printing generally on the back reveals words or patterns when held at an angle. You should state on the front of the check that this feature is present.

True watermarks are valuable but more costly. Some true watermarks that are embedded into the front of the document can interfere with the print quality and durability of the printed image. We recommend true watermarks be only present if embedded on the back side, the wire side, of the MICR document.

Laid Lines - Background lines that make cut and paste alteration difficult. These are normally printed on the back of the check.

Fuse Enhancing Additive - Coatings or additives to the paper that improve the bonding of toner to the paper. This helps prevent altering of critical data such as the amount, or payee name.

Chemical Additives - If an ink eradicator (bleach, acetone, etc.) is applied to the document, the eradicator creates a permanent stain.

Numbered Check Stock - Sequential numbering printed in dye that penetrates to the reverse side of the check can be used to verify authenticity. This also provides for inventory control of blank check stock. This number should not be linked to or be equal to the check serial number due to the potential of double feeding in laser printers.

Note: These features serve as a general guide for check security. You should not consider these features as an all-inclusive list. We recommend consulting with your paper supplier for any additional comments or suggestions.

- D. Firms accepting checks should be aware of damaged MICR lines. Intentionally damaging the MICR line can increase the time necessary to process an item, giving the forger enough time to leave town. Discoloration anywhere on the check could be an indication of alteration as well.
- E. Safeguard check stock paper, and limit access only to necessary employees.
- F. When generating final negotiable items, we recommend:
 - 1. The document always includes the amount value in words.
 - 2. The document should not include information that limits the value range, i.e. "Not valid over \$500." This only guides the fraudulent attempt. Use your application software to detect out of range items.
 - 3. All levels of hardware and software password protection should be utilized.
- G. Understand and approve the security procedures of your check stock suppliers to safeguard stock in their custody.
- H. Consider "Positive Pay" check services from your financial institution. You should provide the check number, check date, dollar amounts, and sometimes the payee name to your bank when checks are issued. The bank will match these values and alert you to mismatches before clearing the check to your account. Financial institutions should encourage full participation of corporate clients.
- I. Move methods of fraud detection to the item's point of entry into the clearing system. For example, low-cost readers can detect low magnetic strength in the MICR line which is a good indication of attempts to copy an original.
- J. Review and document your internal negotiable document printing procedures. Investigate employee backgrounds before assigning security authority. Split the responsibilities. For example, an accounts payable production/security officer should also not balance the account.

Chapter 5 - MICR Features

Source Technologies' secure MICR printers are designed to allow both general office document printing and secure MICR document printing. You may print a variety of conventional jobs with regular Lexmark toner using all the printer features available such as network printer utilities. Source Technologies' printers support multiple printer languages (for example - HP's PCL5 & PCL6, PostScript Level 2 emulations). The MICR features require the PCL5e print data stream. Source Technologies has designed features to enhance these printers with MICR mode specific operation that allows you to securely print high-quality negotiable documents.

Note: The features below are included in all ST98xx and ST99xx printers except the ST9815. If a single MICR application data stream to all printer models is needed, use PJL Based MICR Commands described in Appendix G.

MICR Mode

Your secure MICR printer has two operational states: normal and MICR mode. When the printer is in normal printing mode, MICR resources cannot be accessed. Once the printer enters MICR mode your secure resources become available, and the printer begins the process of confirming readiness to print a negotiable document. There are two conditions which must be met before MICR mode is activated:

The printer must receive the correct password command.

If the front panel combination lock feature has been activated, the correct eight-digit combination must be entered from the front panel.

MICR Fonts

The E-13B and CMC7 MICR fonts reside in the printer. Examples of these fonts are in the Appendix of this manual. They can only be accessed after MICR mode is activated by your software. A MICR toner cartridge must be present to print the MICR fonts.

Secure Fonts

Two Source Technologies-designed fonts are also resident in your printer: Secure Numeric Font and ICR Secure Numeric Font. Examples of these fonts are in the Appendix of this manual. Like MICR fonts, these secure fonts can only be accessed after MICR mode is activated by your software.

- The ICR Secure Numeric Font is designed for the convenience area of your check. It can be read by the imaging equipment used by many financial institutions.
- The Secure Numeric Font should not be used in this area since the reverse image aspect of this font prevents it from being read by this equipment.

We recommend using both fonts on your checks as they are designed to deter check fraud. An example is shown in figures 6.2 and 7.2 later in this guide.

Micro Print

Your secure MICR printer also contains the Micro Print font. Micro Print is text less than .010" tall. It can easily be read with a magnifying glass but appears to be a solid line to an unaided eye. This font provides protection against reproduction by most scanners and copiers because they cannot successfully print the tiny letters.

Most check printers use this font in the signature area of their preprinted checks. We recommend using this font to help deter check fraud. The text in this font can either be fixed, such as the name of your organization, or it can be variable, such as the check amount and payee name. The use of variable text provides an additional method of protection against check counterfeiters.

Use of the "MP" designate symbol, to identify the line as Micro Print, is optional. If the symbol is printed, this would aid in locating the Micro Print field by anyone inspecting the document for acceptance. If the symbol is not printed, the Micro Print field could be a covert feature that only a knowledgeable individual would inspect.

The Micro Print font only contains alphanumeric characters. Punctuation marks and spaces in the field print data are ignored and do not print.

Bi-Directional Feedback

Your secure MICR printer can provide MICR status messages to the check printing application. The application can get information on MICR settings such as toner cartridge type (MICR or regular), locked trays, and audit trail settings. The printer can send the application MICR error messages such as "Load MICR toner."

When the printer receives the "@PJL INFO STVARIABLES" command it will report all MICR settings to the host. The MICR settings can also be seen on the menu settings report (select Reports > Menu Settings Page on the printer's front panel or Embedded Web Server). The last page of this report shows the current MICR settings.

If USTATUS DEVICE=On, the printer will report PjL error 40020 for any MICR error which causes the printer to go off-line. It will appear in this format:

```
@PJL USTATUS DEVICE
CODE=40020
DISPLAY="MICR Password Error Press Go"
ONLINE=FALSE (formfeed---HEX 0C)
```

The code will always be 40020, only the display line will change to indicate the specific error.

Resource Storage

Check-related resources, such as form overlays and signatures, are stored in your printer with unique identification numbers. ID numbers must be less than 32767. Number 5001 is reserved for the Audit Trail overlay. Your secure MICR printer has two areas where you may store these resources: flash and RAM memory.

The ST98xx secure MICR printer has 749 megabytes of resident flash memory. It is user-managed, and its resources can be designated as “secure” or “unsecure.” Secure resources are loaded to flash with the STL command and have ID numbers greater than or equal to 10,000. They can only be accessed by using the STP command when the printer is in MICR mode. Unsecure resources do not require a password and should be assigned an ID number less than 10,000. Resources stored in flash memory are not deleted when the printer is powered off. Flash memory is also used for audit trail features.

Storing resources in RAM is also an option. Because resources in RAM are deleted when the printer is powered off or reset, they may need to be loaded frequently. Resources stored in RAM cannot be password protected.

We recommend storing all check-related resources in secured flash memory.

MICR Menu

Your secure MICR printer contains a front panel menu specific to some of the MICR features. The MICR Menu settings will print with the base printer’s Menu settings. To view and select MICR values or features: with the printer in a Ready state, select Settings, then move down to MICR Menu and Select OK.

MICR Menu displayed options listed.

Audit Menu

- Record Sorting
- Overlay
- Sum Field 4
- Print Report

Setup Menu

- Hex Transfer
- Density Control
- MICRpoint
- PDF 417 Processing

Demo Menu

- MICR Font Demo
- Starter Checks
- Accounts Payable
- Cashier’s Check

Use the arrow buttons on the front of your printer to navigate through the menu options. Press the OK button to select an option. A checkmark indicates the current setting.

The Audit Menu deals with the optional Audit Trail Report settings. See chapter 7 for more information.

Setup Menu

Hex Transfer and Density Control are normally reserved for Source Technologies' Technical Support.

MICR point is a feature that allows for fine positioning of the MICR line by the operator.

PDF Processing can be turned ON to print PDF417 barcodes using a subset of prescribed commands.

Demo Menu has four options that print sample documents using the internal MICR and Security fonts. MICR line characters can be scanned in MICR test equipment for quality and magnetic properties assessments of the internal fonts.

Entering MICR Mode

To print MICR documents, your secure MICR printer uses special alphanumeric text commands called MICR Mode commands.

There are two different commands which activate MICR mode printing: `&%STFPASSWORD$` and `&%STHPASSWORD$`. `&%STF` is the default command and is recommended for most applications.

To use the `&%STF` command, it must be entered at the beginning of the job data stream. The `&%STH` command can be entered anywhere prior to accessing secured resources.

The `&%STH` command is not as powerful as the `&%STF` command because it does not set as many parameters for MICR printing. Both commands and descriptions are as follows:

`&%STF` Command

When entering MICR mode with the `&%STF` mode, the printer will:

- Check to see if the proper front panel combination has been entered (when enabled).
- Allow access to secure check printing resources such as MICR and secure fonts.
- Allow access to protected signatures, overlays, logos, and other important resources stored in password-protected, nonvolatile, flash memory.
- Display "MICR Mode Active" on the printer's front panel.
- Disable the printer's front panel menu system.
- Set printer resolution to 600 dpi for printing MICR fonts.
- Disable jam recovery.
- Set the copies parameter to 1.
- Turn hex transfer ON.

Note: The `&%STF` command must be entered at the beginning of the print job before any other print data is received.

&%STH Command

The &%STH command does not set up the printer to check printing activity as completely as the &%STF command mode. This alternate MICR mode command forces the user to manually program some commands through their host application. It is used when programmers cannot place &%STFPASSWORD\$ at the beginning of their job. Use the &%STH command if you experience page ejects while in &%STF mode.

When entering MICR mode with the &%STH command, the printer will:

- Verify if the proper front panel combination has been entered (when enabled).
- Allow access to secure check printing resources such as MICR and secure fonts. It also allows access to protected signatures, overlays, logos, and other important resources stored in password protected nonvolatile flash memory.
- Turn hex transfer ON.

Note: The &%STH command can occur within a data stream after the page has started. The &%STH command, unlike the &%STF command, can be issued anywhere on the page.

MICR Mode Commands

Password Command &%STFPASSWORD\$ or &%STHPASSWORD\$

&%STF or &%STH	Lead in sequence
PASSWORD	User defined password, 8 characters, case sensitive, unprintable characters allowed. Factory default is PASSWORD. See also New Password Command.
\$	Command terminator

MICR Definition Command &%SMCPxxxx\$ (optional)

&%SMCP	Lead in sequence
xxxx	MICR count, the number of MICR lines to be printed during this print job. (4 bytes in hex)
\$	Command terminator

Example: &%SMCP0010\$

This command prints 16 (Hex 10) MICR lines before disabling MICR mode. This command defines how many MICR lines may print in the current job. When the count decrements to zero, MICR mode is terminated.

Set New Password Command	&%STExxxxxxx\$
&%STE	Lead in sequence
xxxxxxx	New password, must be 8 characters either printable or non-printable. Dollar (\$) sign is an invalid password character.
\$	Command terminator.

To set a new password, the current password must first be sent.

Note: Errors made in sending the new password command could lead to setting it to an unknown value. If the Password is unknown the printer must be returned to Source Technologies to be reset to PASSWORD.

Activate/Set Front Panel Combination Lock	&%STSxxxxxxx\$ (optional)
&%STS	Lead in sequence
xxxxxxx	Eight-digit sequence, valid characters 0-9
\$	Command terminator

This command sets and activates the front panel MICR combination lock. If this feature is activated, MICR mode cannot be entered until the front panel combination is entered correctly. All MICR features will be inaccessible until this combination is entered. Sending an &%STS command and eight zeros deactivates the security lock.

Note: If the front panel combination is set and then forgotten, the printer must be returned to Source Technologies for the combination to be deactivated.

Print MICR E-13B Font	&%SMDddd...ddd\$
&%SMD	Lead in sequence
ddd...ddd	Data to be printed in E-13B MICR font
\$	Command terminator

This command prints the specified data in the E-13B MICR font which is used in the United States, Canada, Mexico, and other countries throughout the world. The correct spacing begins at the cursor position modified by the MICR point adjustment setting at the start of the command. After the terminator is sent, the printer is returned to its default font. After each Print E-13B command, the MICR count is decreased by one. Upon receiving this command, the printer will verify that a MICR toner cartridge is installed and set the copies parameter to 1. See Appendix A for MICR E-13B font character mapping.

Print MICR CMC7 Font	&%SM7ddd...ddd\$
&%SM7	Lead in sequence
ddd...ddd	Data to be printed in CMC7 font
\$	Command terminator

This command prints the specified data in the CMC7 MICR font which is used in Europe and South America. The font and its correct spacing begin at the current cursor position modified by the MICR point adjustment setting at the start of the command. After the terminator is sent, the printer will return to its default font, and the MICR count will be decreased by one. Upon receiving this command, the printer will check to ensure a MICR toner cartridge is installed and set the copies parameter to one. See Appendix B for CMC7 character mapping.

Print Secure Numeric Font	&%SMFddd..ddd~
&%SMF	Lead in sequence
ddd...ddd	Data to be printed in this font
~	Command terminator

The dollar sign (\$) is not a command terminator for this command. For both security fonts the tilde ~ (hex 7E) is the command terminator since the dollar sign is a valid character.

Print ICR Secure Numeric Font	&%SMIxxxxxx~
&%SMI	Lead in sequence
xxxxxxx	Data variables to be printed in this font
~	Command terminator

Print Micro Print Line	&%SMMxxxxxxxxx!\$
&%SMM	Lead in sequence
xxxxxx	Data to be printed in this font
!	MP designator (optional)
\$	Command terminator

If the exclamation point (!) is used, the "MP" designate will print just above and to the right of the last character. This is optional and is typically used to notify the check recipient of the presence of Micro Printing (Only 0-9, A-Z [upper and lower case] print). Special characters and spaces will disappear in the printed field.

Load Flash Resource	&%STLxxxxxyyyzdd....dd
&%STL	Lead in sequence
xxxxx	Resource number in decimal, must be 5 digits
yyyyyy	Byte count of resource file in Hex, must be 6 positions
z	Format of the resource file S = Single byte binary format D = Double byte text format
dd...dd	Flash resource file. e.g., forms overlay, signatures etc.

Resource number values may be between 00001 to 32767. Values of 10,000 and above are password protected and will require the user to enter MICR mode with a valid password before they can be unlocked with the STP command. Values below 10,000 will be unsecured.

Resource number 5001 is reserved for the Audit Trail overlay. Please see chapter 7 for more information.

Format Flash Memory	&%SFF\$
&%SFF	Lead in sequence
\$	Command terminator

This command formats flash memory. A valid password command must precede this command.

Note: All flash contents will be lost. This includes all electronic forms, signatures, logos, etc.

Secure Flash Resource Unlock Command	&%STPxxxxx\$
&%STP	Unlock flash resource command
xxxxx	Flash resource number, must be 5 digits
\$	Command terminator

This command unlocks a secure flash resource.

Tray Lock Command	&%STTL#\$
&%STTL	Lock tray command
#	The tray to be locked (choose from 1, 2 or 3 only)
\$	Command terminator

This command prevents other applications from accessing a particular printer paper tray.

Tray Unlock Command	&%STTU#\$
&%STTU#	Unlocks tray
#	The tray to be unlocked (choose from 1, 2 or 3 only)
\$	Command terminator
Tray Swapping Commands	&%STTSON\$ / &%STTSOFF\$
&%STTSON	Turns tray swapping on
&%STTSOFF	Turns tray swapping off
\$	Command terminator

This command allows the user to redefine the PCL values for Trays 2 and 3 to allow software and operational consistency with older printers in the system. Swapping ON causes any <esc>&l4H to be replaced with 5H and vice-versa.

DES and AES Decryption

Data Encryption Standard (DES) and the Advanced Encryption Standard (AES) are both supported in the Source Technologies secure MICR printers.

DES originated at IBM in 1977 and was adopted by the U.S. Department of Defense. The controlling standards for DES are ANSI X3.92 and X3.106 and in the Federal Information Processing Standard (FIPS) 46-3 standard. An alternative to DES, called Triple DES, is not supported in Source Technologies' secure MICR printers.

AES is documented in a FIPS standard, FIPS 197, dated 11/26/2001. Three key sizes are documented in the standard, 128-bit, 192-bit, & 256-bit. We currently only support the most used 128-bit key size.

The algorithm selected for AES is Rijndael. Developed in Belgium, an English pronunciation alternative is "Rain Doll." In addition to U.S. Government implementations, it is anticipated that AES will be adopted by businesses, organizations, institutions, and individuals outside of government, and outside of the United States as was the case for DES.

Encrypted printer data streams can be decrypted using the key stored prior to the message. New key settings can be encrypted with the current key to avoid clear-text transmission of the new key. Only one DES and one AES key exists at any one point in time. Old keys are not saved. To change either a DES or an AES key requires the MICR Password Command.

The secure MICR printer does not have any capability to encrypt a return or Bi-directional message.

Decryption Commands

Decryption requires printer processing overhead. In our testing encrypted printer data streams near or below 100K bytes per page do not seem to affect printer speed in terms of pages per minute or first page out timings. Some testing done with print files from 500K to 1 MB per page revealed up to a 30% degradation in speed. It is therefore recommended the encryption be reserved for the confidential portions of the data when large file sizes are anticipated.

Set DES Decryption Key Command – `&%STSETDESKEY<16 Hex Characters>$`

The command requires a MICR Password Command to be sent prior to the Key Command. The Key Command could itself be encrypted and then decrypted in the printer. The command requires the key data to be in a double-byte hex format. The 8-byte value must be converted to the 16-byte format. The only values that can be contained in the 16 command bytes are 0 through 9, and A through F. Alpha key characters can be upper or lower case. Command characters must be upper case. Here is an example of a valid key command - `&%STSETDESKEY5f00FF7E3DA938eb$`. The key value remains in the printer until another key command is received. Printer power cycles and printer reset commands do not affect the key value.

The dollar sign (\$) is the command terminator and is required.

Set AES Decryption Key Command – `&%STSETAESKEY<32 Hex Characters>$`

The command also requires a MICR Password Command to be sent prior to the Key Command.

The AES key is twice the length of the DES key but is in the same hex character format representing the 16 byte or 128-bit key value.

Turn DES Decryption ON – `&%STDON$`

Turn AES Decryption ON – `&%STAON$`

All data following the \$ command terminator will be decrypted using the current key value stored in the printer and the DES or AES algorithm. Decryption continues until a Decryption OFF command is received, a printer panel reset occurs, or printer power is cycled. Printer software language resets do not stop decryption.

Turn DES Decryption OFF – `&%STDOFF$`

Turn AES Decryption OFF – `&%STAOFF$`

The OFF command resides within the encrypted data and must also be encrypted. The OFF occurs after an 8-byte block (DES), or 16-byte block (AES) is received and decrypted. The last block containing the OFF should either have the command right justified or padded out to the block boundary. Any padding bytes after the \$ command terminator will be discarded.

Custom Character Conversion Command

The Custom Character Conversion Command can be used to resolve some problems in printer data streams. An example might be to remove a special command character in an existing data stream that was used by your previous printer hardware. Without changing your data stream, these special characters can either be removed, converted to Nulls, or converted to other sets of data to accomplish what is required.

An example of this might convert a Skip Command used by an older generation printer to multiple Carriage Return / Line Feed commands. You could also store a PCL5 command in the SIMM and call it with one character in your data stream. Only one type of conversion is permitted at any point in time, but the function can be modified within a data stream multiple times.

The conversion information is stored in NVRAM and is retained through power-off / power-on cycles. This means you could send the command one time and all future print jobs would be converted. Special precautions are required if printer fonts and macro's are downloaded to your printer. This might require you to disable the function during downloads and re-enable prior to your print data.

`&%STCxx[yy...]$\`

`xx` is a double-byte character to convert - the following characters are not allowed:
&, %, S, T, C and \$.

`yy` is a double-byte string to convert to - can be 0 to 16 characters long

`$` command terminator

Example:

`&%STC1E0D0A$\` – sets the convert character to 1E - the printer will replace any 1E character in the data stream with 0D 0A (carriage return, line feed)

`&%STC1E$\` – replace 1E with nothing - simply removes all 1E characters from the data

`&%STC00$\` – turns character conversion off

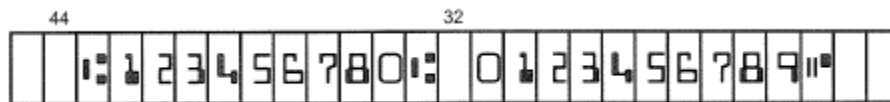
MICR point Feature

Fine positioning of the MICR Line characters is accomplished using the MICR point feature. The feature only works with the SMD & SM7 MICR Print Commands using the printer's resident MICR fonts.

The exact location of the entire MICR Line can be moved left or right, up, or down by the printer operator through the printer's front panel. Only the MICR Line is moved. All other printed information is not affected. This allows the operator, using a MICR Positioning Gauge and the MICR point feature, to precisely locate the MICR characters on the specific printer in use to address slight print location variances.

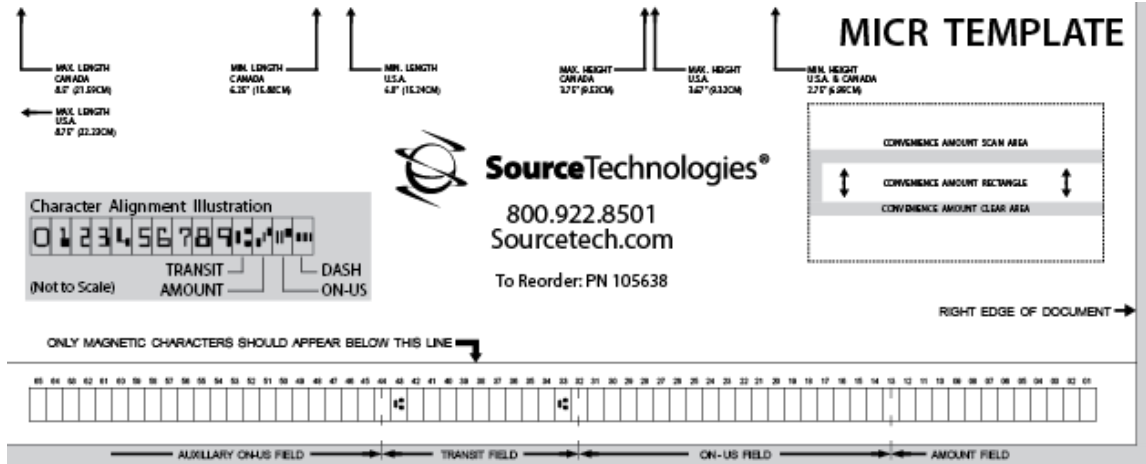
Each value entered by the operator is equal to 1/10th of a Point, a decipoint (720 Decipoints = 1 inch). The maximum value that can be entered is +/- 99 Decipoints allowing the entire MICR Line to move up or down, left, or right a maximum of 0.1375 inches from the print data stream's intended location.

The figure below shows proper MICR character placement using a MICR Positioning Gauge. The best location has the right side of the characters at or near the right edge of the location boxes. An operator may have to choose a compromise location that best addresses the entire line.



To enter MICR point values, access the MICR Menu through the operator panel, select the SETUP MENU, and then select the MICR point Adjustment feature. Horizontal and vertical options are displayed. It's through these horizontal and vertical options we can enter maximum value of 99 and choose + / -. A + horizontal value moves the characters to the right. A + vertical value moves the characters down.

For instructional value, assume the current MICR point values are at 0, the default values. For best positioning from using a gauge and the current printed output, the MICR line needs to move up about 1/20th of an inch, and to the right $\frac{1}{4}$ of the typical character width. The MICR character 0 is 0.091 inches wide. Move the line up 36 decipoints and to the right about 15 decipoints. While in the MICR Menu with MICR point adjustment selected, select Horizontal. There should be two values: first a +/- choice followed by some value. In this case, it is 0 or Default. To Move horizontal 15 points, use the UP/DOWN arrow keys to select +, a positive value. Then press the RIGHT arrow key. Using the printer keypad, enter 15. Then select the OK key to save the values. Again, from the Horizontal / Vertical options, use the UP/DOWN arrow keys, and OK key to enter Vertical values. To move the MICR line UP requires a - or negative value. Use the UP/DOWN keys to select -, and then use the RIGHT key to enter a value. In this instructional case it is 36. Using the keypad enter 36. Select the OK key to save the value. The values are stored in internal FLASH memory in the printer and will remain the same until changed by the operator. Power ON/OFF cycles do not reset the values. Assuming the measurements are correct, when test or production checks are printed, the MICR Line should now be at the new location on the page.



If you wish to utilize the MICR point feature of your printer, please call Sales Support at 1-800-922-8501, and have your printer's serial number readily available to receive the MICR Positioning Gauge (shown above). The Positioning Gauge will be sent to you free of charge.

Chapter 6 - Host Programming Features and Examples

Hex Transfer

The Hex Transfer feature allows the user to send PCL escape sequence printer commands to the printer with simple text strings. You may send any valid command or string of commands with no limit on the length or complexity. Form macros, signatures, or simple commands may be passed through any platform to the printer since they are simple text. The printer will convert them back to ESC (escape) sequences when they arrive at the printer. Hex Transfer is automatically enabled while in MICR Mode. To enable it for all applications, use the following commands:

Turning Hex Transfer On

To enable Hex Transfer, send the following command:

```
&&??&%
```

Once Hex Transfer is enabled, the character sequence &% will function as a trigger sequence. Any data following these trigger characters will not be printed and will be treated as Hex Transfer data until the Hex Transfer ending character \$ is encountered.

Turning Hex Transfer Off

To turn Hex Transfer off, send the following command:

```
&&?!!
```

This command will clear the trigger sequence and allow the &% characters to print. This clear command may be sent at any time to assure that Hex Transfer is disabled. When MICR Mode is entered, Hex Transfer will automatically be turned on, and when MICR Mode is exited, Hex Transfer will be turned off unless it has previously been activated outside of MICR Mode with the &&??&% string.

Hex Transfer Examples

&&??&%	This command enables Hex Transfer On
&%1B 26 6C 34 48 \$ -or- &% 1B \$& l 4H	Sends the PCL Esc sequence– <Esc>&l4H –which is a paper source command identifying the tray from which the paper will be pulled.
&% 1B 45\$ -or- &% 1B \$E	This command is a printer reset PCL command which consists of the Esc character and printable E character. It may be sent by simply putting the Esc character in Hex.

Note: Hex Transfer can now be set ON or OFF via the MICR Menu. Please review Section 6, MICR Menu for more information.

Figure 6.1 MICR Mode Command Example

The following example shows the MICR Mode commands and Hex Transfer commands in use. This data stream would print the check on the following page (assuming the check macro and the signature are loaded as flash resources).

```

& % S T F P A S S W O R D $      & % S M C P 0 0 0 1 $
& % S T P 1 0 0 0 1 $      & % S T P 2 0 0 0 0 $
& % 1 B 2 6 6 C 3 1 7 8 3 0 7 3 3 1 6 8 3 2 6 1 3 6 6 3 4
6 3 0 6 F 3 1 6 5 3 1 6 C 3 7 2 E 3 3 3 0 4 3 1 B 2 6 6 1 3
0 4 C 1 B 2 8 7 3
3 1 3 0 4 8 1 B 2 6 6 B 3 1 3 0 2 E 3 0 3 0 4 8 1 B 2 6 6 6
3 1 3 0 3 0 3 0 3 1 7 9 3 3 5 8 $

          1000
200      Vendor Systems

October 5, 2005

    99999  Oct 1 05      1000.00      20.00      980.00
1234567  Oct 2 05        200.00        4.00      196.00
136784   Oct 3 05        800.00       16.00     784.00
555555   Oct 3 05         55.55         1.11      54.44

                                2055.55                41.11                2014.44

1000
200      Vendor Systems

October 5, 2005

    99999  Oct 1 05      1000.00      20.00      980.00
1234567  Oct 2 05        200.00        4.00      196.00
136784   Oct 3 05        800.00       16.00     784.00
555555   Oct 3 05         55.55         1.11      54.44

                                2055.55                41.11                2014.44

                                                                &%1B$(s1p16v0s3b4148T 1000
&%1B$(3@

                                                                October 5, 2005
                                                                &%SMF$2014.44~
&%1B$(s0p12h1s0b4099T
***** Two Thousand Fourteen and 44/100*****DOLLARS &%1B$(3@
                                                                $2014.44
Vendor Systems
927 Warehouse Road
Kansas City, MO 59782          &%1B$(20000X ! &%1B$(3@

&%1B$&f0S &%1B$*p296x3184Y &%SMD;00001000; :123456789:1234567890123:$
&%1B$&f1S
    
```


The commands in Figure 6.1 in order of appearance:

&%STFPASSWORD\$	Password Command.
&%SMCP0001\$	MICR Definition Command with the count set to one.
&%STP10001\$	Unlock Flash Resource number 10001.
&%STP20000\$	Unlock Flash Resource number 20000.
&%1B26...3358\$	PCL sequence in hex which sets the page format and enables macro number 10001.
&%1B\$(s1p16v0s3b4148T	PCL sequence which changes the font to Universal 16 point. After the check serial number prints (1000), the printer is returned to its default font with the following command.
&%1B\$(3@	PCL command to return to default font.
&%SMF\$2014.44~	Print Secure font command. Note: The tilde ~ is the command terminator.
&%1B\$(s0p12h1s0b4099T	PCL command to change the font to Courier 12 pitch Italic. Print PCL Fonts from the Front Panel menu for a list of fonts with their call commands.
&%1B\$(3@	PCL command to return to the default font.
&%1B\$(20000X!	PCL command to print font number 20000. In this example font 20000 is a signature previously loaded into flash memory. Here we call it and print it with an exclamation point (!).
&%1B\$(3@	PCL command to return to the default font.
&%1B\$&f0S	PCL command to Push (store) the current cursor position.
&%1B\$*p296x3184Y	PCL command to move the cursor to 296X , 3184Y. At 300 units of measure, this is .97 inches across and 10.61 inches down. We are precisely positioning the MICR line.
&%SMD....\$	Print E-13B MICR Command. This prints the MICR line. Note: Refer the MICR font character mapping in Appendix A.
&%1B\$&f1S	PCL command to Pop (return) the cursor to the pushed position.

Escape Character Translation

In many IBM host environments, the programmer cannot send an ESC character (ASCII hex 1B) to the printer from within the application. Your secure MICR printer allows you to define the ESC character as a printable character or a combination of two printable characters. You can select combinations of 1 or 2 characters which are translated to a Hex 1B when they are sent to the printer.

The command `&%STYxxyy$` is used to select the character or character combination. The pair `xx` represents the first characters' ASCII hex value; `yy` represents the second characters hex value.

Example: The symbols `@@` should be translated into the escape character.

`&%STY4040$`

After this is sent to the printer, anytime an `@ @` is received in exact sequence, the pair is translated into the ESC character (Hex 1B). A single `@` would print normally.

If `yy` is equal to `00`, only the first character is used for the escape character.

Example: The symbol `@` should translate into the escape character.

`&%STY4000$`

After this is sent to the printer, anytime an `@` is received it is translated into the ESC character. This means that the printer will never print the `@` character. The only invalid single characters are the `&` (HEX 26) and a null (`00`).

Example: `&%STY2300$ #&l8D`


The printer would translate the number sign (Hex 23) to the ESC character, and it would act on the sequence `Esc&l8D` which will set line spacing to 8 lines per inch.

To reset the ESC character translation from the previous settings, send the `&%STY` Command to deactivate the translation.

Example: `&%STY0000$ 8`

Figure 6.2: Sample Check

Note: The printed output from the commands listed in Figure 7.1 is shown below.



DUPLICATE FILE COPY


CHECK NO: 1000

VENDOR NO: 200

NAME: VENDOR SYSTEMS

CHECK DATE: October 5, 2005

REFERENCE NUMBER	INVOICE DATE	GROSS AMOUNT	DISCOUNT TAKEN	NET AMOUNT PAID
99999	Oct 1 05	1000.00	20.00	980.00
1234567	Oct 2 05	200.00	4.00	196.00
136784	Oct 3 05	800.00	16.00	784.00
555555	Oct 3 05	55.55	1.11	54.44
TOTALS		2055.55	41.11	2014.44




CHECK NO: 1000

VENDOR NO: 200

NAME: VENDOR SYSTEMS

CHECK DATE: October 5, 2005

REFERENCE NUMBER	INVOICE DATE	GROSS AMOUNT	DISCOUNT TAKEN	NET AMOUNT PAID
99999	Oct 1 05	1000.00	20.00	980.00
1234567	Oct 2 05	200.00	4.00	196.00
136784	Oct 3 05	800.00	16.00	784.00
555555	Oct 3 05	55.55	1.11	54.44
TOTALS		2055.55	41.11	2014.44



Source Technologies, LLC
2910 Whitehall Park Drive
Charlotte, NC 28273
800.922.8501

First National Bank
of Any State
Any City, NC 27514

CHECK No. 1000

66-156
531

DATE October 5, 2005

PAY

\$2014.44


DOLLAR TWO ZERO ONE FOUR PERIOD FOUR FOUR

***** Two Thousand Fourteen and 14/100 ***** DOLLARS

AMOUNT \$2014.44

TO THE ORDER OF Vendor Systems
927 Warehouse Road
Kansas City, MO 59782

NON-NEGOTIABLE



⑈0123456⑈ ⑆123456780⑆ 0123412345670⑈

Chapter 7 - Audit Trail Reports

The Audit Trail Report feature provides a report of the printer's MICR printing activity. The printer must have flash memory to utilize this option. Details of each flagged check record sent to the printer are provided since the last audit report was purged from flash memory.

Report Details

A record (check) must be bounded by a start of record command and an end of record command. Within each record, fields to be included in the Audit Trail Report must be flagged. The printer stores each record in flash memory. After the check is successfully printed, its record is designated as a successfully printed document in flash.

The report is built by printing each of these check records as a line item. At the end of the report, an exception report is generated which highlights any records received by the printer but not successfully printed.

Each record (check) has a maximum of seven fields with a total of 146 bytes. **Two of the flagged fields, SQ1 and SQ7 are Audit Report fields only.** They are not printed on the MICR document. Flagging other fields for inclusion in the Audit Report does not affect how they print on a check.

Audit Trail Menu

The MICR menu contains a section for the Audit Trail options. Menu options are Audit Location, Record Sorting, Overlay, Sum Field 4, and Print Report.

Audit Location

Choose to store audit data on flash or disk. The display will show "No Device" if neither is installed. Flash is the default if both are present.

Audit Record Sorting

This enables sorting of the report by the first 20 digits in the MICR line field. In an unsorted report the records are in the order in which they were printed.

Overlay

To assist in reading an Audit Trail report you have the option of using a form overlay. This overlay can provide lines, boxes, and shading for a more user-friendly report format.

The Audit Trail Report overlay can be stored in printer flash or RAM. We recommend storing it in flash. It must have an ID of 5001. It is enabled by accessing the MICR menu via the printer's front panel. Select **Audit Menu > Overlay**. This overlay will now be merged with the record details every time the Audit Trail Report is printed.

Sum Field 4

The values in field four of the Audit Trail Report can be added together with the total provided at the end of the report. This feature is activated through the MICR menu. Select **Audit Menu > Sum Field 4**.

The values in field 4 must follow certain guidelines to be included in the column summation. Dollar signs and commas must be properly located, no more than two numbers after a decimal point, and no alpha characters. For example:

<u>Valid Formats</u>	<u>Invalid Formats</u>
"\$1,234,567.89"	"\$1,23,"
"4321234.56"	"432.123"
"5,321"	"34 test"
"\$.89"	"12\$123"

If the value in field 4 is in an invalid format, that line will have a question mark to the right of the field, and it will not be added to the total. Under these circumstances, the total will print with the notation "Fields flagged with '?' not included in total."

If the total exceeds \$4,294,957,295.99 the printer will print an error message "Total exceeds maximum value" instead of the total.

Print Audit Report

This prints an Audit Trail Report. The Audit Trail Report is also part of the command set so the Audit Report can be printed and purged via the host application. As a security control mechanism, purging is only possible after entering a valid password.

The printer can store approximately 6,000 records or checks for each megabyte of flash. If the Audit Report feature is activated, and the printer's flash memory becomes full, an error condition occurs. The printer will stop printing and prompt the operator to print and purge the Audit Report memory. See the following section for purge instructions.

Audit Trail Report Command Set

&%SAR\$	Start Audit Record
&%SAR	Lead in sequence
\$	Command terminator

Marks the start of an audit record and begins a PJI job. This command must be inserted in the data stream after MICR Mode is entered and before the first flagged field appears. It should be sent at the beginning of each check record.

End Audit Record	&%STORE\$
&%STORE	Lead in sequence
\$	Command terminator

Ends the Audit Record and the PJI job (ignored if there was no Start Audit Record Command).

Audit Report Field One	&%SQ1d..d\$
&%SQ1	Lead in sequence
d..d	Data to be stored
\$	Command terminator

This command identifies the data to be printed in the first column of the report. It allows for a maximum of 14 characters in length. If less than 14 characters are sent, the printer fills the field with spaces when the audit report is printed. This field is only recorded in the audit report; it is not printed on the check.

Audit Report Field Two-MICR Line &%SMDd..d\$ or &%SM7d..d\$

&%SMD or &%SM7	Lead in sequence
d..d	Data to be printed
\$	Command terminator

This command identifies the data to be printed in the second column of the report. It allows for a maximum of 40 characters in length.

Audit Report Field Three &%SQ3d..d\$

&%SQ3	Lead in sequence
d..d	Data to be printed
\$	Command terminator

This command identifies the data to be printed in the third column of the report. It allows for a maximum of 40 characters.

Audit Report Field Four &%SQ4d..d~

&%SQ4	Lead in sequence
d..d	Data to be printed
~	Command terminator

This command identifies the data to be printed in the fourth column of the report. It allows for a maximum of 16 characters in length. Since a total of this field can be provided at the end of the Audit Trail Report it is typically used for the convenience amount field.

Note: This is the only command where the \$ is not a command terminator. The tilde ~ (hex 7E) acts as the command terminator.

Audit Report Field Five &%SQ5d..d\$

&%SQ5	Lead in sequence
d..d	Data to be printed
\$	Command terminator

This command identifies the data to be printed in the fifth column of the report. This field allows for a maximum of eight characters.

Audit Report Field Six &%SQ6d..d\$

&%SQ6	Lead in string
d..d	Data to be printed
\$	Command terminator

This command identifies the data to be printed in the sixth column of the report. This field allows for a maximum of 19 characters.

Audit Report Field Seven	&%SQ7d..d\$
&SQ&7	Lead in string
d..d	Data to be stored
\$	Command terminator

This command identifies the data to be printed in the seventh column of the report. This field allows for a maximum of 12 characters. The data in this field is recorded for the Audit Report only.

Print and Purge Audit Report	&%SPURGExx\$
&%SPURGE	Lead in string
x	option(s)
\$	Command terminator

This command prints and purges the Audit Report. All recorded information is deleted. The optional field can be any combination of the following letters:

T	Total Field 4
O	Overlay
S	Sort by MICR line
C	Communicate - send report to host instead of printing - see additional information below on SPRINT command

For example, the command &%SPURGES\$ sorts the records by the MICR line while the command &%SPURGESO\$ sorts the records by the MICR line and prints an overlay with the data.

Options can be forced on with these commands, but they cannot be forced off. In other words, if the front panel overlay setting is on, it cannot be forced off by a data stream command. If the front panel overlay setting is off, however, a data stream command can activate this feature. This command can only be accessed with a valid password command.

Print Audit Report	&%SPRINTxx\$
&%SPRINT	Lead in string
x	option(s)
\$	Command terminator
Prints the Audit Report	

The optional field can be any combination of the following letters:

T	Total Field 4
O	Overlay
S	Sort by MICR line
U	Unsuccessful report only
C	Communicate - send report to host instead of printing

The report sent back to the host begins with SOH (0x01) and ends with EOT (04). Since the reports can be quite long, they will likely be broken into separate buffers which may be interspersed with non-audit buffers such as PJI JOB status. Each buffer will begin with an STX character (0x02) and end with ETX (0x03).

Each record will be terminated with carriage return-line feed (0x0D 0A).

Start Audit Feedback Command

&%SAF\$

The printer will report to the host that sent this command every time an audit job successfully prints.

Each report will be a 151-byte string:

byte 1	STX (0x02)
bytes 2-15	field 1 of the audit record (from SQ1)
16-55	field 2 (from SMD)
56-95	field 3 (from SQ3)
96-111	SQ4
112-119	SQ5
120-138	SQ6
139-150	SQ7
151	ETX (0x03)

The printer will continue to report until it is cycled off and then back on.

Figure 7.1 Audit Trail Example

The following example shows the Audit Trail, MICR Mode and Hex Transfer commands in use.

```

&&??&% &%STFPASSWORD$ &%SMCP0001$ &%SAR$ &%STP10001$ &%STP20000$
& % 1 B 2 6 6 C 3 1 7 8 3 0 7 3 3 1 6 8 3 2 6 1 3 6 3 4 6 6 3
0 6 F 3 1 6 5 3 1 6 C 3 7 2 E 3 3 3 0 4 3 1 B 2 6 6 1 3 0 4 C
1 B 2 8 7 3 3 1 3 0 4 8 1 B 2 6 6 B 3 1 3 0 2 E 3 0 3 0 4 8 1
B 2 6 6 6 3 1 3 0 3 0 3 0 3 1 7 9 3 3 5 8 $

                1000

&%SQ1200$200      Vendor Systems                                Oct. 5, 2005

99999      Oct 1 05      1000.00      20.00      980.00
1234567    Oct 2 05      200.00      4.00      196.00
36784      Oct 3 05      800.00      16.00     784.00
555555     Oct 3 05       55.00      1.11     54.44

                2055.55                41.11                2014.4

                1000

200      Vendor Systems                                Oct. 5, 2005

99999      Oct 1 05      1000.00      20.00      980.00
1234567    Oct 2 05      200.00      4.00      196.00
136784     Oct 3 05      800.00      16.00     784.00
555555     Oct 3 05       55.55      1.11     54.44

                2055.55                41.11                2014.44

                &%1B$(s1p16v0s3b4148T1000&%1B$(3@

                &%SQ6October 5, 2005$                                &%SMF$2014.44~


&%1B$(s0p12h10v1s0b4099T
*****Two Thousand Fourteen and 44/100*****DOLLARS &%1B$(3@
                &%SQ4$2014.44~

&%SQ3 Vendor Systems$
          927 Warehouse Road
          Kansas City, MO 59782                &%1B$(20000X ! &%1B$(3@

&%1B$&f0S &%1B$*p296x3184Y &%SMD;00001000; :123456789:1234567890123:$
&%1B$&f1S &%SQ710:33:45 AM$                &%STORE$                &&??!!
    
```

Figure 7.2 Audit Trail Check Sample

The data stream in Figure 7.1 will print the following check (assuming the check macro and signature are loaded as flash resources).



DUPLICATE FILE COPY


CHECK NO: 1000

VENDOR NO: 200

NAME: **VENDOR SYSTEMS**

CHECK DATE: **October 5, 2005**

REFERENCE NUMBER	INVOICE DATE	GROSS AMOUNT	DISCOUNT TAKEN	NET AMOUNT PAID
99999	Oct 1 05	1000.00	20.00	980.00
1234567	Oct 2 05	200.00	4.00	196.00
136784	Oct 3 05	800.00	16.00	784.00
555555	Oct 3 05	55.55	1.11	54.44
TOTALS		2055.55	41.11	2014.44




CHECK NO: 1000

VENDOR NO: 200

NAME: **VENDOR SYSTEMS**

CHECK DATE: **October 5, 2005**

REFERENCE NUMBER	INVOICE DATE	GROSS AMOUNT	DISCOUNT TAKEN	NET AMOUNT PAID
99999	Oct 1 05	1000.00	20.00	980.00
1234567	Oct 2 05	200.00	4.00	196.00
136784	Oct 3 05	800.00	16.00	784.00
555555	Oct 3 05	55.55	1.11	54.44
TOTALS		2055.55	41.11	2014.44



Source Technologies, LLC
2910 Whitehall Park Drive
Charlotte, NC 28273
800.922.8501

First National Bank
of Any State
Any City, NC 27514

CHECK No. 1000

66-156
531

DATE October 5, 2005

PAY

\$2014.44


DOLLAR TWO ZERO ONE FOUR PERIOD FOUR FOUR

***** Two Thousand Fourteen and 14/100 ***** DOLLARS

TO THE ORDER OF Vendor Systems
927 Warehouse Road
Kansas City, MO 59782

AMOUNT \$2014.44

NON-NEGOTIABLE



@0 1 234 56 @ # 1 234 56 780 : 0 1 234 1 234 56 70 @

The commands in Figure 7.1 are in order of appearance (Audit Report fields shown in bold).

&&??&%	Hex transfer enable.
&%STFPASSWORD\$	Password Command.
&%SMCP0001\$	MICR definition command with the count set to one.
&%SAR\$	Activates Audit Report recording.
&%STP10001\$	Unlock flash resource number 10001.
&%STP00200\$	Unlock flash resource number 200.
&%1B26...3358\$	PCL sequence in hex which sets the page format and enables macro number 10001.
&%SQ1200\$200	Stores the vendor number 200 in the first position of the Audit Report. Note: that this field will not be sent to the page to be printed. Here we send the field again so that it will print.
&%1B\$(s1p16v0s3b4148T	PCL sequence which changes the font to Universal 16 point. After the check serial number prints (100), the printer is returned to its default font with the following command.
&%1B\$(3@	PCL command to return to default font.
&%SQ6October 5, 2005\$	Stores the date in the sixth position of the Audit Report.
&%SMF\$2014.44~	Prints Secure Font command. NOTE: Tilde (~) is command terminator.
&%1B\$(s0p12h10v1s0b4099T	PCL command to change the font to Courier 12 pitch Italic. See print PCL Fonts on the Front Panel under the test menu for a printout with the call commands.
&%1B\$(3@	PCL command to return to the default font.
&%SQ4\$2104.44~	Stores the amount in the fourth position of the Audit Report.
&%SQ3Vendor Systems \$	Stores the payee, Vendor Systems, in the third position of the Audit Trail report.

&%1B\$(200X!	PCL command to print font number 200. In this example font 200 is a signature previously loaded into flash memory. Here we call it and print it with an exclamation point (!).
&%1B(3@	PCL command to return to the default font.
&%1B\$&f0\$	PCL command to push (store) the current cursor position.
&%1B\$*p296x3184Y	PCL command to move the cursor to 296X, 3184Y. At 300 dpi, this is .97 inches across and 10.61 inches down. We are precisely positioning the MICR line.
&%SMD...\$	Print E-13B MICR command. Prints the MICR line and stores the MICR line information in the second position in the Audit Report.
&%1B\$&f1\$	PCL command to pop (return) the cursor to the pushed position.
&%SQ710:33:45 AM\$	Here we send the time of print to the printer. The data is recorded in the Audit Report, but this field is not printed on the page.
&%STORE\$	Signals the end of a check and the end of Audit Report recording.
&%?!!	Turns Hex Transfer off.

Figure 7.3 Audit Trail Report

Audit Report page1	Records 1 through 10 of 10	*indicates check did not print	**indicates gap in check numbers		
200	:00001000; :123456789: 12345678912345678: 10:33:44 AM	Vendor Systems	\$2,014.44	February 10, 2001	
200	:00001001; :562478923: 12345678912345678: 09:45:40 AM	Classic Homes Construction	\$28,576.72	February 12, 2001	
200	:00001002; :285946731: 12345678912345678: 01:00:26 AM	Computer Source, Inc.	\$55,600.00	February 14, 2001	
MSMITH	:00001003; :628499761: 12345678912345678: 08:45:36 AM	Eastern Cleaning Supplies	\$876.00	February 15, 2001	
MSMITH	:00001004; :559873164: 12345678912345678: 08:46:50 AM	Dillon Consulting Company	\$1,200.00	February 15, 2001	
MSMITH	** :00001006; :578642315: 12345678912345678: 08:47:32 AM	Klaussen Enterprises	\$449,466,800.00	February 15, 2001	
MSMITH	:00001007; :556791324: 12345678912345678: 08:49:45 AM	Woods Paper Products	\$89.95	February 15, 2001	
*PJONES	:00001008; :256988974: 12345678912345678: 09:35:40 AM	Printers Quarterly	\$899.99	February 19, 2001	
Administrator	:00001009; :123654987: 12345678912345678: 10:30:45 AM	XYZ Insurance	\$123,568.00	February 21, 2001	
T53DODER	:00001010; :155554897: 12345678912345678: 11:15:25 AM	Carmine's Deli	\$2,354.00	February 22, 2001	
SQ1=14 spaces	SMD=40 spaces	SQ3=40 spaces	SQ4=16 spaces	SQ5=8 spaces	SQ6=19spaces Q7=12 spaces

Note: Each of the seven fields in the Audit Report holds a maximum number of characters. Those numbers are represented in BOLD above with their corresponding fields. Field 1 and Field 7 will not print on the check.

This Audit Report is just one example of a report format. Any of the seven fields can be manipulated to show any information the user feels are appropriate. For example, the check amount could be in field 3 rather than field 4; or field 5 could contain items such as taxes drawn on the check, check numbers, year-to-date accumulations, etc.

Each line is a record of a check that was printed. The top of every Audit Trail Report shows how many pages make up the report as well as the number of records that will be printed. The Audit Report can be printed in two ways: a sorted report or an unsorted report. A sorted report sorts all checks numerically by the first 20 characters in the MICR line field and prints asterisks (**) beside checks printed out of sequence. Sorting can be done via the front panel or by the commands &%SPRINTS\$ or &%SPURGES\$. An unsorted report lists checks in the order they were printed. An asterisk (*) at the beginning of a line states that the check number did not print.

In this example:

- SQ1= the authorized user who accessed the Audit Trail Report.
- SMD= displays the client's check number, the bank institution's routing number, and account number.
- SQ3= the name of the payee (The name of the person or organization to whom the check was made payable).
- SQ4= the amount of the check.
- SQ5= not used in this report.
- SQ6= the date the check was written.
- SQ7= the time that the check was printed.

All the above fields will be printed on the check except for field 1 and field 7.

Chapter 8 - Error Messages

Your secure MICR printer has front panel error messages unique to MICR applications. These messages appear if there is a MICR related problem. The printer may also print an error message on the page near where the error occurred. See the base printer's User's Guide for posted errors on the operator's panel not listed below.

MICR Toner Supplies Related Errors

Error Message on Display	Printed Message	Description	Action
Load MICR Toner OR Install MICR Cartridge	N/A	Before printing a MICR document, the printer checks for MICR toner supplies. If a regular cartridge and IU are installed, the printer will stop all printing and display this message	Change out the regular toner cartridge and regular IU with a MICR toner cartridge and IU. Note: If MICR supplies are not available, you must power-off the printer and restart the MICR print job later when MICR supplies are available.
[41.60A] Cartridge, imaging unit mismatch.	N/A	The printer may have the wrong cartridge or wrong IU installed. The supply types must both be either MICR or regular (non-MICR)	Check labels and install matched components
[84.33K] Replace Imaging Unit, recommended life exceeded.	N/A	The IU will soon need to be replaced	Press CONTINUE. Up to 5000 pages remain to End-of-Life of the IU.
[84.43K] Replace imaging unit to resume printing.	N/A	The imaging unit is at End-Of-Life	Replace only the imaging unit. The toner cartridge need not be replaced at this time.
[88.30K] Replace cartridge, xxx estimated pages remain.	N/A	The cartridge is empty of toner. Replace the cartridge soon when available.	Press CONTINUE to continue printing using reserve toner in the IU.
[88.40K] Replace cartridge, 0 estimated pages remain.	N/A	The toner cartridge is beyond empty and reserve toner limit from the IU has been reached.	Replace only the toner cartridge. The IU need not be replaced at this time.















Programming Related Errors

Error Message on Display	Printed Message	Description	Action
Can't Create Node		There was insufficient memory to track another audit job	Turn printer off and back on, then retry. If the problem recurs, call Tech Support.
Can't Purge, password not enabled		This error indicates that MICR mode has not been enabled.	Press Go. Enter MICR mode, then re-attempt the purge.
Can't Sort Insufficient Memory		This error indicates the printer does not have sufficient memory to sort the Audit Report.	Press Go. The printer may need to be upgraded with more RAM memory to sort; otherwise, an unsorted Audit Report may be printed.
Command Decode Error	Decode error &%Sx (where x is the incorrect character)	A syntax error was detected in a MICR command.	Check your software for a syntax error in the MICR command that was being used when the error occurred.
File System Error Can't Open File		There was an internal error while trying to access flash for audit trail	Check that Flash is installed and not full.
Flash Full Purge and Format		This error message indicates that the printer's flash memory is full. The audit trail cannot accept more jobs until more space is available in flash.	Press Go then purge the audit trail. Then either defragment or format flash memory (Utilities Menu).
Integer string incorrect length	Integer string incorrect length	A parameter in a command was not the correct length.	Check the Command (&%STP, STS) for syntax/numbering errors.
Invalid AES/DES key		Invalid hex digit or length of decryption key	Check the syntax of SETAESKEY or SETDESKEY command.
Invalid Convert to Escape Character	Invalid Convert to Escape Character	An error was detected in the User Programmable Escape Character Selection Command. The software tried to specify a NULL or an ampersand as the first Escape Character.	Check the Command (&%STY...) for errors.

Error Message on Display	Printed Message	Description	Action
Macro Definition Error	Invalid decode mode specified	The Load Flash Resource Command contained an invalid character specifying the format of the file. Must be either a D or S.	Check the Command (&%STL...) for syntax errors.
Macro Definition Error	Macro ID greater than 32767 limit.	The resource number in the Load Flash Resource Command (&%STL...) was over the 32767 limit.	Check the Load Flash Resource Command for syntax/numbering errors.
Macro Definition Error	Macro size exceeds available space	Flash resource file size specified in the Load Flash Resource Command is too large for the available space remaining in the flash module.	Format flash memory to remove all existing resources or upgrade flash memory to a larger module.
MICR Definition Line Count Error		The number of digits in the MICR definition Command is not equal to four, or there is a non-hexadecimal character in the count.	Check your software for errors in the MICR definition Command (SMCP).
MICR Password Error	Password Length Error.	Password length is not equal to eight characters.	Check the Password Command in your software, it must be eight characters long.
MICR Password Error	Password Match Error	Password sent does not match the current stored password.	Check the Password Command in your software.
Non-hexadecimal Value Received	Non-hexadecimal value received.	A command contained a non-hexadecimal value in a parameter.	Check the Command (&%STL, STY) syntax for errors.
Non-Integer Value Received	Non integer value received.	A parameter in a command was not an integer.	Check the command (&%STL, STS, STP) for syntax/ numbering errors.
Password Not Enabled Error		A secure command was sent without the password being sent first	Check the software to ensure that the password is sent before any secure commands.
Purge Audit Report, Then Format		An SFF command was received, but there is audit data in flash which should not be erased	Purge the audit data, then resend the SFF command

Error Message on Display	Printed Message	Description	Action
Secure File Not Unlocked/Opened /Written/Read		There was an internal error while trying to access Flash for an STL or STP command	Print the menus to ensure that Flash is installed. Print a directory of Flash to ensure that it is not write protected or full. If error occurs on STP command, check to confirm that the resource is stored in Flash.

Appendix A: E13B MICR Font Mapping

Command		&%SMDddd..ddd\$	
MICR Font Character	Description	Alpha/Numeric Values ¹	Hex Values
	Amount Symbol	A a /	41 61 2F
	Transit Symbol	T t B b :	54 74 42 62 3A
	On-Us Symbol	O o C c ;	4F 6F 43 63 3B
	Dash Symbol	V v D d - =	56 76 44 64 2D 3D
	Zero	0	30
	One	1	31
	Two	2	32
	Three	3	33
	Four	4	34
	Five	5	35
	Six	6	36
	Seven	7	37
	Eight	8	38
	Nine	9	39













Example: &%SMD ;00001234; T01234567T3210987654321;\$ **will print:**






¹Select only one alphanumeric character to call the font.

Appendix B: CMC7 MICR Font Mapping

Command &%SM7ddd..ddd\$











Description	Alpha/Numeric Characters	Hex Values	CMC7 Font Values ¹
Zero	0	30	
One	1	31	
Two	2	32	
Three	3	33	
Four	4	34	
Five	5	35	
Six	6	36	
Seven	7	37	
Eight	8	38	
Nine	9	39	
Colon	:	3A	
Semi-Colon	;	3B	

Description	Alpha/Numeric Characters	Hex Values	CMC7 Font Values ¹
Less Than	<	3C	
Equal	=	3D	
Greater Than	>	3E	

Note: The CMC7 Font in the example above is magnified for purposes of clarity.

Appendix C: Secure Numeric Font Mapping

Command – &%SMFddd...dd~

Description	Alpha/Numeric Character	Hex Value	Secure Font Character
Dollar Sign	\$	23	
Left Bracket	(28	
Right Bracket)	29	
Asterisk	*	2A	
Comma	,	2C	
Dash	-	2D	
Period	.	2E	
Slash	/	2F	
Zero	0	30	
One	1	31	

Description	Alpha/Numeric Character	Hex Value	Secure Font Character
Two	2	32	A stylized number '2' rendered in a font with horizontal scanlines. The number is white against a black background with horizontal bars.
Three	3	33	A stylized number '3' rendered in a font with horizontal scanlines. The number is white against a black background with horizontal bars.
Four	4	34	A stylized number '4' rendered in a font with horizontal scanlines. The number is white against a black background with horizontal bars.
Five	5	35	A stylized number '5' rendered in a font with horizontal scanlines. The number is white against a black background with horizontal bars.
Six	6	36	A stylized number '6' rendered in a font with horizontal scanlines. The number is white against a black background with horizontal bars.
Seven	7	37	A stylized number '7' rendered in a font with horizontal scanlines. The number is white against a black background with horizontal bars.
Eight	8	38	A stylized number '8' rendered in a font with horizontal scanlines. The number is white against a black background with horizontal bars.
Nine	9	39	A stylized number '9' rendered in a font with horizontal scanlines. The number is white against a black background with horizontal bars.
Arrow	>	3E	A stylized right-pointing arrow rendered in a font with horizontal scanlines. The arrow is white against a black background with horizontal bars.

Example:

```
&%SMF($>>>15,575.00)~
```

will print.....



Note: The secure fonts in the example are magnified for purposes of clarity.

Appendix D: ICR Secure Numeric Font Mapping

Command	&%SMlxxxxxx~		
Description	Alpha/Numeric Character	Hex Value	Secure Font Character
Zero	0	30	0
One	1	31	1
Two	2	32	2
Three	3	33	3
Four	4	34	4
Five	5	35	5
Six	6	36	6
Seven	7	37	7
Eight	8	38	8
Nine	9	39	9
Asterisk	*	2A	*
Comma	,	2C	,
Period	.	2E	.
Dollar Sign	\$	23	\$

Appendix E: MICR Mode Command Summary

Description	Command	Structure Function
Password	&%STFPASSWORD\$ &%STHPASSWORD\$	Must be sent to enable MICR Mode
MICR Definition	&%SMCPxxxx\$	MICR Line Count command
Set New Password	&%STExxxxxxxxx\$	Sets new password. Must be preceded by current password
Activate/Set Front Panel	&%STSxxxxxxxx\$	Turns on and sets front panel
Combination		Combination Lock, must be 8 integers
Print MICR E13B Font	&%SMDddd...ddd\$	Prints E13-B MICR font at the current print position. Please refer to Appendix A.
Print MICR CMC7	&%SM7ddd...ddd\$	Prints CMC-7 MICR font at the current print position. Please refer to Appendix B.
Print Secure Numeric Font	&%SMFddd...ddd~	Prints the Secure Numeric font at the current print position.

Note: The tilde is the command terminator, see Appendix C.

Print ICR Secure Numeric Font	&%SMIxxxxx~	Prints the ICR Secure Numeric Font at the current print position. Refer to Appendix D.
Print in Micro Print	&%SMMxxxxx\$	Prints data in Micro Print font
Load Flash Resource	&%STLxxxxxyyyyyzddd...dd\$	Loads a Flash Resource file into password protected Flash memory
Format Flash Memory	&%SFF\$	Formats Flash memory Caution: All Flash content will be lost.
Flash Resource Unlock	&%STPxxxxx\$	Makes Flash Resource Command available to be called, must be 5 integers
Tray Lock Command	&%STTL#\$	Locks Tray 1, 2 or 3 for MICR Printing
Unlock Tray Command	&%STTU#\$	Locks Tray 1, 2, or 3
Tray Swapping Commands	&%STTSON &%STTSOFF\$	Turns tray swapping ON Turns tray swapping OFF
Quit MICR MODE Command	&%STQ\$	Terminates MICR Mode

Appendix F: Audit Report Command Summary

Description	Command	Structure Function
Start Audit Record	&%SAR\$	Activates Audit Trail and begins PJJ job
Audit Report Field One	&%SQ1.d\$	Records first field on the Audit Report - does not print
Print MICR E13B Font	&%SMD..d\$	Print and records MICR line
Audit Report Field Three	&%SQ3d..\$	Records third field on the Audit Report
Print the Check Amount	&%SQ4d..d~	Records fourth field of the Audit Report and prints the check amount
Audit Report Field Five	&%SQ5d..d\$	Records fifth field of Audit Report
Audit Report Field Six	&%SQ6d..d\$	Records sixth field of Audit Report
Audit Report Field Seven	&%SQ7d..d\$	Records seventh field of Audit Report - does not print
Print Audit Report	&%SPRINT\$	Prints Audit Report
End Audit Record	&%STORE\$	Ends Audit Record and PJJ Job
Print and Purge	&%SPURGE\$	Prints and purges the Audit Report Caution: All previous Audit Report information will be lost.
Format Flash Memory	&%SFF\$	Formats flash memory. An error will occur if the Audit Report has not been purged.
End MICR Mode	&%STQ\$	Ends MICR Mode

Appendix G: PJJ Based MICR Commands

The PJJ based MICR Commands were added to offer a subset of MICR features and functions that do not depend on a DLE present in the base printer. Not as robust as the Text Based MICR Command Set described in Sections 5, 6, and 7 of this document. The PJJ Based MICR Command set still offers password protection of the MICR and security fonts and features to maintain the print quality of the MICR documents.

The low end ST9815 only supports the PJJ based MICR Commands. The ST9815 requires the FLASH memory printer option to store the MICR and Security fonts, and any additional resources such as PCL signatures fonts, logos, or macros. All remaining models of the ST98xx family, i.e., the ST9818 through ST9830 Secure MICR Printers, also support the PJJ Based MICR Commands allowing for a single print data stream to be used across a network of Secure MICR printers that include the presence of the ST9815 model in the mix.

The following are the key PJJ and PCL commands required to access MICR resources in the printer. For the complete source of information on PJJ and PCL languages, consult the Lexmark Technical Reference documentation.

PJJ MICRJOB

The MICRJOB command (@PJJ MICRJOB) forces Copy count = 1, and Jam Recovery = OFF. In addition, if your MICR printer has been custom configured to support both standard and MICR cartridges, the MICRJOB command will request a MICR cartridge be installed. The function of the MICRJOB PJJ command has been expanded to support both SET and DEFAULT PJJ options. Previous ST Secure printers only supported the @PJJ MICRJOB option that performed like a PJJ SET. The @PJJ MICRJOB is still supported and unchanged.

SET and DEFAULT formats for the MICRJOB command

There are two formats of the SET MICRJOB command

```
@PJJ SET MICRJOB=ON  
@PJJ SET MICRJOB=OFF
```

The ON value functions like the older @PJJ MICRJOB command. It must be included with the MICR printing application. The OFF value can allow a particular job to be processed as a non-MCR job if the DEFAULT MICRJOB=ON was the current status of the printer.

There are two formats of the DEFAULT MICRJOB Command

```
@PJJ DEFAULT MICRJOB=ON  
@PJJ DEFAULT MICRJOB=OFF (factory default)
```

The ON value forces all jobs to be treated as MICR jobs. This new command format allows users who could not embed the MICRJOB into their MICR printing application, to send MICRJOB separately. For example, the user could send the command in a flat file totally separate from the printing application. Once set the printer is now set for MICR printing. OFF format returns the printer to the factory default value.

Because DEFAULT commands alter information stored in non-volatile memory, the frequency of switching between DEFAULT ON & OFF should be limited to around 5 times daily, thereby protecting the memory from premature failure.

Fonts and Secured Resources

Source Technologies' secure MICR printers have five fonts password protected in Flash memory. The printer requires PJJ commands with the correct password value to unlock the font resources, followed by PCL to print the fonts. They are then re-locked by PJJ commands or by a printer power cycle.

The PJJ commands to unlock the fonts must precede all PCL commands. The re-lock PJJ commands must follow the PCL commands and final form feed command. The PCL commands could print an unlimited number of pages between the unlock and re-lock sequences. The following examples will be used <ESC> to indicate the Escape character, ASCII 27. Values shown in parentheses () are hexadecimal.

PJJ Unlock Sequence

```
<ESC>%-12345X@PJJ LDECLARE LRESOURCE:"flash:" LRWLOCK="PASSWORD"(0D)(0A) @PJJ
ENTER LANGUAGE=PCL(0A)
```

The sequence contains a UEL (Universal Exit Language) command followed by the unlock and enter language commands. The commands are case sensitive. PASSWORD is the initial default password value. The command delimiter is a Line Feed (hex 0A) with Carriage Return (hex 0D) being optional. Spaces are required as shown. The ENTER LANGUAGE command is optional but recommended. The command should also end with a LF (hex 0A). Currently all secured resources including any resources that are customer unique in Flash are unlocked and available to PCL.

The password value is limited to no more than 8 alphanumeric, case-sensitive characters.

PJJ Re-Lock Sequence

```
<ESC>%-12345X@PJJ LDELETEPASSWORD LRESOURCE:"flash:"(0D)(0A)
<ESC>%-12345X
```

This sequence re-locks the resources with no change in the password value. The PJJ syntax of LDELETEPASSWORD is *not* the password. The command sequence terminates with the UEL command (Universal Exit Language). This is optional but recommended.

PJJ Re-Lock Sequence with a New Password Value

```
<ESC>%-12345X@PJJ DEFAULT LRESOURCE:"flash:" LRWLOCK="xxxxxxx"(0D)(0A)
<ESC>%-12345X
```

This command requires the resources to be previously unlocked. The new password is represented by the value xxxxxxxx. The UEL is again optional but recommended. After consulting Lexmark Technical Reference materials, you may wish to expand the PJJ sequences to include more than the examples above. To chain multiple PJJ commands follow the following format:

(UEL)(PJL COMMAND)(0A)(PJL COMMAND)(0A)(PJL COMMAND)(0A)(UEL or ENTER LANGUAGE)

The normal printer action to any format problems or missing or extra symbols is to ignore the PJL command.

PCL Font Call Commands

After PJL has unlocked the MICR flash resources, the printer uses standard PCL5e commands to print. The five resident Source Technologies' MICR font resources are all bitmapped fonts and therefore cannot be scaled larger or smaller than the bitmapped images. These fonts can be called by either a PCL Font Selection String or by their ID. The commands are:

E13B MICR FONT String	<ESC>(100<ESC>(s0p8h8v0s7b360T	The Selection
	<ESC>(30802X	The ID Call
SECURE NUMERIC String	<ESC>(16C<ESC>(s0p5h36v0s0b112T	The Selection
	<ESC>(30043X	The ID Call
ICR SECURE String	<ESC>(10<ESC>(s1p12v0s0b110T	The Selection
	<ESC>(30066X	The ID Call
MICROPRINT String	<ESC>(2Q<ESC>(s1p1v0s0b112T	The Selection
	<ESC>(30055X	The ID Call
CMC7 MICR FONT String	<ESC>14Y<ESC>(s0p8h8v0s0b361T	The Selection
	<ESC>(30803X	The ID Call

MICR Font Note

The E-13B and CMC7 Fonts are 8 characters per inch. To position correctly, at exactly 8 characters per inch, the printer must be set to an internal Unit of Measure of 600 DPI or greater or must have a horizontal motion index command at 8 CPI be issued after the font call. This is true even if the base printer is at 600 DPI. The default character positioning is at 300 DPI and 8 into 300 is 37.5 pixels. The printer will either round down to 37 or up to 38 pixels causing characters to creep. To resolve this there are multiple options.

1. If you are using a printer driver that is set to 600 DPI, the printer data stream should include a Unit of Measure PCL command set to 600. The command is <ESC>&u600D
2. If the application controls the printer data stream, add the Unit of Measure command early in the data stream. The command also affects X & Y positioning commands. Add <ESC>&u600D

3. After calling the E-13B MICR font, issue an HMI (Horizontal Motion Index) command set to 8 characters per inch. The command must be included with every E-13B MICR font call using either the Selection String or ID call. The command string is:

```
<ESC>(100<ESC>(s0p8h8v0s7b360T<ESC>&k15H font data The Selection String
<ESC>(30802X<ESC>&k15H font data The ID Call
```

See Font Mapping Appendix pages for specific character set data for each font.

PJI MICR Command Example

Appendix H has an illustration of an Accounts Payable check and remittance information. The page used a PCL macro for the static data and background design. This manual does not address macro design and programming, but the variable text information including all the PJI and PCL commands used to print the example are on the page following the sample check. For illustrative purposes there are some extra spaces in the text preceding the printable data. The following paragraphs describe the command functions. The commands are a minimal set chosen to produce the example. Please consult Lexmark Technical Publications for the complete descriptions of PJI and PCL printer commands.

PJI Unlock Sequence

The first two lines of the variable text example are PJI commands that unlock the MICR font resources and enter PCL language processing. The password used is PASSWORD, the initial ship default. These commands and all following commands are all case sensitive.

<ESC> is used to illustrate the ASCII Escape Character, ASCII 27, hex 1B. An actual data stream requires the Escape Character, not <ESC>.

PCL Initial Set-Up

The next two commands set up some printer PCL variables. These commands are normally found early in the data stream. We chose a minimal set.

<ESC>&l2a1h6d1e64F sets the paper size to LETTER, the input tray to TRAY 1, the lines per inch to 6, the top margin to 1, and the lines per page to 64. The next command, <ESC>&u600D, is the Unit of Measure command set to 600 dots per inch mentioned in Section 7. This affects proper MICR line spacing and X and Y cursor positioning.

PCL Macro Call

The next command calls macro 100 that was previously loaded in RAM memory. When called, the graphic background, logos, and static data are written to the internal print buffer.

PCL Font Calls, Positioning Commands and Variable Print Data

The next eleven lines of data in the example call printer resident fonts, position the cursor, and print the variable information. This is using the minimal data required, particularly the font selection strings, <ESC>(s4099t0b10H) being a condensed version to call Courier, normal weight, 10 pitch.

<ESC>*p300x600Y is a PDL positioning command. In this case its values are 600 pixels down and 300 pixels to the right of the upper left corner of the page. The Unit of measure command determines the exact distance.

The next 4 lines call our secured MICR font resources. We are using the ID for the font call. The Form Feed prints the page.

PDL Re-Lock Sequence

The last two lines re-lock the secured fonts. The password was not changed in this example.


Appendix H: Accounts Payable

CHECK NO: 123456

Source Technologies, Inc.		2910 Whitehall Park Drive		Charlotte, NC 28273	
REFERENCE NUMBER	INVOICE DATE	GROSS AMOUNT	DISCOUNT TAKEN	NET AMOUNT	
XXXXXXXXXX	xx/xx/xxxx	\$x,xxx.xx	3%	\$x,xxx.xx	
TOTALS					

CHECK NO: 123456

Source Technologies, Inc.		2910 Whitehall Park Drive		Charlotte, NC 28273	
REFERENCE NUMBER	INVOICE DATE	GROSS AMOUNT	DISCOUNT TAKEN	NET AMOUNT	
XXXXXXXXXX	xx/xx/xxxx	\$x,xxx.xx	3%	\$x,xxx.xx	
TOTALS					



Source Technologies, LLC
2910 Whitehall Park Drive
Charlotte, NC 28273
800.922.8501

NON-NEGOTIABLE

Date xx/xx/xxxx

\$1,234.56**


DOLLAR → → → → → ONE COPRA TWO THREE FOUR PERIOD FIVE SIX

Check No. 123456

PAY xxxxx Thousand xxxxx Hundred xxxxx Dollars and xx/100 ****1,234.56**

TO THE ORDER OF Your Company
123 Main Street
Yourcity, ST 12345-6789

NON-NEGOTIABLE



⑈0 1 234 56⑈ ⑆ 1 234 56 780 ⑆ 0 1 234 1 234 56 70⑈

PJL and PCL commands used to print the sample check:

```
<ESC>%-12345X@PJL LDECLARE LRESOURCE:"flash:" LRWLOCK="PASSWORD"

@PJL ENTER LANGUAGE = PCL

<ESC>&l2a1h6d1e64F

<ESC>&u600D

<ESC>&f100y3X

<ESC>(s4099t0b10H

<ESC>*p300x600Y xxxxxxxxxx xx/xx/xxxx $x,xxx.xx 3% $x,xxx.xx

<ESC>*p300x2775Y xxxxxxxxxx xx/xx/xxxx $x,xxx.xx 3% $x,xxx.xx

<ESC>*p3250x75Y<ESC>(s4099t3b8H 123456

<ESC>*p3250x2200Y 123456

<ESC>*p4250x4450Y 123456

<ESC>*p3650x4775Y xx/xx/xxxx

<ESC>*p400x5225Y<ESC>(s4099t0b15H xxxxx Thousand xxxxx Hundred xxxxx Dollars
and xx/100 Cents

<ESC>*p600x5600Y<ESC>(s10H Your Company

<ESC>*p600x5700Y 123 Main Street

<ESC>*p600x5800Y Yourcity, ST 12345-6789

<ESC>*p900x6325Y<ESC>(30802X<ESC>&k15H O0123456O T123456780T
012341234D56700

<ESC>*p1500x5100Y<ESC>(30043X ($**1,234.56)

<ESC>*p3650x5400Y<ESC>(30066X $**1,234.56

<0C> Form Feed
<ESC>%-12345X@PJL LDELETEPASSWORD LRESOURCE:"flash:"

<ESC>%-12345X
```