SMALL CHECK SCANNER MICR READ PERFORMANCE BENCHMARK STUDY

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Date Prepared: *1 February 2006*

Silver Bullet Technology wishes to acknowledge the support of Deluxe Corporation for providing the MICR stress documents used for this study.

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INTRODUCTION

With the shift from centralized to distributed capture occurring in the financial industry, there is a growing concern with checks that are captured by small inexpensive check scanners. Many fear a deterioration in the quality of the MICR and image data captured is emerging among early adopters. In the case of MICR read quality, higher rejects will lead to increases in operational costs for processing checks. Misreading checks may lead to incorrect routings and account postings, which in turn leads to financial losses and customer dissatisfaction.

Silver Bullet, in response to market indications of inferior MICR read performance from small check scanners, has conducted an independent MICR read performance study. The study validates the industry's claims of inferior performance in the smaller scanners and assesses the value of adding MICR read performance enhancement technology to check processing.

With the assistance of Deluxe Corporation, a major US check printer, Silver Bullet assembled a MICR stress test deck to perform the analysis. The stress deck contains 9 MICR defect conditions representative of the type of defects that exist in live production environments. This test deck was processed on the check scanners under evaluation. For each check the MICR codelines and the front view black and white images were captured using the scanners default image settings. MICR read performance was measured for each scanner by counting field level rejects and misreads.

It is important to understand that although the stress deck contains defects that exist in live production work, it is not representative of the frequency these defects occur in live production. For this reason readers of this report should not use the results to compare overall performance of various scanners. The readers may use the statistics in this report to assess how well a scanner MICR reader performs on a particular type of defects. The reader may also make the conclusion that if a MICR reader performs well on the various types of MICR defects, then the MICR reader will also perform well on live production work.

MICR STRESS DECK

Leveraging their knowledge of MICR specifications, Deluxe created unique and specialized documents into a stress deck to represent the types of MICR errors experienced in the industry. Deluxe has created these types of specialized documents since the inception of MICR printing

The stress deck consists of MICR quality defects designed to test the behavior of the MICR reader under evaluation. In typical live work processed at banks throughout the USA, the majority of checks fall within specified MICR standards, however, there is still a significant fraction that fall outside of specifications. Manufactures of high speed check reader sorter equipment recognized many years ago the financial market demands for high recognition rates on the general population of checks, even when the MICR codelines do not meet the specifications outlined in industry standards.

High speed check sorter manufactures design their MICR readers to achieve the highest possible recognition rates, even on MICR print that is outside specifications. Today a typical US bank sees

reject rates of less than 1% for documents processed on their high speed capture systems. There is also little tolerance for misreading documents. Typical document misread rates fall under 0.1% of the documents processed on these systems.

The Silver Bullet stress deck consists of 9 defect conditions. Each condition represents a MICR printing defect that is outside industry MICR standard specifications. When processing checks with these types of defects, it is first highly desirable to read the MICR codeline without errors. Failing this, it is important to reject these documents. It is least desirable for the MICR reader to incorrectly read the codeline and substitute wrong characters. The defect conditions are described below.

MICR spots

These documents contain a few minute spots of MICR ink near and between characters. They test the MICR readers ability not to be affected by small ink spots sometimes present on checks due to printing defects or smudging.

Narrow bars

The character stroke widths of these documents are slightly thinner than the minimums defined in industry specifications.

Wide bars

The character stroke widths of these documents are slightly wider than the maximums defined in industry specifications.

Low magnetic toner

The ink used to print the MICR codelines in these documents contains below average numbers of magnetic particles. The resultant MICR signal strength is very low. They test the dynamic range of the MICR reader to read characters with varying signal strengths.

High magnetic toner

The ink used to print the MICR codelines in these documents contains above average numbers of magnetic particles. The resultant MICR signal strength is very high. They test the dynamic range of the MICR reader to read characters with varying signal strengths.

Character spacing

These test documents contain characters spaced closely together. The space between these characters is below the minimum defined by industry specifications.

Vertical position errors

These test documents contain characters in high and low vertical positions relative to the nominal position of the codeline.

Broken characters

These test documents contain deformed shape characters. In some cases the characters are barely legible to the human eye. The test documents represent too high an expectation for a MICR reader

to recognize these correctly, but tests the reader's ability to reject characters that should be rejected.

Skewed characters

The characters in these documents are printed at an angle (horizontal axis) slightly above the maximum angle specified in the standard's specifications. The documents also test the sensitivity of the reader for recognizing MICR codelines from skewed documents.

Stress Deck Document Mix

Approximately 7200 documents were used for the study. The following table shows the percentage content or mix of each defect type.

Defect Type	Document Mix
MICR spots	13.9%
Narrow bars	13.9%
Wide bars	13.9%
Low magnetic toner	13.9%
High magnetic toner	13.9%
Character spacing	13.9%
Vertical position errors	1.39% (Note 1)
Broken characters	1.39% (Note 1)
Skewed characters	13.9%
Total	100.0%

Table 1 Stress Deck Defect Mix

Note 1: The percentage content of test documents with vertical position errors and broken characters were adjusted lower than other defect types. Recognition errors on these test documents were 100% for these two defect types for all the scanners evaluated. Higher volumes were not necessary to show the reader performance on these types of defects.

IBM 3890 MICR READER TESTING

The IBM 3890 represents a typical high speed reader sorter used by major US banks. This reader sorter achieves better than 1.0% document reject rates with less than 0.1% document misread rates on live production work. The study's stress deck was also processed on an IBM 3890 for comparison purposes.

Defect Type	Documents Read Correctly	Documents Rejected	Documents with Misreads
MICR spots	100%	0%	0%
Narrow bars	100%	0%	0%
Wide bars	100%	0%	0%
Low magnetic toner	100%	0%	0%
High magnetic toner	100%	0%	0%
Character spacing	0%	100%	0%
Vertical position errors	100%	0%	0%
Broken characters	0%	100%	0%
Skewed characters	100%	0%	0%
Total	84.7%	15.3%	0%

Table 2 IBM 3890 MICR Read Performance on Stress Deck

The table clearly shows the recognition characteristics of a high production device across the MICR defect types. Interestingly, the IBM 3890 was unable to read the test document with "Character Spacing" errors. It illustrates that this reader is designed with a conservative nature to reject instead of misread characters. The 100% rejects on the "Broken Characters" is the desirable behavior.

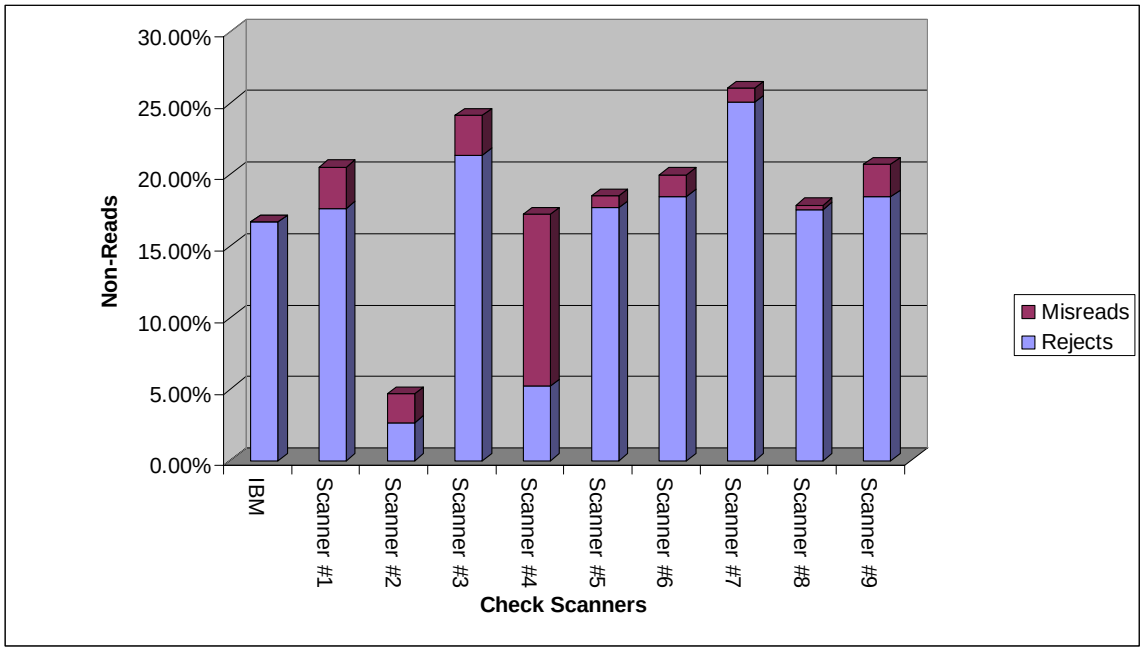
SMALL CHECK SCANNERS EVALUATED

Nine different models from seven check scanner manufactures were evaluated as part of the study. These scanners represent the most popular brands currently deployed in distributed capture environments. With only one production unit tested for every model, this evaluation will not reflect any variations accountable to manufacturing tolerances.

Anonymity of individual scanner results is maintained as the purpose of this study is to demonstrate the general problem and not to compare performance among various scanners.

SMALL CHECK SCANNER RESULTS

The following graph reflects the overall recognition performance of each scanner included in the study. A comparison to the IBM 3890 is included.



The results demonstrate significant variations in behavior among the various check scanner models. All the scanners evaluated generated misreads, with some performing better than others. Examining the detailed results of each MICR defect category separately can profile scanner behavior better. Generally, all scanners could not read the test documents with vertical position errors. This is attributed to the smaller MICR read heads used in these scanners. The IBM 3890 scans the full 0.5" MICR band. The smaller MICR read head appears to scan close to a 0.25" band; this would contribute to the smaller scanners inability to read these test documents.

MICR READ PERFORMANCE ENHANCEMENT TECHNOLOGY

The Silver Bullet study confirms the industry's growing concern that the MICR read performance of small check scanners is inferior to that of high speed reader sorters. Our evaluation demonstrates that the scanners have varying degrees of sensitivity to MICR defects, resulting in the generation of rejects and misreads. It is this writer's belief that the MICR slot read technology used in the small check scanners has limitations and will never deliver the required level of performance demanded by the financial industry. The reasons for these conclusions are as follows:

- The slower transport speed of the various devices produces a weaker signal at the read head. This results in a low signal to noise ratio that increases the challenges of achieving accurate recognition.

- A low signal to noise ratio also makes the scanners susceptible to noise interference, from the check scanner itself, from monitors, cell phones, or other magnetic wave interferences.
- The small footprint of the devices makes it challenging to achieve a stable document during MICR scanning. An unstable document will have changing velocity, skew, and potential flutter during MICR scanning. All these may cause distortions in the captured MICR waveform resulting in poor recognition accuracy.
- The small check scanners have smaller MICR read bands. The high speed reader sorters have larger read heads that make them less sensitive to vertical position variations.

Using MICR recognition performance enhancement technology is a viable solution for achieving acceptable levels of MICR read performance. This technology uses additional data from the scanner to automatically correct rejects while reducing misreads. The most popular solutions will use OCR technology to read the MICR line optically and combine them with the MICR results for a best read. Better solutions will use additional data from the scanner such as confidence levels, second choices, raw grayscale images for OCR recognition, intelligent combination techniques using codeline syntax rules, and even use specific scanner characteristic data to achieve the best results possible.

These technology solutions will also normalize MICR read performance across different scanners. Under such conditions it will no longer be important to be concerned about which scanner models perform the best for MICR reading. Using good MICR recognition performance technology will ensure high quality MICR recognition rates across all scanner models. It will even compensate for the deterioration of MICR read quality over time due to unhealthy check scanners.

An additional benefit these solutions can enable is counterfeit check detection by flagging items that have improper magnetic ink toner. A check that reads well optically, but poorly magnetically, can be flagged as a counterfeit suspect for further research.

CONCLUSION

With the increasing use of economical, small check scanners as a point of deposit capture device, the financial industry should understand the reality that these devices do not perform as well as the traditional reader sorters when it comes to MICR read quality. If unchecked, this will lead to an increase in check rejects and misreads that will elevate the levels of operational costs, losses, and customer dissatisfaction.

The financial industry should incorporate MICR read performance enhancement technology in their distributed capture solutions. This technology will ensure high MICR read quality across all capture devices, independent of the models used. This removes dependencies on actual MICR read performance across scanners and will even compensate for poor MICR read quality from unhealthy devices.