

Cash Register Interfacing

Introduction

Cash Register Interfacing is the ability to extract the data from a cash register that prints on the receipt and overlay this data on a video picture of the check out area. Most front end cameras are positioned to see the cashier, the cash drawer, items purchased and the customer. With all these elements recorded, a store owner can review this scene and with one view verify the check out was legitimate.

How an Interface Stops Theft

The cash register interface as an overt security system (clerks and customers know the interface is in place and how it works) can deter theft by the fear of being caught along with a permanent record. This system as a covert security system (hidden system) will not prevent the theft but will record the event for later prosecution.

In either case, the register interface system will allow the recording of all transactions for later review for such thefts as sweethearting, substitute scanning, no rings, short changing, short rings, and pilfering.

Types of POS Theft

- **Sweethearting** : This requires an accomplice or “*sweet heart*” that loads up expensive items for check out. The clerk then either does not ring up certain items or rings up the items but charges a lower price than marked. This type of loss shows up later as inventory shrink.
- **Substitute Scanning**: This is usually a type of sweethearting that is done in stores that have scanning systems. The clerk fixes a scan tag of a low value item on their palm. When an item is scanned, the palm tag is read and not the actual item. Substitute scanning can also be done without a sweetheart. The correct value of the sale is collected from the customer and later pulled from the register near the end of the shift. This type of theft if viewed by a convention camera system looks like the clerk was ring correctly, but with the text overlay, the manager can instantly see the substitute scan.
- **No Rings**: This is where a clerk rings nothing up and makes change from an open cash drawer or from the top of the change drawer.
- **Short Changing**: This is where the clerk is actually cheating the customer by giving incorrect change.
- **Short Rings**: This is where a clerk rings up an incorrect amount for an item much lower than the actual value and either immediately pockets the extra money or pulls it from the register later. Usually the clerk does not complete the sale until the customer leaves. This is because if the customer asks for a receipt or challenges the price, the clerk can cancel the entry and ring up the correct one.
- **Pilfering**: Is taking money directly from the register and leaving the register short. This usually occurs when more than one clerk uses the same cash drawer.

Exception Reporting

As described above most of these theft practices require the ringing up of substitute or low value items or opening the drawer without a normal sale. These types of register transactions are called “exceptions”. A cash register interface can electronic watch for these types of questionable transactions and give a signal when detected. This signal can be in the form of an on-screen flag, alarm a DVR for later search or automatically turn on the camera watching that register and clerk. The most common type of exceptions monitored are no sale, voids, returns, refunds, cancels, purchases, payouts, low value sales and high value sales.

- **No Sales**: This is the most common exception. Some legitimate uses are making change or correcting change mistakes. The “*No Sale*” is always a questionable transaction. Towards the end of a shift, whether the clerk was doing short rings or any kind of pilfering, will have to remove the

accumulated money for that shift. All No Sales should be exceptions, and all in the last hour of a shift should be reviewed.

- **VOIDS:** The void is used after the customer has left and the same transaction has been voided. The money is still in the register and will have to be removed either then or towards the end of the shift.
- **Returns/Refunds:** This is usually questionable when no exchange is being made and cash is paid out. Items are pulled from inventory and fictitious refunds are given to one self, the clerk or a sweet heart.
- **Cancels:** This is where a transaction is partially rung up. The clerk asks the customer for the money and if the customer does not ask for a receipt and leaves, the clerk cancels the sale. If the customer wants a receipt then the clerk finishes the transactions and gives the receipt.
- **Purchases or Payouts:** This is usually in small convenience stores when they receive papers, or other non account deliveries. The clerk rings a payout and gives the vendor cash. The clerk can be in "kahouts" with the vendor and overpay and later collect or simply make the pay out for more and keep the difference.

Pre-Exceptions or Post Exceptions

There are two schools of thought on exception monitoring. The *pre-exception* technique is usually for low cost situations and is most common. This is used where the exception is programmed into the text inserter or DVR and it gives an alarm when the exception is detected.

The *post exception* systems record all the data from all registers in an electronic file. They also will store either only the exceptions when using Pan/Tilt cameras or all the video data with fixed cameras and DVRs from all the registers. At a later date the store owner can search the database for any type of exception he may think of later. He will then have to go to the DVR at the time and watch the exception. Some sophisticated POS systems actually match this database with the correct piece of video automatically which is commonly called "POS Text Search".

Selling Cash Register Interfaces

Cash register interfaces can be sold effectively anywhere a POS terminal is used. If a retail outlet is having an inventory shrink problem or consistent inaccurate end of day POS totals, a cash register interface will greatly reduce both problems. Statistics vary from store to store and store type to store type but generally theft from the POS accounts for 80-90 percent of a store's total shrink. The remaining 10-20 percent accounts for shop lifting and waste. Of this 80-90 percent loss from the POS, typically the installation of a cash register interface system with a CCTV system will reduce half of this loss. With this kind of savings for a store the cost of the system and installation will usually pay for itself very quickly. With lease options the store owner will actually see a net profit increase the very first month. If possible obtain the dollar amount of inventory shrink prior to installation. After installation verify the savings with the store owner and use this as a reference for other potential customers in like businesses. Some dealers actually guarantee a percentage reduction in shrink or they will remove the CCTV and interface systems at no charge. Discounting a register interface system to obtain business is usually not necessary. The cost basis of the system should be sold in proportion to the savings realized by the customer. If sales tactics are used to emphasize the savings of the inventory instead of the system cost one can yield high profit.

Where to Sell Cash Register Interfacing

As stated before the market for cash register interfaces is anywhere a POS device is used. There are four major categories where interfacing is most popular and yields the best results. Remember family owned and operated businesses are usually not good candidates for interfacing system sales. The businesses that are the most desirable are ones that have many low paid employees that usually work by themselves or in unmonitored areas.

- **Convenience Stores**
This is the most popular type of store for CCTV and register interfaces. "C" stores have low paid employees and usually work alone. Stores with gas, alcohol, and cigarettes do a high amount of cash transactions. This makes it very tempting for employees to steal. Inventory is usually done

monthly and shrink is well known. This type of store is guaranteed to save half the shrink with these systems.

- **Monitoring a Convenience Store**

In a one camera system it must always be the check out area. If two registers are in place there can be a camera on each register or one camera for both. The next important camera location is the drug aisle and then the beer and wine coolers. This camera would be for shoplifting rather than employee monitoring. In heavier used stores four or more cameras can be used to monitor all aisles constantly. Some high volume gas stations also monitor drive offs by cameras on the pumps as well.

- **Fast Food Outlets**

Again we have low paid employees and almost all cash transactions. Usually more people are working together but in afternoon and evenings slow times allow for theft. These shops also have a high amount of inventory going home with employees so additional CCTV cameras are needed on rear doors. The CCTV system for this type of operation is similar to the convenience store.

- **Grocery Stores**

Theft here is usually from sweethearting, coupon scams and short ringing. In busy times it is easy to implement these actions since managers are very busy with customers. There are generally two types of systems for groceries, *Pan Tilt* or *Fixed camera* systems.

The Pan/Tilt systems utilize domes to cover 3-5 registers. A security person monitors a lane and selects a certain cash register to monitor or has one lane with a permanent interface. More sophisticated systems monitor all lanes and move the camera to the register if an exception is occurring. This can be done by integrated systems or using alarm outputs from the interface to control the PTZ preshot inputs. This system only covers one register at a time and review of other lanes later is not possible.

The fixed camera system has one camera per lane. One interface per lane is also installed and the data is inserted into the respective camera and recorded to the DVR. This video is then fed directly into the DVR. With the DVR all data from all registers is recorded simultaneously and the exceptions highlighted. This allows review of all information of all registers later.

- **Department Stores**

In large chain stores with seasonal temporary help with large ticket items, loss can be very high from store to store. In problem stores CCTV is a must. Since any single register is usually not used constantly PTZs are usually employed here. This allows the operator to watch for shoplifters since this type of theft is higher in dollar value than other types of stores. Interfacing is usually on every register or monitored on the POS network.

How Cash Register Interfacing Works

The cash register business is a unique industry in itself. There exists no standards, as a matter of fact, cash register companies go out of their way to make hardware different. This is true from company to company and even true within a company so older accessories are not compatible with the newer models. It is this fundamental fact that makes cash register interfacing such a complicated problem. One interface box can only connect to an extremely limited number of registers. The use of converter boxes are needed to translate from one format to another. Every model register has unique features that enhance the interface or cause major problems when dealing with loss prevention.

Typical Cash Register Interface

Text Overlay

Most cash register interface systems contain a *Text Inserter* to do the text overlay on the video picture. This main box also has communication channels that can plug directly to some cash register without the need for other converters. As stated above the number of direct connections is limited and in most applications the need for a converter box is warranted. These converter boxes are almost always placed in or near the cash register. Data cable is then run from the register location back to the security room to the text inserter. The text inserter and other security equipment are then centrally located.

Direct Data

When POS Text Search DVRs are used the data from the cash registers or POS network can be fed directly to the DVR. The cash register data can then be inserted by the DVR for live viewing or during playback. However the inserted register data is not a permanent part of the video recording but an associated data file record simultaneously with the audio video and even alarm data.

Cash Register Interface Outputs

- **Alarm Outputs**
The alarm output option gives hard alarm outputs to go to DCRs to flag the recording for later search. This alarm can control a switcher to home a camera in on the cash register when certain type of transactions are detected.
- **Printer Outputs**
Most cash register interfaces have serial printer outputs. This output is usually configured to print a list of the detected exceptions. At the end of the day, the store manager can review the exceptions of the day or night before and decide whether to view the tape or not. Other uses may be to connect to a PC and record all the transaction or go to modem to download the exceptions in the middle of the night to central. This same data port is where the cash register data is delivered to the POS Text Search DVR for recording data only.
- **On-screen Messages or Flags**
Usually when a cash register interface detects an exception it also highlights or some how marks the video picture. This allows easy review of the exceptions in forward scan mode or alert a manager during operational hours.
- **Email or FTP**
The DVR can connect directly to the Internet and send video clips of exceptional transactions. These can be the form of email or delivered live viewing directly to an online PC or PDA.

Network Interfaces

When POS systems have many terminals they are usually connected together through a network of some sort. Most of these networks can be monitored and the data from any register can be overlaid on the video picture. Usually the data on networks is not live (does not happen exactly when the clerk rings up the sale) to save network time. Although it is usually live enough to monitor for exceptions or make an alternate electronic journal. The advantage of this type of interface is that the data from all registers is available to one text inserter. This inserter in conjunction with a matrix switcher allows monitoring of any register throughout the store.

POS Interface Networks

When live data is required for the text inserter, an interface must be put at each register and thus configured into a network exclusively for the cash register interface. This is effective but still has limitations and advantages of the POS networks in some much it usually only monitors one register at a time in video.

How Registers Communicate

The following are brief technical explanations of the most popular types of methods that cash register interfaces communicate to cash registers.

- **Serial Communications**
Serial communications are simply a series of voltage or current changes which are translated into the binary equivalents of 1 or 0s. After a series of this data is received, the computer reconstructs the serial data into its original binary format for computation.
- **Asynchronous**
Asynchronous communications or simply assync, is usually called RS-232 communications. This generic RS-232 terms is over used because there are several types of asynchronous communications broken into electrical formats and/or protocol format. All assync communications

consist of a pre-defined baud rate, a start bit, a defined number of stop bits and parity which determine the number of bits sent per frame or data packet. Standard RS-232 communications is most common in your home computers COM1-COM4 ports on the back of the computer. These ports connect to the mouse, modem or serial printer. RS-232 uses voltage swings from +12VDC to -12VDC to denote the transmission of 1s or 0s. RS-422 is similar in format to RS-232 but uses current pulses to denote 1s or 0s. This is typically a 4 wire system. RS-423 is similar to RS422 but uses isolated grounds between the TXD and RXD channels for noise immunity. RS-485 is a current technique that utilizes current flow in the forward direction as a 1 and reverse current as a 0. This is normally a 2 wire system. High Speed interprocessor communications are used for short distance applications. These techniques vary from microprocessor manufacturer but range in baud rates from 38K to 387K typically.

- **Synchronous**
Synchronous data usually consists of a Data signal and a synchronous clock signal. With this format the baud rate is defined by the synchronous clock. The data stream is searched by byte by the receiver device and when the sync byte is detected the received is said to be in sync. At this type the receiver reads each successive byte to decode the proper data. This type of data is packetized, which means a sync byte heads up a certain amount of data.
- **Bisynchronous**
Bisynchronous communications is very similar to synchronous, but varies in the protocol and packet information. This format has to detect two successive sync bytes or one word, for the stream to be in sync. The popular names for this format is IBM 3270 or 3275. High Speed interprocessor communications can also be synchronous or bisynchronous. This is similar to the high speed async method but the use of an external clock signal and sync bytes are used. This data rate can range from 38K to 10Mhz typically.
- **SDLC**
Synchronous Data Link Communications (SDLC) is a high level communications technique that combines all of the above techniques. SDLC can contain high level protocol with multiple header and data identifiers. This format is similar to synchronous communications but searches the data stream bit by bit to identify a sync byte or word. Again this format is packetized with sync bytes and can contain packets from many sources and destinations.
- **NRZ/NRZI**
None Return to Zero (NRZ) or None Return to Zero Inverted (NRZI) are common protocols for SDLC. These formats contain a separate clock signal for each data channel. Their electrical format is +12VDC to -12VDC similar to RS-232.
- **NRZId**
None Return to Zero Inverted Derived Clock (NRZId) has the clock signal electrically embedded in the data signal. The receiver must lock on to this clock to generate the proper baud rate to read the incoming data stream.
- **Manchester Encoding**
This encoding technique also has the clock embedded in the signal and must be split apart.
- **USB**
This protocol is called the Universal Serial Bus which is very high speed serial protocol. There is protocol 1.0 – 2.0 and can be up to 60 Mb (MegaBytes) per second data rate. Usually this device is used in conjunction with a PC to a peripheral.
- **FireWire IEEE 1394**
This protocol is an advanced version of the Universal Serial Bus. However it is designed for peer to peer communications and not required to host through a PC. The speed is almost double the USB 2.0.
- **Parallel**
Parallel communications format presents data in a parallel format to the receiver and then strobes the receiver when the data is ready. The receiver reads in the data and processes it. This format is faster than serial since more than one bit is transferred per clock signal.
- **8 Bit Parallel**
The most common parallel technique is the Centronics format. This is what every PC uses to talk to the LPT or printer port. Eight bits or one print character or control code is sent at one time. Some proprietary variations of this format are used for other printers, customer displays and general communications.
- **4 Bit Parallel**
This technique is similar to the 8 bit but only 4 bits are sent at a time. To get one ASCII character, two transfers must occur. This format is also used for send numeric values only which can be describe by on 4 bit nibble.

Networks

The trend in communications are Local Area Networks (LAN). These communications are usually high speed serial communications. Data and electrical format vary radically but most are based on variations of SDLC or HDLC. Some use carrier frequencies for high throughput. Some of the common ones are listed below with its typical transmission rates. Ethernet is now the defacto standard.

- Ethernet 10Mbps/100Mbps and 1000Mbps GigaBit
- Arcnet 2Mb=(Million bits transmitted per second
- Starlan 2-10Mb
- PC Baseband Lan 1Mb
- Token Ring Lan 10Mb (New 100Mb)

ATM Asynchronous Transfer Method 100-200Mb To interface to the above networks, a dedicated PC is usually used to read these networks via dedicated add in cards in the computer. Software is then written to reformat the data and send it out serially to the text inserter.

Printer Interfaces

There exist printers in most type of cash register and ATMs. These printers are communicated to by various special function integrated circuits. Usually these circuits are communicated to by serial formats from the host microprocessor. Since this internal serial channel is usually not available, the need has arisen to tap directly to the printers to extract the data needed for loss prevention.

The following are the most common printers found in these types of devices.

- **Drum Printers**

These printers contain a drum with 10-20 permanently mounted wheels. These wheels contain the complete set of characters that can be printed in its associated column on the paper. There is an electronic hammer associated also with each column. While the drum is turning the hammers are fired when the correct character is over the paper. A complete line of information can be printed every time the drum is rotated.

- **Wheel Printers**

These printers operation very similar to drum printers but there are independent wheels instead of a fix drum. This is mainly a design for ease of manufacturing since only wheels need be changed from customer to customer rather than complete drums.

- **Dot Matrix Printers**

These printers have a moving print head with small pins that form a dot matrix of the character to be printed. The hammers in the print head fire accordingly when the head of over the correct portion of the paper. These printers can print any type of character or graphic.

- **Thermal Printers**

These printers use a special heat sensitive printing paper. When the paper is moved across the stationary print head, the head instantly heats to make a black dot on the paper. The paper is pulled across the printing heads, printing a matrix of dots which forms legible characters.

POS Common Types

RS-232 is the most widely used since there is a abundance of available ICs to handle this communication. Also the widest use of peripheral products make this format the choice for speeds generally up to 9600 baud. Cash registers use this format to communication to PCs for inventory control, bar codes readers, scanners, scales, and customer displays. Most cash registers require the addition to the RS-232 board at a substantial cost and usually require programming. The trend is to go directly to the printer to eliminate this high cost. The data is then sent our standard RS-232 to the text insertion device. This data can then be sent to a PC or modem or converted by inexpensive boxes to RS-485 to go long distance. Most high end POS systems use their own proprietary networks. Most NCR systems use their version of SDLC simply called DLC. TEC grocery line uses their version of SDLC call TDLC. These networks are normally a variation of the RS-485 current loop. The trend in high end POS is to use standard network protocols since most of these registers are PC based anyway.