White Paper
Laser M.I.C.R. Check Printing

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OBJECTIVE OF THIS PAPER

The objective of this paper is to present pertinent issues surrounding the implementation of an inhouse Laser MICR check printing system in an AS/400 (or AS/400 - Client Server) environment. Cost-Benefits, Security against Fraud, implementation issues and solutions will be reviewed. We hope to convince you that the ***concept*** of an in-house laser MICR check printing system is viable, cost-effective and secure. And, perhaps we can convince you to look at inFORM Decisions as your MICR solution provider.

WHO IS inFORM Decisions ?

inFORM Decisions is an electronic form and check software development specialist for AS/400 (iSeries) and associated Client-Server nvironments. inFORM Decisions' electronic document systems have been installed in hundreds of Corporations worldwide (e.g. Smith Kline Beecham, KOA, and Chase Manhattan…to name a few) and are recognized for their simplicity, enhanced security and ease of use. Some of inFORM Decisions' state-of-the-art electronic document technologies employed are artificially intelligent based algorithms to automate check and forms design operations; Toolbars with easy to use drag 'n' drop WYSIWYG design tools; AS/400 SAA compliant menu based prompting integration screens; and removable "flash" technologies to enhance security and increase performance.

DEFINITION OF MICR

M.I.C.R. is an acronym for **M**agnetic **I**nk **C**haracter **R**ecognition. MICR specifically refers to the special magnetic encoding, printed on the bottom of a negotiable check. This information is machine readable via bank reader/sorters, which read the visual patterns and magnetic waveforms of the MICR encoding.

HISTORY OF MICR TECHNOLOGY

MICR technology was a natural evolution to the voluminous paper processing requirements of a growing society. Originally invented at Stanford Research Institute in the 1950's, it was quickly accepted by the American Bankers Association (ABA) as a standard in 1958. The font developed for this automated check handling technology is known as - **E-13B**. This character recognition technology is evident today in the black characters, symbols, which are printed in magnetic ink (or toner), and run along the bottom of a check.

Figure 1 E-13B MICR Font

The American National Standards Institute (ANSI) accepted the ABA specifications for MICR in 1963.

These standards to maintain MICR specification are continued today with the banking industry looking to ANSI to administer this specification. Another special MICR encoding font known as CMC-7 is utilized in some European countries and South America. The CMC-7 font

was developed in France by Machines Bull and adopted as a standard in France in 1964. The E-13B font is used primarily in the U.S., Canada, Australia, Columbia, Europe, Central America, and the Far East Countries.

E13-B

There are two types of characters in the E-13B font, numbers and symbols.

Numbers: 0123456789

Symbols: C On-Us Symbol - Tells the reader/sorter that the next numbers identify the account number.

A Transit Symbol - Tells thereader/sorter that the numbers between the Transit symbols represent the institution upon which the check is drawn.

B Amount - These two symbols tell the reader/sorter that the numbers between represent the amount of the check written. This field is usually filled in by the bank.

D Dash Symbol - Used as a separator within the On-Us field, or as a separator between the bank branch number and the account number.

CMC-7

The use of the CMC-7 font is similar to the implementation of the E13-B font with some differences. CMC-7 consists of ten numeric characters, five special symbols and 26 alpha characters (A-Z). As follows:

Numbers:

0 1 2 3 4 5 6 7 8 9

Symbols:

A S-1 symbol is similar to On-Us. It identifies the start of bank account information

C S-2 symbol identifies the start of the amount field.

B S-3 symbol is a terminator for bank routing information.

D S-4 symbol not currently implemented in the MICR line

E S-5 symbol is the analog to the transit symbol.

Up until the late 1970's MICR checks were printed via off-set wet ink presses. In 1980 Xerox introduced the first xerographic toner (dry powder) based laser printer - the Xerox 9790 - for printing negotiable checks. With the proliferation of decentralized, inexpensive, all-points-addressable desktop laser printers, the implementation of costeffective and efficient MICR Check printing has become a realistic demand by organizations worldwide.

The cost benefits are easily determined, and MICR solutions ***can be*** relatively easy to implement. We reiterate "can be" and therein lies one of a few concerns. Quality, Security, Integration Seamlessness and Ease of Use should all be addressed with your chosen MICR solution.

COMPONENTS OF A WORKING MICR SYSTEM

In general, we can break down a MICR solution into three basic components: *Physical* components, *Software* components, and *Service* components. inFORM Decisions offers this completeness with their ***MICR400*** system. We've outlined our representative system below:

Physical Components

1. MICR enabled **Laser Printer** capable of handling a ferromagnetic MICR toner
2. A Quality, tested and approved ferromagnetic **MICR toner**
3. Quality ***Blank security check paper*** to enhance levels of security

Software components

1. ANSI, ABA and ISO (International Organization for Standardization) approved **E-13B** font
2. **Design Software** to compose the check templates and graphic images needed - logos, signatures, etc.
3. An **AS/400 **host-based check integration software** with the intelligence and seamlessness to integrate to the AS/400 accounting system.

**We distinguish host-based solutions from PC-based solutions, which attempt to provide a MICR printing solution from the AS/400. Downloading check printing data to a PC is not only cumbersome in process, but inherently *insecure* and should be avoided. A direct print (merge) from AS/400 to laser printer is cleaner and more secure.

Service components

Service components should be ***optional*** if the AS/400 MICR solution is intuitive enough. In other words, can you easily modify, add or delete bank account information? Or does the vendor require you to go back to them to modify ?

1. **MICR Quality Assurance** testing for issues, such as:
   - Check document layout
   - MICR font positioning
   - MICR encoding signal strength
   - Check paper evalution
   - Check software integration issues

2. Services available to **design the check templates**, logos and signatures (optional).

3. Services to do **check integration work** for AS/400 environment (optional).

4. Services to **program removable "flash" devices** (optional).

5. On-site **installation, testing and training** for the complete MICR system (optional).

SOFTWARE IMPLEMENTATION ISSUES

There are, simply put, two primary operations to undertake to install an AS/400 MICR check printing system:

1. Design operations
2. Integration operations

Design Phase

In the design phase, we will compose (design) the check template layout. Drawing rectangles, lines, shading and inserting static text and graphics are the usual exercises. Once complete, we'll need to digitize any needed graphics, such as logos, signatures, etc. Your integration software should be able to conditionally call these graphic elements into your check template at merge time from your AS/400 based on the correlated bank account.

The typical elements of a checkface are usually comprised of: *Bank name, Date line, Amount line, Payee line, Signature line(s), Memo line, Account title, Check serial number, Transit number*

Check Template Layout Rules:

- Date is in the upper right hand corner
- The amount is printed twice. The convenience amount (the numerically identified amount), and the legal amount (the textually represented amount).
- The signature line is above 5/8 inches from the bottom of the check.
- The Title of Account is generally in the upper left section.
- The Transit number is the fraction in the upper right hand corner of the check.
- The MICR line is generated and contained within the "clear band" - defined as the bottom 5/8 inches of the check.
- All MICR characters must be in a single line within the clear band. Positioned as follows:

  3/16 inch from the bottom edge of the check
  5/16 inch from the right edge of the check
  ¼ inch from the left edge.

** inFORM Decisions' MICR security check stock contains a default start box for the transit character to assist with exact placement.

If the transit character is placed within this box, the MICR line will either print in the exact location or be very close.

Figure 2 Check Components

Designing the Check template

It is highly recommended that you utilize a user friendly, WYSIWYG design tool to design your check template and graphic elements. inFORM Decisions' MICR400 software utilizes state-of-the-art tools to offer point 'n' click capability to draw forms and checks.

Below is an example of inFORM Decisions' intuitive iDocs Design software:

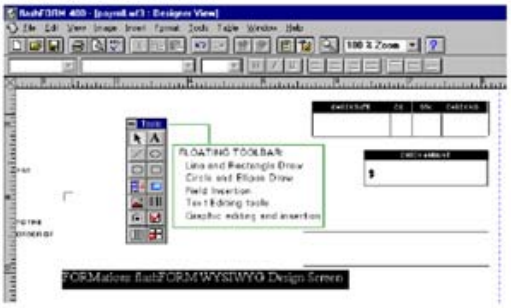

Figure 3 Intuitive Check Template Design with inFORM Decisions' iDocs Design Software

We will not get into the detail of form and check design here. Just know that it is important that the design tool you choose should be user friendly, provide for seamless integration to AS/400 applications, and compile compressed overlay files for fast efficient processing. inFORM Decisions' iDocs overlay files average between 10k - 30k.

** This is very efficient code and should not cause any performance hit on the AS/400 host or laser printer.

** With some compiled printer output code, such as IPDS or PostScript, file sizes can be too large to process efficiently. Performance hits can be seen on AS/400 and/or Laser Printers.

Integration Phase

After the check form(s) and images(s) have been composed, integration operations need to follow. This piece can be complex, and vary greatly from vendor to vendor. It will be difficult if not impossible to determine the best integration solution until after you're knee deep into your own application. Each vendor's presentation will highlight his own strengths and shadow his weaknesses. Therefore we provide what we believe are the important questions to answer…for yourself.

1. How easy is the Integration software to use ? Can you edit, modify, add, or delete options yourself or does the software require the vendor's involvement? This will be an indication of intuitiveness and your ability to control your own destiny. How are modifications done - Menu/Prompting based ? Complex Command Lines ? Custom Code ? Be aware, many of the offerings out there are customized for a particular accounting system, or for your company - they work well as long as nothing changes !

2. Can the integration software provide for direct printing of checks from the AS/400, or does it require you to download data to a PC first ? This may be a concern due to the cumbersome steps involved, and the loss of data control and security. There are enough AS/400 specialized MICR systems that a PC based solution should not be considered - whether inFORM Decision is your choice or not.

3. What is the method with which the MICR font is implemented? The consideration here is whether or not the MICR font is "built" on the fly during the check run. This is important towards the system's ability to handle multiple accounts.

4. How secure is the MICR system? Multiple level passwords ? Is there a removable data storage security option to store signature, MICR fonts, etc.?

Below is an example with inFORM Decisions' "Check-Secure" removable check security system

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inFORM Decisions' *"Check-Secure"*

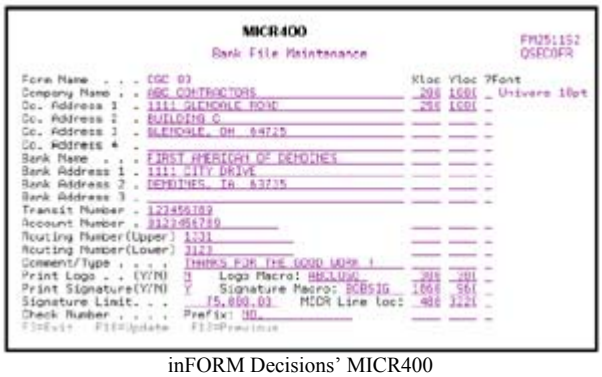
Figure 4 Check Printing Security

5. Does the system provide a Positive Pay module? This is an optional security measure in which the bank and the company work together to prevent fraud. A report can be generated which identifies all the checks that a company generates on daily check runs. The report can be faxed or electronically transmitted (more on this later).

6. Can the system provide for the printing of multiple bank accounts on the fly? How easily is this accomplished?

7. Does the system provide for conditional signatures? If the amount is over a designated amount DO NOT print the signature, for example.

8. Below we show inFORM Decisions' ***MICR400*** Bank File Maintenance Menu to show our core screen to address check integration requirements. Multiple Bank File Maintenance screens can be set up for multiple accounts. Once completed, the system will recognize which spool file belongs to which account - automatically. Thus, there is no user intervention required to load paper, correlate check numbers, void check jams or other timely actions.



inFORM Decisions' MICR400

Figure 5 Laser Check Integration Menu

Again from this author's point of view the following integration issues should be addressed with your MICR integration software:

- The integration software should be AS/400 hostbased.
- The integrations software should be easily modifiable, as opposed to custom code for your environment.
- The integration software should have a good amount of security options.
- The integration software should work seamlessly to your AS/400 accounting applications. (There should not be cumbersome steps involved to print checks.)
- The integration software should handle multiple accounts easily.

By the way, inFORM Decisions' ***MICR400*** software does all of this. (…just a few plugs for us here and there.)

UTILIZING LASER MICR TECHNOLOGY TO ELIMINATE FRAUD AND INCREASE SECURITY

As check fraud has become one of the fastest growing forms of fraud in the U.S. today, Banks and Corporations have stepped up efforts to install increased security measures to stem the tide.

In 1995, estimated losses to U.S. enterprise was over $12 billion. U.S. banks spend approximately $150 million annually to detect and prevent fraud, as they stand to lose more than businesses.

Laser check printing technology lends itself well to increased security and check fraud prevention. One very important reason is due to the fact that *we no longer store preprinted checks that only require filling with a typewriter and forging a signature.* Laser MICR check printing systems (at least ***MICR400***) requires a bad guy to have multiple level password (and/or authority) entrance to get into the AS/400 Accounting System, and possibly have access to the removable storage "key" (if used). Many IS Departments already have strong password control to get into the AS/400. This is probably more difficult and complex than accessing preprinted check stock in a locked cabinet.

Some of the following security steps probably already exist; we'll add a few more:

- As mentioned, there are authorities and passwords to get into your AS/400 check producing application. This is obviously necessary in order to print checks with a Laser MICR check printing system. This IS NOT the case with preprinted checks since all that is required is a forged signature and a typewriter !
- The MICR check printing system should have a password screen to modify the banking/company information, in addition to a minimum of one password required to actually run checks.
- Removable security is a powerful option for laser check printers. Many of the laser printer manufacturers have eliminated their Font cartridge or PCMCIA card slots and moved to internal programmable memory SIMM storage. The problem is that this technology is not removable. inForm Decisions' Check-Secure is an alternative which offers simple password protected programmability to program PCMCIA cards which can be stored and removed with the sensitive signature and MICR font data (***see figure 4***).
- Positive Pay is a new and popular approach by which banks and companies work together to correlate approved printed checks. A positive pay report will typically consist of the date, check number, amount of check, and Pay to. Specifications for positive pay reports can vary from bank to bank. This report can be transmitted via electronic data interchange or facsimile, and thus only pays those checks on the report. The positive pay report operation shifts more responsibility and accountability to the bank.

- Various security precautions can be ordered with Blank MICR Security Check Stock that make it difficult to forge. inFORM Decisions provides blank security check paper features and options to enhance this level of security:

    - Pantographs and photocopy voids which are activated when a check is photocopied.

    - Special Watermarks that are difficult to see unless held up to the light at an angle.

    - Security Seal similar to a Watermark. Can't see unless held at an angle.

    - Prismatic printing produces a rainbow effect that is difficult to copy.

Figure 6 inFORM Decisions' "Rainbow" Blank Security Check Paper for Laser Check Printers

Operational Procedures to Increase Security

- Divide areas of responsibility for check handling. Make sure there are no conflicts of interest i.e. The person cutting checks should not be the same person who purchases.

- Control access to Laser MICR printer, MICR Toner, Security Paper and Removable check printing media (if used).

- Change passwords regularly if needed.
- Control access to any critical files graphics - signatures, Check Template, MICR font, etc.

TESTING THE MICR APPLICATION

Some MICR vendors, your bank and various institutions have the ability to verify and test your final Laser MICR check printed output. inFORM Decisions can advise, consult and test on the integrity of your laser printed check in the below areas. Know that you probably shouldn't worry about all of these areas. Many software solutions and services (like inFORM Decisions') ensure that the critical areas of quality and integrity are addressed. Simply sending your outputted checks to your local bank will suffice. Below is a comprehensive list of the testing that inFORM Decisions can provide for your MICR check quality; as an example:

- Document design and MICR character clear band layout.
    - inFORM Decisions' can provide a service or provide a *MICR Position and Dimension Gauge* to ensure that the MICR line is within the clear band area. MICR line positional areas measured with this gauge are - horizontal, vertical, skew, and character spacing. (In addition inFORM Decisions' can provide X/Y coordinates for MICR line placement for various check layouts on 8 ½ " x 11 " paper.)
- Software implementation procedures which result in an invalid MICR line.
- Laser printer hardware connectivity and output results.
- MICR line readability issues can occur due to Toner or Laser Printer quality, in the following areas:
    - Signal strength
    - Extraneous toner bits in the MICR line
    - MICR line character integrity
    - Shadowing - whereby light transparent images from one check are shadowed on the next check
    - Spots caused from toner, paper dust, contaminants, etc.
    - Skewing of the document during printing. Thisis a problem with some older model laser printers.
    - Character spacing and size
    - Debossment or depression of paper surface caused by the laser printers pressure fusion process.

This comprises most of the concerns for laser check printing output. Again, much of the above should not be a worry due to today's laser printers and advancements in MICR technology. Certainly, inFORM Decisions provides much assistance and advice for laser printers, and toner and paper selections to ensure that the output is consistent with ABA, ANSI and ISO standards.

THE PHYSICAL COMPONENTS

MICR Laser Printers

There are various manufacturers with accepted MICR laser printer technology on the market today. HP, Lexmark, Xerox, Olympus and Brother are among the more popular models. The issue of whether a laser printer is truly a laser MICR printer or not is primarily related to its ability to handle the ferromagnetic MICR toner. The MICR encoding is really a font, and a font can be made or modified as required. Quite often inFORM Decisions will tailor its MICR fonts for specific laser printer models, as their output can vary slightly.

It is important to be aware that some laser printers are sold as "Laser MICR Printers". Be aware that most likely this will mean you pay almost double for a regular laser printer with MICR toner. Again, what comprises a Laser MICR printer system is:

1. A laser printer which handles MICR toner
2. MICR Toner
3. An ANSI/ABA approved MICR font
4. The software to design and integrate the check application
5. A reasonable amount of password and removable security features

MICR Toner

Laser printing is a printing process that uses heat and pressure to fuse thermoplastic dry toner to paper. The dry ink is melted to make it adhere to the paper. Because heat and pressure are used to bond the toner to the paper, it is difficult to remove toner without detection. It is also difficult to chemically alter a toner fused image since the colorant material is well protected by its plastic binder.

Because of the improved bonding of today's laser printers, quality laser MICR printing is now possible (or at least has been for the past ten-plus years). We should point out that some laser printers perform better as check printers than others. inFORM Decisions can provide recommendations of Printer Manufacturers and Models.

MICR Toner is really the heart of what makes a laser printer print a negotiable check - the rest is basically software. It is important to check out the MICR Toner manufacturer prior, however. We recommend you call references; visit or call users; and most importantly test the toner manufacturer's output with your bank. inFORM Decisions can be of assistance with this testing, and recommend vendors to provide quality MICR toner.

Security paper

Although you could technically cut a negotiable check on blank white paper, its probably best to utilize blank security check paper. These papers have various security elements built within them to combat check fraud. These papers can be chemically treated so that marks such as the word "void" become visible in areas where erasers or chemical eradicators are used. Another very common feature of these security papers is to provide a background that makes alteration easily visible. E.g. repetitive or duplicated background logos and graphics

Another detail of a security paper's integrity is in its actual ink. There are what are called "safety inks" which are more susceptible to mechanical or chemical tampering. "Stable inks" are often used to print just patterned "safety" papers, however these documents aren't as secure since they are more easily altered than documents printed on true safety paper. At this point, we are really getting into deeper levels of security. We should point out that many companies print checks on patterned blank check paper with fewer security features, and have not seen problems.

CONCLUSION

Laser MICR check printing is truly one of the most cost-justifiable application solutions on the market today. It is important to remember that you will not only save on the paper costs (which often are significant), but more importantly, save on the storage, waste, obsolescence, and labor costs associated with handling and managing preprinted check processing environments. According to an intelligence report by Datek, the actual cost of handling a preprinted form is 10 - 15 times more than the actual cost of the paper. For this and other reasons Banks, Financial Institutions, Corporations and Government organizations have installed Laser MICR Check Printing.

If you would like to learn more about electronic form and check automation for your environment, please contact **inFORM Decisions** at:

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