Check Deposits Without Check Scanners

It’s More Than Mobile Capture

Contents

First Edition January 2011

EXECUTIVE SUMMARY

The Rules Are Changing

Remote Deposit Capture (RDC) has been in use by banks and other financial institutions for some time. What is relatively new for RDC is the capture of checks from camera based devices without hardware magnetic MICR readers. These Remote Deposit Camera Capture (or **RDCC)** devices such as cell phone cameras, flatbed scanners and portable scanners are challenging many traditional assumptions about Remote Capture:

Assumption 1 – "Reading the MICR Line is Easy"

The capture of check images is now in the hands of small businesses and consumers, and they are using devices without magnetically-read MICR data. RDCC capture devices cannot be counted on to seamlessly work in place of traditional RDC devices and to accurately read the MICR line. Failure to accurately and successfully read the MICR line from check images results in slower clearing due to return processing and increases exception and return processing expenses. Therefore, accurate MICR OCR software is essential.

Assumption 2 – "Image Processing for RDCC is Easy"

With the move to RDCC, the quality of the check image cannot be assured. A significant amount of image processing before and after the MICR OCR process is required to create exchange-ready TIFF check images. In addition, each type of check capture device produces images with different characteristic flaws that require different processing strategies. These strategies must be fine-tuned with real-world data.

Assumption 3 – "There is No Need for Duplicate Detection"

When submitted to a bank, a paper check is easily removed from circulation. However a check scanned by an RDCC device might not be taken out of circulation after conversion to a check image. The same paper check can be accidentally or intentionally submitted for deposit multiple times. Therefore, a robust duplicate detection mechanism for checks received from all customer channels is needed for fraud prevention and cost containment.

Assumption 4 – "There is Only One Cash Image Letter Format"

The exchange networks such as the Federal Reserve Bank, SVPCO and others have worked to restrict the number of Image Cash Letter formats. This effort is formalized in X9.100-187 and agreed to by the exchanges in the Universal Companion Document (UCD). However, the remote capture deposit ICL formats for different institutions are often proprietary to a particular financial institution. Any RDCC solution adopted must be able to create the formats required by the destination point of the ICL.

Assumption 5 – "RDCC Produces a Positive Customer Experience"

If the customer has to take repeated pictures of the check, or has to wait too long for a response, or if the deposit requires correction, the experience is lessened. All of these are new to the RDCC environment.

Assumption 6 – "Comparing OCR Software Vendors is Easy"

In evaluating MICR OCR software engines it is important to measure the substitution rates (such as reading a "9" as a "3"). Many MICR OCR software products might seem to give a high success rate when capturing a MICR line but potentially they are mis-recognizing many characters that can lead to downstream rejections and returns.

Executive Summary Conclusions

Camera capture is not new. Every check scanner, flatbed scanner or portable scanner has a camera. What is new is the number of institutions using camera capture devices in their daily check flow. There are a limited number of vendors with long term experience in camera capture. All My Papers is among the most experienced of these vendors.

All My Papers

All My Papers (AMP) provides core server technology for the processing of check images to Remote Deposit Capture vendors and to the internal development teams of financial institutions and has done so since 2000. All My Papers does NOT capture images or control the capture of images from scanners or cameras. It is a member of X9, ECCHO and the UCD council of the Check Image Collaborative. A notable deployment is the largest and oldest home capture financial institution that has used AMP's MICR OCR, image processing and ICL file creation technologies in daily production since 2006. These technologies are core components of its home capture solutions.

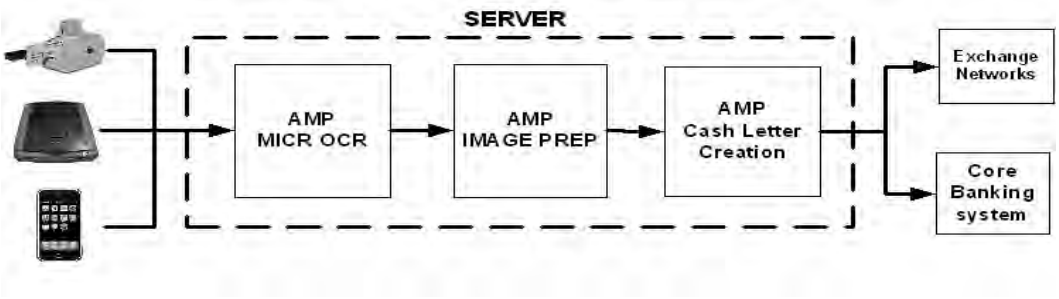

Figure 1—All My Papers products convert RDC/RDCC images into compliant Image Cash Letters

For more information about All My Papers solutions to the challenges of Remote Deposit Capture and Remote Deposit Camera Capture, contact sales@allmypapers.com

ASSUMPTION 1 – "READING THE MICR LINE IS EASY"

The capture of check images is now in the hands of small businesses and consumers, and they are using devices without magnetically-read MICR data. RDCC devices cannot be counted on to seamlessly work in place of traditional RDC devices and to accurately read the MICR line.

Failure to accurately and successfully read the MICR line from check images results in slower clearing due to return processing, contributes to poor customer experience (such as forcing rescans), and increases exception and return processing expenses

Traditional high speed magnetically-read check scanners provide hardware-based MICR reads with high accuracy.

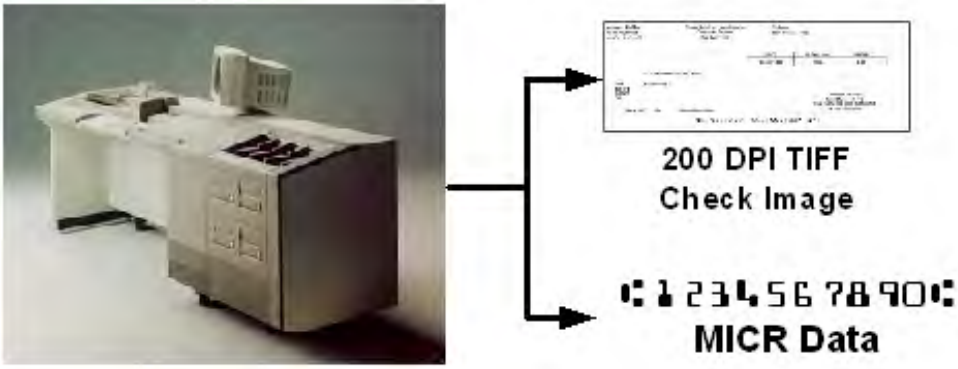

Figure 2—A traditional high-speed check scanner outputs check images and MICR line data

As remote deposit scanners have become less expensive, design considerations have forced a decline in their MICR hardware read accuracy. In this environment, MICR OCR software must be used to verify the hardware reader output.

Now, in the RDCC environment, the capture of check images is being done with devices that do not have hardware MICR reading capabilities. The MICR OCR software that was originally used to verify is now being used to capture the MICR data.

The accuracy of the MICR line read will impact the extent of liability losses, operational expenses and customer satisfaction related to RDCC activities.

Figure 3—Flatbed scanners and cell phones only capture images and not MICR data

.

ASSUMPTION 2 – "IMAGE PROCESSING FOR RDCC IS EASY"

With the move to RDCC, the quality of the check image cannot be assured. A significant amount of image processing before and after the MICR OCR process is required to create exchange-ready TIFF check images.

In addition, each type of check capture device produces images with different characteristic flaws that require different processing strategies. These strategies must be fine-tuned with real-world data.

To process RDCC check images, the MICR line data must be recovered optically via MICR OCR software. However, initial check images coming from these devices may have serious image flaws that must be analyzed and corrected prior to reading the MICR line.

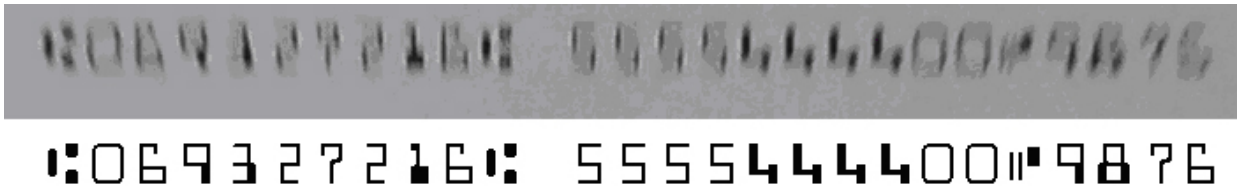

Figure 4— MICR line from RDCC captured check image before and after processing

There are many kinds of image flaws that a successful RDCC solution will need to address to be able to extract highly reliable MICR data and achieve low return rates.

Magnetic Check Scanner	Flatbed and Portable Scanner	Digital and Mobile Phone Camera	Impact on Process
MICR line is magnetically read	MICR line is not magnetically read	MICR line is not magnetically read	MICR line must be optically read and decoded. Any distortion in the captured image will degrade the reliability of the result.
Captures black and white TIFF image ready for exchange	May capture color or grayscale image depending on scanner and driver	Captures color image	Process must convert color and grayscale images to black and white TIFF images to be incorporated into ICL files for exchange.
Resolution is always fixed	Resolution can vary depending on configuration and driver properties, and is sometimes not known	Resolution varies and is unknown	A resolution of 200/240 DPI is required for exchange. In the case of cell phone cameras, the resolution of the image depends the camera's resolution and on the shooting distance from the camera to the check.
Resolution is symmetric and linear	Resolution is generally symmetric and linear	Resolution may be asymmetric and non-linear	In the case of cell phone camera images, any angle between the camera and the check can cause differences between the horizontal and vertical resolutions of the image which, in turn, can challenge MICR line capture and TIFF conversion.

Magnetic Check Scanner	Flatbed and Portable Scanner	Digital and Mobile Phone Camera	Impact on Process
Check image is framed correctly	Check image may not be correctly framed	Check image will not be correctly framed	Framing refers to having only a picture of the check in its entirety within the image without extraneous borders or cropping. Camera images are always poorly framed as there is little control over distance from or angle to the check being captured. This, in turn, negatively impacts both the absolute resolution and linearity of the image's resolution.
Check image is rectangular	Check image is rectangular	Check image may be trapezoidal	In the case of cell phones, any angle between the camera and the check can cause trapezoidal distortion of the image. This challenges the MICR OCR reliability and must be corrected because check images must be rectangular for incorporation into an ICL file.
Check image contains little to no skew	Check image may be radically skewed	Check image may be radically skewed	Skewing challenges MICR line recovery and must be corrected prior to the processing and packaging of the image into an ICL file for exchange.
Check image is in focus with good contrast	Check image generally has good focus and contrast	Check image may have poor focus and/or contrast	Poor lighting and movement while taking the picture can impair contrast and focus – both of which are key to reliable MICR OCR extraction and human reading of the final image.
Check image is evenly illuminated	Check image is generally well illuminated	Check image may have shadows and uneven illumination	Shadows and poor lighting can cause some or all of the check image to be unreadable by both MICR OCR software and human vision.

Fine Tuning with Real-World Data is Key

Each type of check capture device produces images that require unique processing strategies.

Check images captured by engineers in labs do not fully encompass the range of real-world check conditions in terms of the type of capture equipment, operator skill levels, lighting and other conditions. Images captured by real customers provide the only valid test bed for such processing strategies.

For a successful RDC solution, real-world data in the form of check images captured by real customers (as opposed to those captured or created in the lab) is the key to perfecting the image processing techniques required.

RDC versus RDCC Image Capture Examples

Figures 5 and 6 compare the significant differences between capture using a magnetically-read check scanner (RDC) and capture using a cell phone camera (RDCC). To produce the 200 DPI TIFF compliant image shown in Figure 5, the magnetically-read check scanner

- controls the document position, scanning speed, and skew
- uses a contact image sensor that always keeps the document in focus
- has a document illumination system to ensure the capture of images with good contrast ratio
- employs a magnetic read sensor for the capture of MICR line information

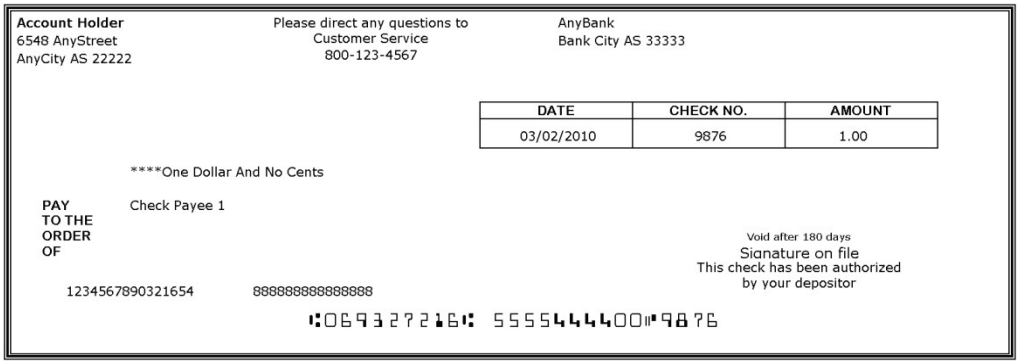

Figure 5—Check image captured by a magnetically-read check scanner

Compare this to the image in Figure 6, which shows the same check captured by a mobile phone. No longer is the check framed correctly. It is skewed and has a trapezoidal shape caused by taking the picture at an angle.

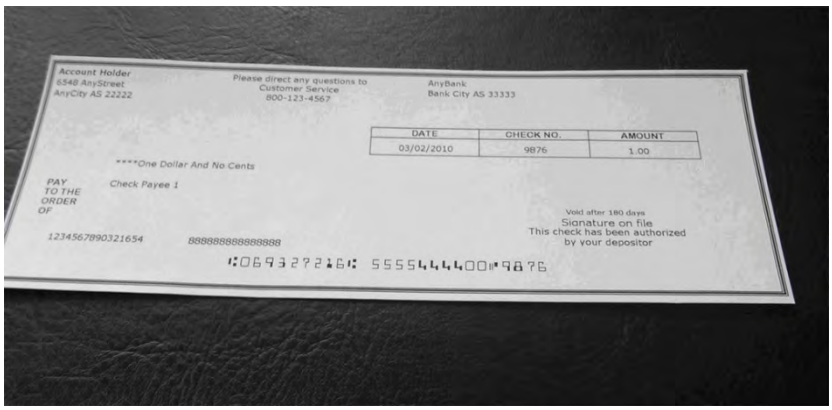

Figure 6—Check image captured by a mobile phone

Since the distance from the camera to the check is arbitrarily set by the user, the resolution of the check image is unknown. To produce a compliant TIFF image it is necessary to detect the resolution of the camera image and rescale to the 200 DPI resolution required by image exchange regulations. These issues create challenges for the MICR OCR software.

Illumination, Shadows, Blurring, and Low Contrast in RDCC Images

Figures 7, 8 and 9 show a check captured with different kinds of poor illumination. The poor illumination can cause shadows, blurring, and low contrast information in the image.

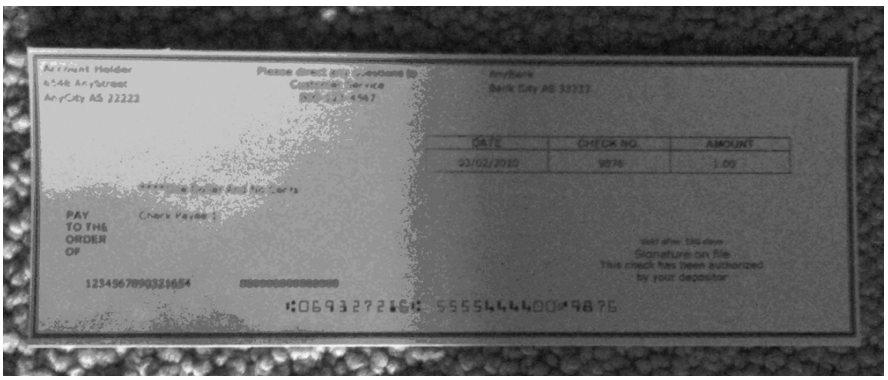

Figure 7—Shadows can cause all or some of the check image to be unreadable.

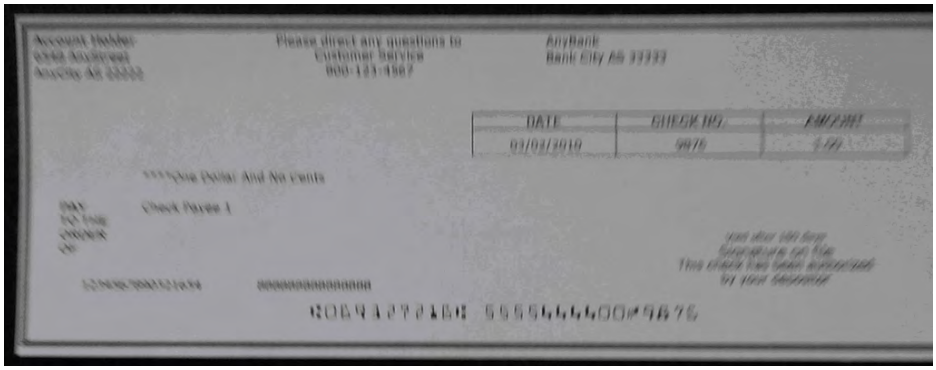

Figure 8—Many mobile devices don't take clear pictures at close range; shaking also affects focus

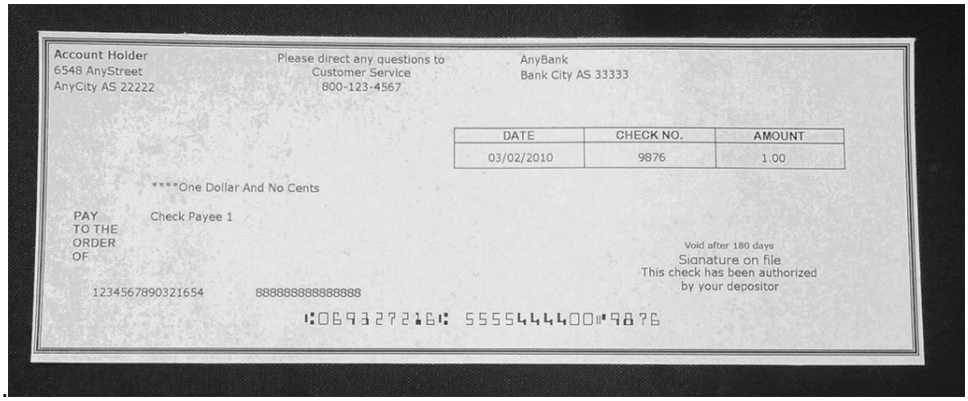

Figure 9—Too much illumination caused by direct sunlight or a photo flash leads to low contrast

RDCC Image Processing and MICR Extraction Workflow

Processing RDCC check images requires a carefully designed workflow in order to capture an accurate MICR line and produce compliant TIFF images for both the front and rear views of the check image.

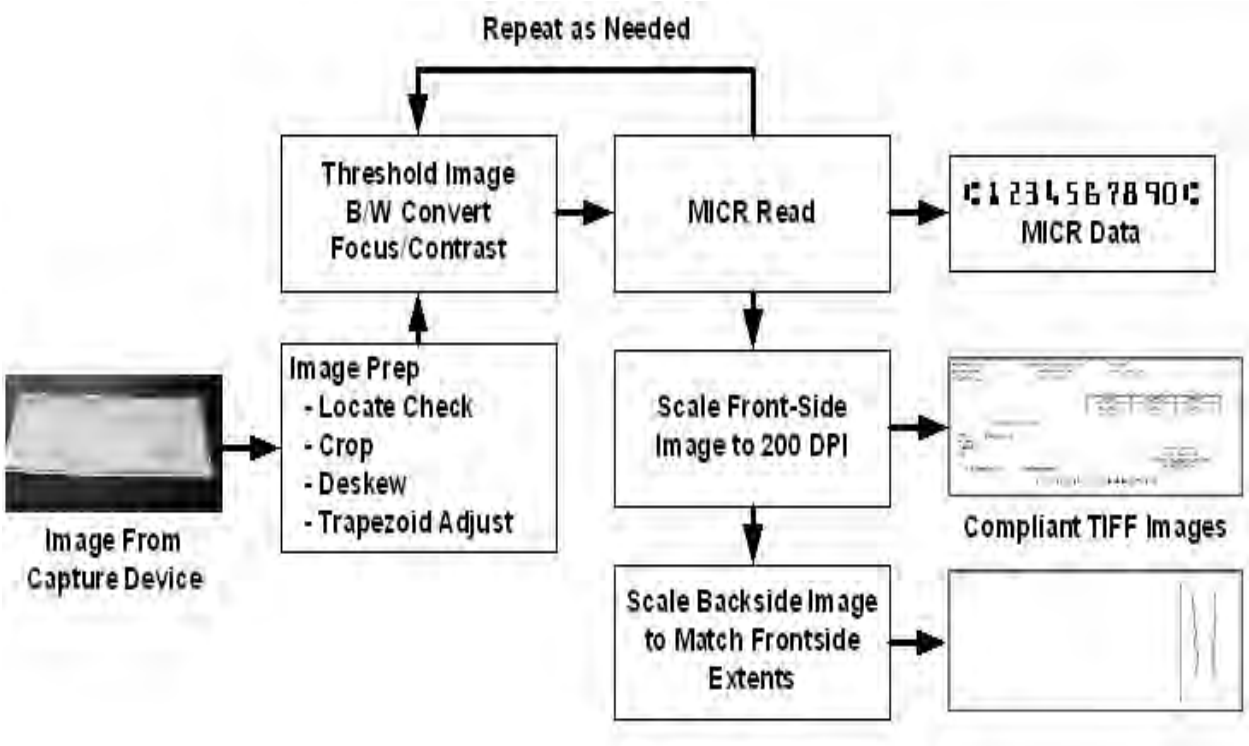

Figure 10—RDCC Image Processing Workflow

RDCC images from mobile phone, portable scanners or flatbed scanners are captured as color or grayscale and compressed using JPEG compression. Back-end software functions process the input and, if color, convert to grayscale image using standard color to grayscale transforms. Then an iterative process will threshold the image, locate the check image, crop it from the background, correct for skew and compensate for any trapezoidal image shape. The grayscale image may undergo this processing several times (using different processing values) until a good MICR read is obtained.

The conversion to black and white uses an algorithm that analyzes the image content to determine the optimal thresholding curve to produce a high quality black and white image. The thresholding algorithm automatically compensates for poor focus and low contrast conditions in the image.

Once the OCR technology is used to read the MICR information from the image, the final step is to scale the image to a 200 DPI resolution, adjusting for any non-symmetrical resolution detected.

The rear images are processed in the same manner except that the resolution scaling is determined from the results of processing the front image, as there is no MICR information to process on the back.

The result is an image exchange compliant TIFF image.

Putting It All Together

After creating compliant TIFF images for MICR line data extraction, the data must now be incorporated into ICL files for insertion into the exchange workflow.

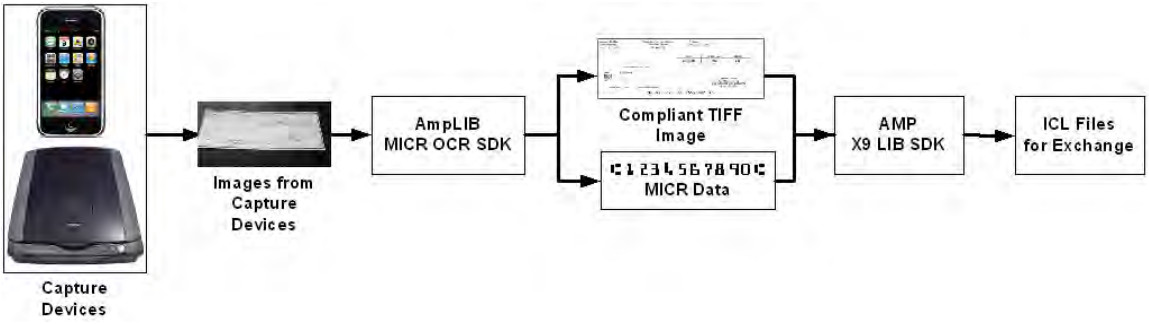

Figure 11— Workflow from Remote Deposit Camera Capture devices to ICL files.

ASSUMPTION 3 – "THERE IS NO NEED FOR DUPLICATE DETECTION"

When submitted to a bank teller, a paper check is easily removed from circulation. However a check scanned by an RDCC device might not be taken out of circulation after conversion to a check image. The same paper check can be accidentally or intentionally submitted for deposit multiple times. Therefore, a robust duplicate detection mechanisms for checks deposited through all customer channels are needed for fraud prevention and cost containment

Magnetically-read capture devices already face the problem of duplicate detection. Similarly, with RDCC, the same check can be deposited multiple times via mobile capture, or it can be deposited by mobile capture and then again at an ATM or bank branch, accidentally or intentionally.

Core banking system augmentation is needed to detect duplicates from all deposit channels and to create the appropriate exception handling.

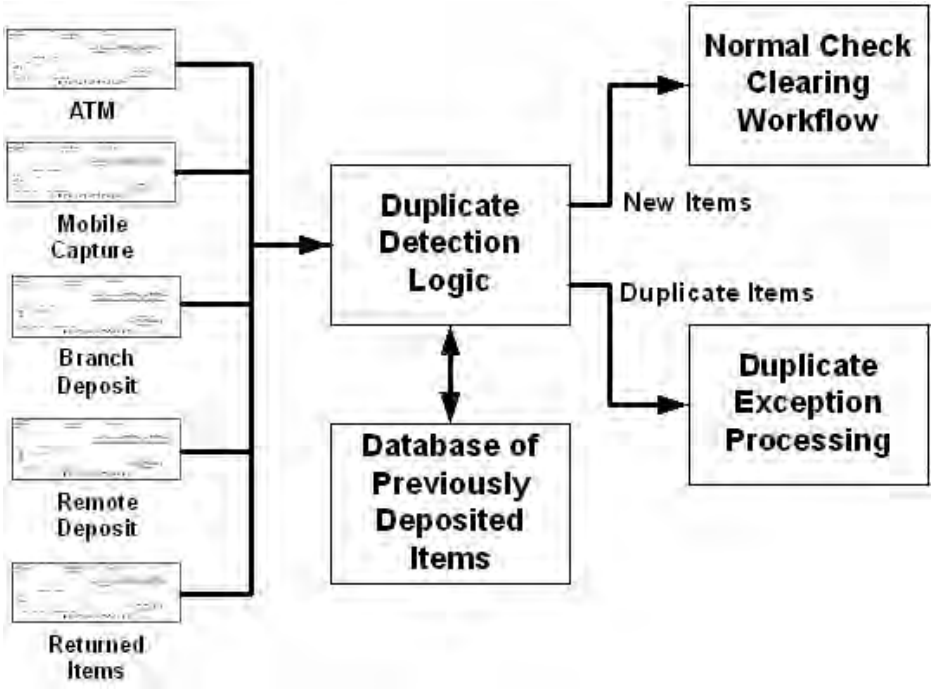

Figure 12—Duplicate Detection Workflow

In addition to the duplicate detection of incoming deposited items, the system should allow items that are represented after being returned.

ASSUMPTION 4 – "THERE IS ONLY ONE IMAGE CASH LETTER FORMAT"

The format for exchange of paper cash letters is very standardized. However, the format for remote transmission of an ICL to a bank is not.

The exchange network has worked hard to restrict the format and content of the ICLs for exchange. This effort is standardized in X9.100-187 and agreed to by the exchanges in the Universal Companion Document (UCD). However the remote capture ICL formats for different institutions are not standardized. They are close to X9.37 or X9.100-187 but almost always different. Each institution publishes its own companion document describing its variant of the X9.37 format, the X9.100-180 or X9.100-187.

ICL deposits must be able to match the many ICL variants created by the proliferation of Remote Deposit Capture.

The All My Papers X9LIB product provides for conversion to more than 25 different remote capture formats as well as UCD compliant formats for Exchange.

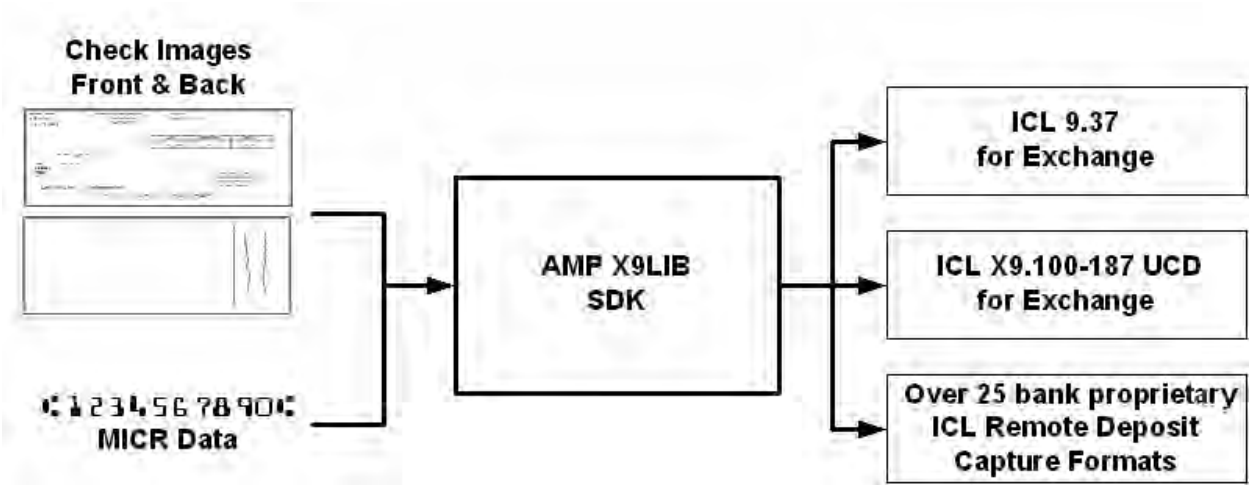

Figure 13 – AMP X9LIB SDK creates ICL files in standard and proprietary formats

ASSUMPTION 5 – "RDCC PRODUCES A POSITIVE CUSTOMER EXPERIENCE"

RDCC is becoming accepted because it is motivated by the same business drivers that gave us RDC. Financial institutions need to retain their current customers and win new customers.

In order to do this, the customer experience using RDCC devices must be equal to or better than using branch deposit or an ATM machine. In order to succeed, RDCC has to provide a positive customer experience:

- Acceptance of most RDCC images at the customer's first attempt to submit the check images – no repeat scanning
- Accurate and fast extraction of MICR data to limit statement surprises.
- Check images that are easy to read in the image statement.

ASSUMPTION 6 – "COMPARING OCR SOFTWARE VENDORS IS EASY"

When evaluating different vendors or different release versions from the same vendor, there are two important metrics: read accept rate and substitution rate.

The read accept rate is the percentage of checks read without rejecting any of the characters. In traditional OCR, the read rate is computed based on all of the characters read. However, with checks, any character that cannot be read means the whole check will need manual processing, so the check read accept rate is a more statistically significant measurement of recognition performance than one that is based on individual characters.

The substitution rate is a measurement of the occurrences of misreading a character ("9" as a "3" for example) on what is reported as a good check read. The substitution rate metric can be computed in different ways:

- The character substitution rate is calculated as the total substitutions divided by all characters read in the measurement test set.
- The document substitution rate is calculated as the total number of accepted documents with substitution errors divided by the total number documents in the measurement test set.

The latter metric is recommended because a check that has inaccurate substitutes will at some time require manual processing. Substitution errors can cause both routing and posting exceptions.

To perform a comparison between different MICR OCR software products, the developer can adjust the confidence threshold levels on each product to achieve a fixed accept rate, and then examine the substitution rate. Alternatively, a fixed substitution rate can be determined and the associated read accept rate then measured. The comparison process requires a relatively complex analysis of two metrics.

CONCLUSIONS & SUPPLEMENTARY INFORMATION

- Accurate MICR OCR is an essential component of successful remote capture solutions.
- Sophisticated image processing is required to produce compliant TIFF images from RDC or RDCC devices.
- Duplicate detection across all check deposit channels is needed to prevent losses through fraud and accidental redeposit of checks
- ICL deposits must conform to a proliferation of proprietary formats
- A fast and accurate process is critical to a positive customer experience.
- When evaluating MICR OCR engines, the read accept rate and the substitution rate must both be analyzed.

About the Need for Real-World Data

Each type of check capture device produces images that require unique processing strategies. These strategies must be fine-tuned with real-world data.

Check images captured by engineers in labs do not fully encompass the range of real-world check conditions in terms of the type of capture equipment, operator skill levels, lighting and other conditions. Images captured by real customers provide the only valid test bed for such processing strategies.

AMP's technology and trusted relationships with major financial institutions have given AMP access to large image databases of real customer deposited checks. This has allowed AMP to evolve and develop technology to solve the major challenges of processing check image deposits that are captured without the aid of magnetically-read MICR data.

Some RDC History

The original attempt by Congress to provide for check imaging was the Check Truncation Act of 2000. It did not pass but it did serve to alert vendors such as All My Papers to the need to provide a new level of check and image processing. The Check 21 Act passed in 2004 and it enabled the remote capture products we see today. The ASC X9 standards group responded to Check 21 with the IRD printing standard that was mandatory for implementation of the Check 21 regulations. This was quickly followed by the development of check image quality assurance standards covering check images from camera capture to transmission wrapper.

The largest home capture financial institution requested versions of the All My Papers MICR OCR engine for its consumer RDCC solution. After extensive trials, AMP's engine was certified for production and is the MICR OCR engine for this product today. In addition, they use AMP's image processing and ICL file creation technologies and have expanded their usage in both volume and function.

Since first delivery in 2006, AMP has made continuous product improvements based on access to real camera-generated check images from real customers. AMP's latest generation MICR OCR engine embodies four years of experience and feedback from SOHO (Small Office/Home Office) and cell phone customers – added to 17 years of experience in imaging technology. AMP's MICR line accuracy for a given read rate exceeds all other MICR OCR vendors in the market.

About All My Papers

All My Papers (AMP) is a developer and distributor of software toolkits and applications. AMP's core competency is check Image Cash Letter (ICL) processing software. Products include the technologies required to perform interoperability and data integrity processes such as the extraction of MICR data from check images, validation of check data and standards conformance for ICL files. In addition, AMP provides tools for viewing, editing and reformatting of check image cash letters and the printing of IRDs.

All My Papers (AMP) is a supplier of technology for the processing of check images for Remote Deposit Capture vendors and the internal development teams of financial institutions. AMP's technology is field proven and has successfully processed over 1.5 million deposit transactions from home scanners and mobile phones since its initial deployment. This is in addition to the billions of check images AMP has processed in the traditional venues.

AMP's trusted relationship with major financial institutions has given AMP access to large databases of real customer deposited check images. This has allowed AMP to develop technology that is able to solve the major challenges of processing check image deposits with reliable OCR extraction for the existing and emerging segments of the RDC marketplace.

For more information about All My Papers solutions to the challenges of Remote Deposit Capture and Remote Deposit Camera Capture, contact sales@allmypapers.com

All My Papers
13750 Serra Oaks
Saratoga, CA 95070

Phone: (408) 366-6400
Fax: (408) 366-6406

www.AllMyPapers.com

APPENDIX A – SOME ALL MY PAPERS CUSTOMERS

All My Papers products are primarily sold to Independent Software Vendors (ISVs) for incorporation into their own branded applications and toolkits. All My Papers also sells to system integrators, value added resellers and large corporations for inclusion in their developed applications.

Customer List

Please note that this list is not all-inclusive.

Corporate and Financial Institutions	Software and Hardware Vendors	Countries
3M	Advanta	Australia
7-Eleven Corp.	Affiliated Computer Services, Inc. (ACS)	Canada
Amalgamated Bank	AnyDoc Software Inc.	England
American Express	AQ2 Technologies	France
AMSouth Bank	Autoscribe Corporation	Germany
Bank of Delaware	Avalon International, Inc.	Guatemala
Bank of Whitman	Banctec	Holland
Capital One	Bankserv	India
Comerica Bank	Captiva/ECM	Israel
Commerce Bank	Conix	Italy
Compass Bank	CSC	Korea
Citibank	Data Cap	Malaysia
CrossCheck	DST Technologies	New Zealand
DataTrade	EDS	Pakistan
Deutsche Bank	EFT Network Inc.	Philippines
EFT Network	EiStream	Spain
Federal Express	Enterprise Payment Systems	Switzerland
Flag Bank	Expervision Imaging	Turkey
First Business Financial Services	Fiserv Inc.	United States
First Data Corporation	Goldleaf Technologies	
First Horizon/First Tennessee	IBM	
Greenfield Savings	Imagescan	**State Agencies**
Greentree Servicing	Image Tag	
GS Associates	Investigación y Programas S.A. (IPSA)	State of Delaware
Huntington National Bank	KLD	State of North Carolina
Hubank	Kodak	State of Mississippi
HSBC	Kodak UK	State of Michigan
Irwin Bank	Maverick International	State of Ohio
JP Morgan Chase	Metavante Corporation	State of Tennessee
Kansas City Credit Union	Modern Banking Systems	State of Washington
Lending Tools	NCR	
Liberty Savings Bank, FSB	NetDeposit	
Modern Banking Systems	NMS Imaging	
Merck & Co. Inc.	Northwest Bank Technology	
Mellon Bank	Nuance (formerly ScanSoft)	
MWA Bank	OCE	
NCS Pearson	Open Solutions	
National Presort	Recognition Research	
Navy Federal Credit Union	Site Scan	
PNC Bank	Software Earnings	
Royal Bank of Scotland	Symcor	
Royal Bank of Canada	Synoran	
Sage Telecom	Systems and Methods Inc.	
State Fund of California	Tangent Systems	
Sterling National Bank	TroyGroup	
SunTrust Bank	Unisys	
Symcor Inc.	Vsoft Corporation	
TCF Bank		
United Bank of Mississippi		
United Parcel Service		
US Dept of State		
US Dept of Defense		
Viewpointe LLC		
Wells Fargo Bank		
Zions Bank		

APPENDIX B - ALL MY PAPERS PRODUCTS FOR RDC IMAGE PROCESSING

AmpLIB SDK

The AmpLIB MICR OCR SDK is a High Level Programming System for Windows™ application development consisting of COM objects, Dynamic Linked Libraries (DLLs), associated import libraries, header files and example source code. The SDK is compatible with many programming environments.

AmpLIB MICR OCR SDK lets you quickly develop back-end applications for remote deposit and mobile capture of check images. The MICR OCR SDK includes image processing, MICR data extraction and image formatting functions that allow easy and accurate processing of incoming check images, prepare them for OCR, reliably extract the MICR data and format the final images ready for integration into ICL files for exchange.

MICR OCR

AMP's AmpLIB SDK supplies the MICR read and image formatting functionality that is missing from SOHO flatbed scanners, portable scanners and cell phone cameras,

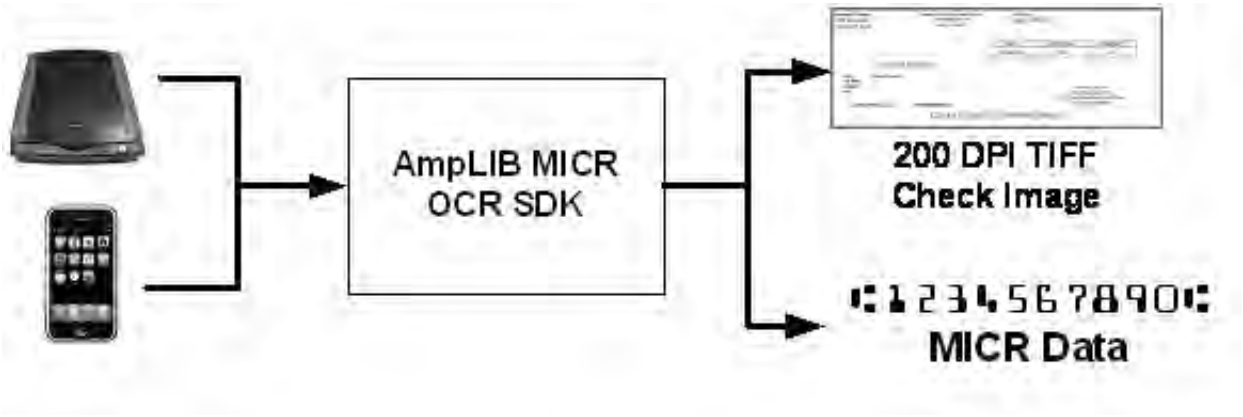

Figure 14—AmpLIB turns an RDC image into a compliant TIFF image with accurate MICR data

Image Processing

Figure 15 shows the original camera image, and Figure 16 shows the reconstructed TIFF image using the AMP MICR OCR SDK.

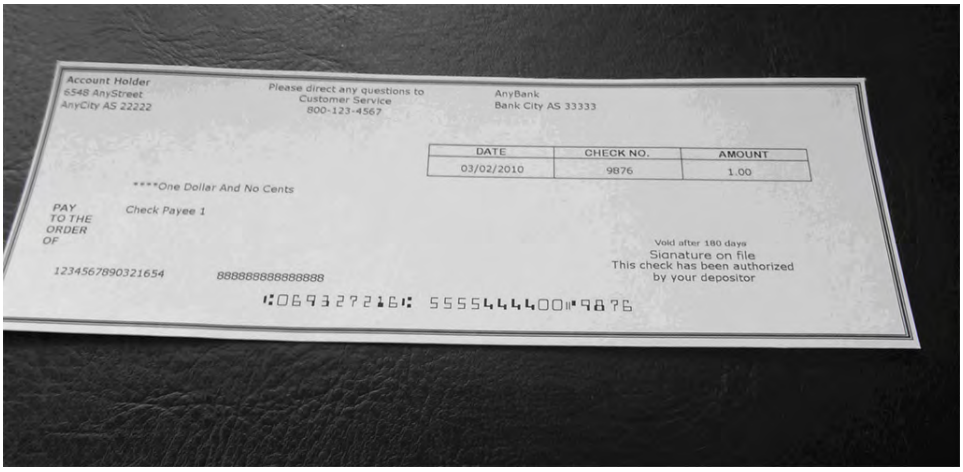

Figure 15—Original cell phone check image

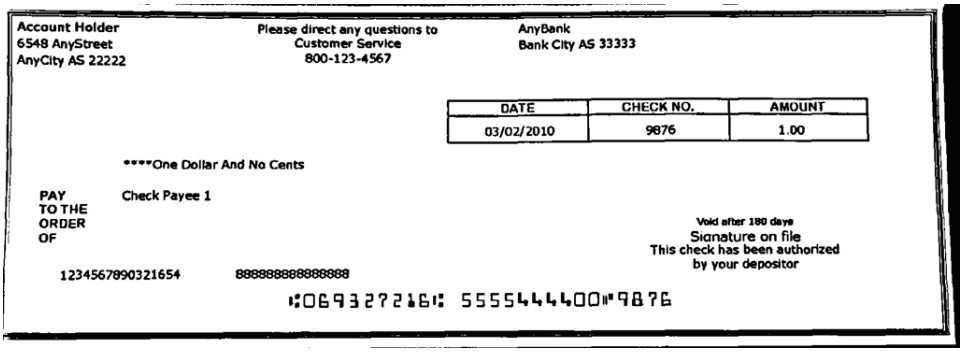

Figure 16--Reconstructed compliant TIFF image ready for incorporation into an ICL file

With compliant TIFF images captured for the front and back of the check, and an accurate MICR line extracted, you can then use AMP's X9LIB SDK to build a Check 21 Compliant ICL file. The ICL data can be formatted as 937, 187 or one of dozens of remote deposit formats used by various financial institutions.

AMP MICR OCR capabilities can be invoked with a few simple calls from your code and will:

- Find, read and parse the MICR data from check images
- Find, crop, de-skew and scale the camera images to create Check 21 compliant TIFF images
- Provide flags indicating success of processing the check transaction
- Deliver processing rates scalable to 1000s of check transactions per minute

X9LIB SDK

X9LIB is a suite of software tools for creating and processing X9.37 and X9.100-187 files (Image Cash Letter files). X9LIB is a Windows™-based DLL High Level Programming System that allows for X9.37 files to be:

- Composed
- Converted
- Edited
- Sorted
- Merged
- Split
- Recalculated
- Tested

The SDK supports dozens of banks' remote deposit formats. It allows the rapid development and deployment of a set of applications for dealing with ICLs in the same way that banks are used to working with paper checks, bundles and cash letters.

APPENDIX C – AMP CAMERA PROCESSING FUNCTIONS

All My Papers has been developing check processing technologies for more than ten years. The basic functions used for processing SOHO scanner images and camera captured images are summarized here:

ampDynamicThreshold

This function converts color or grayscale images to binary. Checks printed in compliance with the check industry requirements must have a well defined Print Contrast Signal (PCS). This is a known value that is used to determine what should be black and what should be white in the binary image.

The PCS assumes a consistently illuminated check, but this is not the case with many camera images and even with home scanners with a decaying light source. For example, if the light source is fluorescent, the intensity will roll off at the ends of the bulb. In the case of camera capture, the source is whatever the ambient lighting is and it has a problem similar to a decaying light source on any scanner, including high end scanners. Hence, the value of the PCS itself must be dynamically adjusted based on the overall lighting of the scanned image.

ampPrepMicr

This function crops, registers, de-skews and performs trapezoidal adjustments on the grayscale image to prepare it for the MICR read engine and further image processing.

ampReadMicr

This function takes an image, locates the MICR line and reads its MICR contents. It detects and reads upside down images. It also detects both the vertical and horizontal resolutions of the image that can be used to scale the image to the 200 DPI image required for exchange.

The ampDynamicThreshold function operates on color or grayscale images. The ampPrepMicr and ampReadMicr functions operate on color, grayscale and binary images. Customers for SOHO and mobile capture processing have used different combinations of these three functions to produce the images and the MICR data needed to create a cash letter ready for exchange.

To provide additional support, the following new functions have been added to the All My Papers SDK:

ampReadMicrCamera

This function takes a color or grayscale image as input and performs all of the steps from the traditional AMP function list above that are needed to process the image and extract the MICR data. Source code for this call is provided so customers who want to do their own special processing can do so.

ampReadCamera

This function takes two color or grayscale images (front and back check images) and generates two black/white images conforming to exchange standards, as well as parsing the MICR data into the fields needed for ICL generation. The function includes IQA analysis to ensure the processed images conform to exchange standards.

In addition to the new functions that use existing code calls, All My Papers has added a new Camera Feature License bit to substantially enhance image processing of images from cameras or SOHO scanners.

Camera Feature License

All capture devices, and camera images in particular, often have distorted character shapes caused by poor focus and non-symmetric resolution. The Camera feature uses newly trained fonts from the large number of production camera images AMP has studied. This feature can be used on traditional black and white images as well as color and grayscale to improve the read rate and lower the substitution rates. This, in conjunction with enhancements in the AMP multi-engine voting, significantly improves recognition accuracy.