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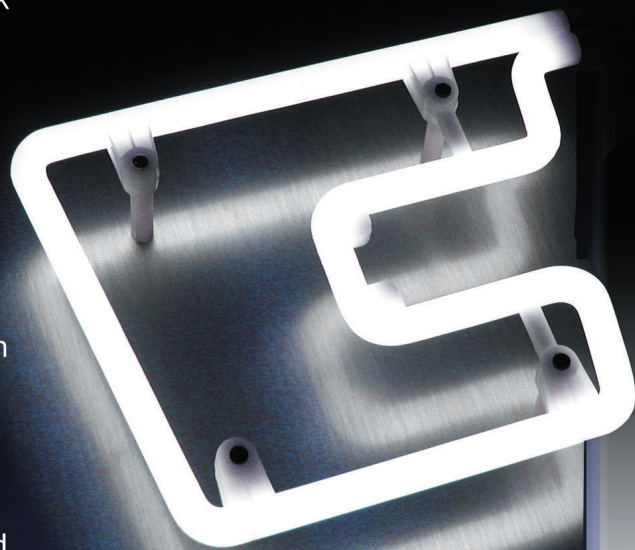
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Page 4 - Editorial

Page 6 - Coin Comparator and Basic Game Operations

Page 14 - Unwrapping and Installing an e-motion™ Game

Page 20 - Understanding Video Reels

Page 28 - *Quick* and Simple Repairs # 9

Page 32 - TransAct and JCM Formally Combine Gaming Sales Efforts

Page 34 - Ireland's Amusement & Gaming Industry Prepares For AmEx 2006

Page 36 - Heber To Launch Firefly X10i At ATEI 2006

Page 38 - Subscriptions and Order Form

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Happy new year, everybody.

Herschel Peeler begins the new year with a beginning look at how slot play begins, beginning with the coin drop. Herschel's article begins on page six. You may begin reading now.

John Wilson, our resident Slot Mathemagician, carries on with his continuing series on Video Reels. We're up to part five. I wonder when the madness will

end? Turn to page 20.

Did you get everything you wanted for Christmakawanzaka? Atronic's Michael Brennan hopes you received a shiny new slot machine. He shows how to unwrap and install it in his monthly column beginning on page 14.

Pat Porath had to shovel snow and trudge uphill to work BOTH WAYS in order to bring us the latest installment of his "Quick and Simple Repairs" column. This month, it's column #9 with a look at a variety of simple problems and solutions that he encountered on the slot floor at Chip In's Island Resort in Harris, Michigan.

For my Euro and Irish readers, I am happy to announce that TechFest will be coming to Ireland on March 7th & 8th 2006. It's not the full-blown TechFest but rather an abbreviated version that will cover a bit about monitor repair, LCD repair and more. The final seminar program is now posted at the slot-techs.com website.

In a final nod to the recent holiday season, I want to thank Unicum for sending the best holiday card I have ever received. The card fea-



tures Unicum's CEO Yuri Larichev dressed as Santa Claus and COO Alexey Kuchvalsky playing the part of Snegurochka, the Snow Maiden.

That's all for this month. See you at the casino.

Randy Fromm

**TechFest 13 will be held
at Mystic Lake Casino in
Minneapolis, MN
May 16-18 2006**

Randy Fromm's Slot Tech Magazine

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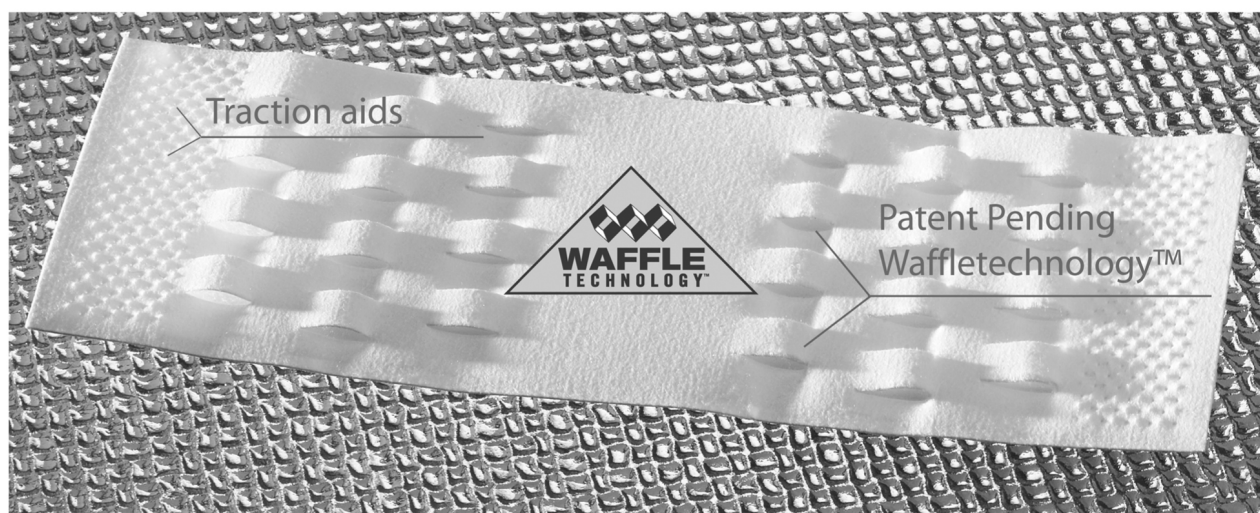


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Coin Comparator and Basic Game Operations

By Herschel Peeler



Building up a game requires coordination between hardware and software. This article gives a simplified example of how hardware and software must work together to make a system function. If all goes as planned we will go through a game, function by function and see how hardware and software work together.

This article deals with a simple coin comparator, what it takes in software support to enable and disable it, and where the errors come from.

We will assume a coin comparator that has an Inhibit function. It is always powered up and the MPU enables and disables it through an Inhibit line on the comparator. Older games controlled power to the coin comparator and the MPU enabled and disabled the coin comparator by controlling power to the com-

parator. Not many games do this anymore.

Since this is not a lesson in programming, we will only cover what the program would cover that applies to us. Other things would certainly be accomplished at the same time but we are only concerning ourselves with operations that relate to the Coin Comparator, Coin-In Optics, Insert Coin Lamp and Coins Inserted display. In the process we will cover a number of other things that happen that are important to game function.

Pre-Existing Conditions

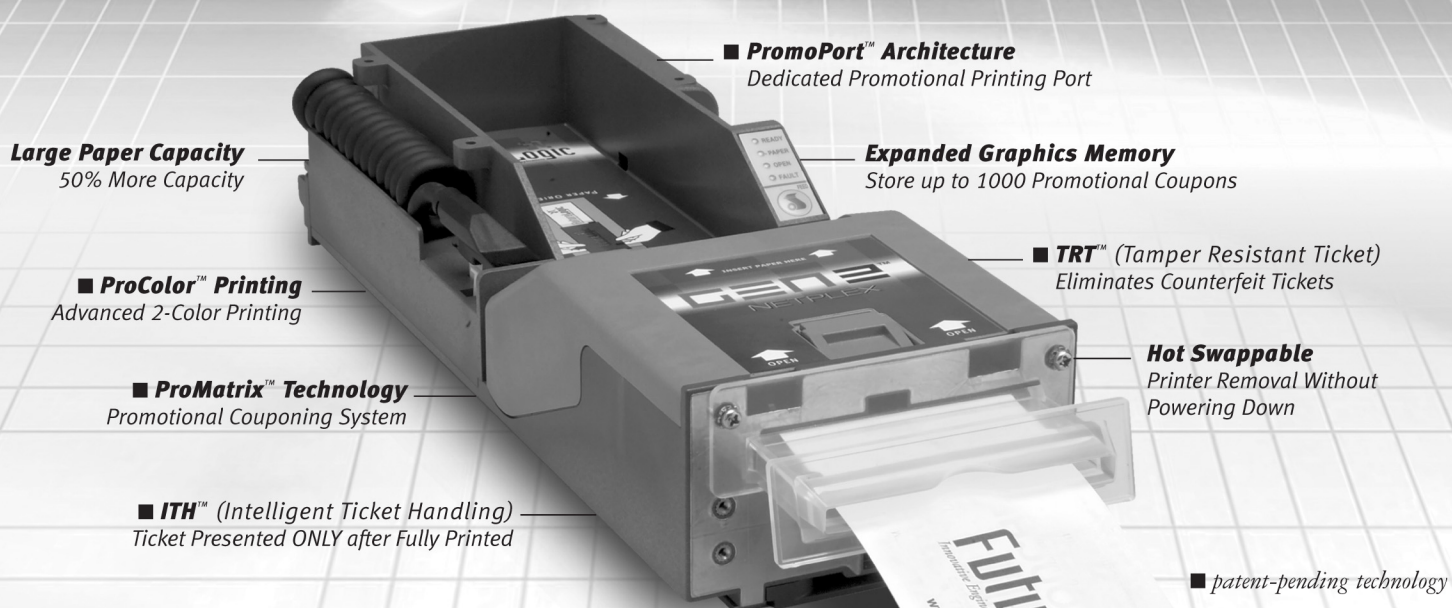
The Coin Comparator is always under power, but it may not be enabled. The MPU enables the Coin Comparator when the game is ready to accept coins, that is, any time the "Insert Coins" lamp is turned on. This usually happens at the end of the last game. The MPU has completed the bookkeeping from the last game, assigned any credits that were won and has entered the Idle Mode, waiting for the customer to insert coins. It has cleared the "Coins In" display, turned on the "Insert Coins" lamp and turned on the Coin Comparator. It has also cleared

Flags in RAM that will be used in the next step. For a definition of a Flag, see the Glossary at the end of this article. From this point, we enter a loop of instructions (called a subroutine) that has a specific task.

The Random Number Generator is generating sets of random numbers. We are assuming we have a three-reel game, with each reel having 48 positions, no bonuses or anything that would make our example complicated. Our Random Number generator generates a set of three numbers between 1 and 48 for each reel to be the next symbol to be stopped on. We will call these "Y values." We will also likely generate another set of three numbers to indicate how many times each reel will go around before stopping. We will call these "X" values. For our three reels we will generate X1, X2, X3, Y1, Y2 and Y3. We may also generate another number that might be the delay in milliseconds before we generate the next set of numbers. Every manufacturer has their own way of doing these things. Since it is invisible to us, it doesn't matter much anyway. At the same time, we have a Real Time Clock in the game

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that is constantly running. We use this RTC to track what time events occur as well as how long it takes for events such as incoming coins to occur.

The MPU has turned on the Insert Coins lamp, enabled the Coin Comparator and is waiting for a coin to be inserted.

Coin-up Process

The MPU looks at the "Coin Sense" signal. Normally this signal is a "Low," a voltage close to ground level. Typically this is an Open Collector signal from the coin comparator. It is normally low and is allowed to go high for a short pulse (15 ms to 50 ms) when the Sensing coil detects a good coin. There is a good reason to make this signal normally low. If the wire should break the MPU will see an error if this input is High for an extended period.

When the MPU sees this signal make a Low to High transition, it assumes a good coin is in the process of being accepted but does not yet conclude that a credit should be given. As the positive edge is sensed, the MPU reads the RTC and notes what time it is. The MPU might also set a Flag to indicate that a coin has been sensed.

The routine would also monitor the "Coin-In Optics A" input. We would also likely be looking for a Low to High

transition on this line to indicate that the coin has dropped through to the "A" optic. Again, the program sets a Flag indicating the "A" optic has been sensed.

If the program sees the coin passing through the "A" optic before it gets a "Coin Sense," it notes an error condition. The program uses these flags to tell the sequence of events as they occur.

The routine will also check the "Coin-In Optics B" signal and sets a Flag. If the program finds "B" flag set but does not find "A" it assumes it has detected a coin going in the upwards direction and notes this as an error.

"A" and "B" should occur before the Coin Sense signal times out, referring to that 15 to 50 ms time frame. The High to Low transition should occur within a reasonable time. If it took longer than expected, we might indicate this as a "Long Coin." If "A" or "B" go on for a longer period, the MPU might interpret this as a "Stuck Coin Error."

If all goes well, we see Coin Sense, the A and B occur in the proper sequence in the proper time frame and the MPU recognizes this as a valid Coin Up. The MPU adds one credit to the Credit value in RAM. This value is displayed out on the Credits display. The "Spin Reels" button is lit, indicating to the customer that he now has the

option of starting the game. It will check to see if the "Spin Reels" button is pressed.

If Credits match the expected maximum allowed limit, the MPU turns off the "Insert Coins" lamp, turns on the Coin Comparator Inhibit line and checks the "Spin Reels" button to see if the player is ready to start the game.

The Play of the Game

When the MPU detects the "Spin Reels" button has been pressed, it turns off the "Insert Coins" lamp (if it isn't already off) and turns on the Inhibit to the Coin Comparator. The last complete set of Random Numbers is used and the MPU starts the reels spinning. Reel number one is monitored and the Home pulse tells the MPU when the Reel makes a complete rotation, after X1 many rotations, the MPU stops the reel at Y1 position. It knows where the reel should be by noting when Home passes and counting a set number of steps beyond that point where position Y should be. We then count reel two rotations the same way, stopping at Y2 after X2 rotations. Likewise we spin reel 3 X3 times stopping at position Y3.

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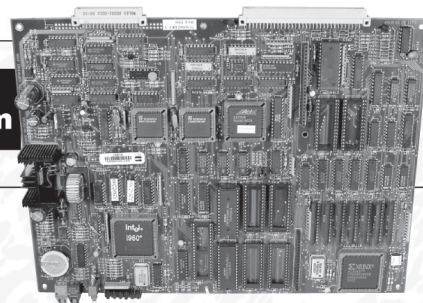
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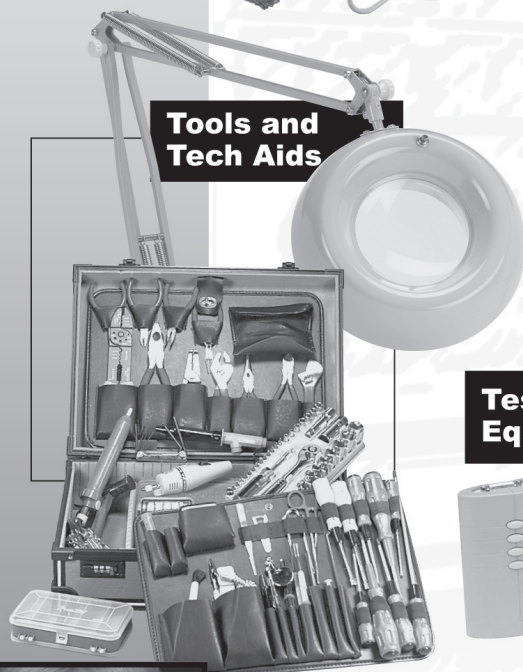


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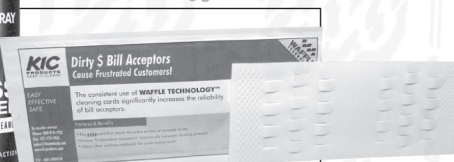
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Did We Win?

We would then check the Pay Table EPROM for a combination of Y1, Y2 and Y3 values to see if we had a winning condition. Starting from the highest paying values we work down. In this way we only pay out the highest possible win. We only have to check winning values because there is no point in checking losing values.

The Pay Table EPROM is like a Spread Sheet of values. A section of it is broken up into these Y1, Y2 and Y3 values followed by a pay value indicating how many credits that win is assigned. Note here that the Pay Table is only organized by the random number values. Symbols are of no importance except for the customer's entertainment. A given Pay Table may well be used in any number of different games.

If the player wins, the credits are added to the area in RAM where Credits are stored. The Credits displayed is updated to reflect the win. The MPU lights the "Cash Out" lamp. The MPU adds the Cash Out Switch to the list of switches to check in the Idle Routine. The MPU does the bookkeeping with Coins In and such information that is stored in RAM.

If the player does not win, the MPU does the bookkeeping, turns on the "Insert Coin" lamp, enables the Coin Comparator and we re-enter the Idle Routine waiting for the

player to press a button.

Points Worth Noting

The MPU keeps track of what is going on in the game by keeping RAM up to date. Most everything that happens is stored in RAM, somewhere. The exception here is data, such as random numbers, that we are in the process of generating. These values only exist in the registers of the CPU itself. Once we complete a set of random numbers for a game we store this data in RAM.

When we do a proper Power Down sequence, we take all the contents of the CPU's registers and store that in battery backed up RAM. We then store important areas of RAM to EEPROM. Then the CPU enters a Wait state, waiting for power to go down. In a properly designed game, we have large filter capacitors in the power supply. We then sense the AC line voltage. If we should miss even one AC cycle (about 16 ms) the game assumes AC is failing and DC will follow as soon as the filter caps discharge. Hopefully, we have given ourselves a few tenths of a second before DC power fails. To a microprocessor that runs at more than one instruction per microsecond, this is more than enough time to do all the housekeeping needed. Lesser games may only sense the DC level dropping below a certain voltage. We may not have all the time needed to do this housekeeping and power outages give us lost

information and inconsistent operation.

When power comes back up, the Reset line is pulsed. The power up routine goes through POST (power on self test) and reads the data from RAM to set the CPU back up exactly as it was before the power failed. If we lost power during the play of a game, we are assured that the game will complete in exactly the same way as it would have if power had not failed.

Glossary

CPU – Central Processing Unit. This is usually a single chip in the game that actually does the processing of information. This microprocessor is the actual IC that does the Read, Writing, Math and Logic operations in the game. It does not include RAM and EPROM or I/O functions.

Flag - A Flag is one bit or perhaps a byte in memory dedicated to a specific purpose. Normally flags used to indicate that a specific event has occurred. These Flags are a section of RAM set aside for this purpose. Most events that happen in the game are represented by some value stored in RAM. Among these things are normal events as well as error conditions. Since this RAM is backed up by a battery, the contents of RAM are retained even on loss of power. In this way, a game remembers what it was doing on power loss. Likewise, it is necessary to clear

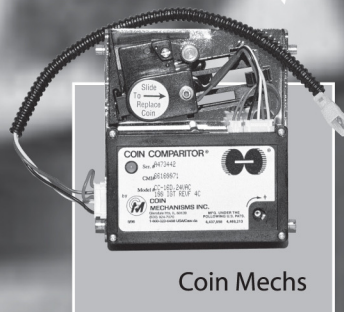


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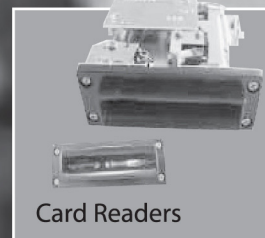
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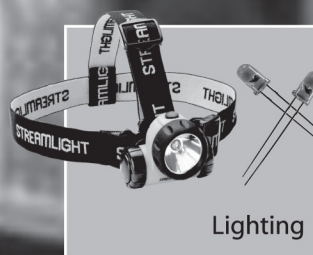
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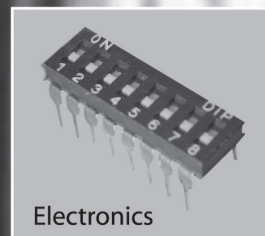
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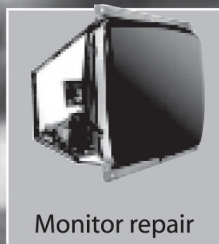
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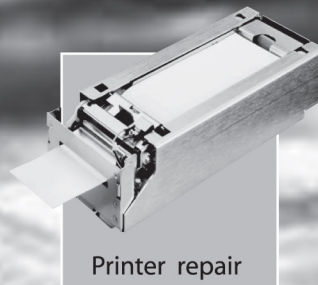
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RAM in order to clear certain error conditions.

MPU – Microprocessor Unit. This section includes the CPU, RAM, EPROM and perhaps a degree of I/O circuits. It may be a group of many ICs or one IC with all these circuits integrated inside. Typically, just the CPU is considered a Microprocessor. A Microcomputer encompasses all of the MPU circuits.

POST – Power On Self Test. Started by the Reset pulse in the system. Every microprocessor responds predictably following a Reset. Intel processors all start executing Program EPROM at address 0x0000. The routine this invokes first determines why we lost power or if this was just a Reset. We first check the CPU to see if it is working okay, test RAM and ROMs to see if they are okay and ROM is the same as it was

when we lost power. We may then check what I/O functions we can and, if all is well, we come out of POST and start setting up the game just as it was before power failed. Note that during POST, the CPU is not checking the Player Panel buttons to see if any are being pressed so there is little we can do to influence the game during POST. If you pay attention, you can see the processes POST goes through and tell what the problem is if POST does not complete properly. Not always, of course. Most of POST is invisible to the operator but at the bench, you can see more happening.

RAM – Random Access Memory. A chip, or group of chips, that the CPU can read data from and write data to casually. Any type of information may be stored in RAM. In personal computers, just about everything is stored in RAM. In games,

RAM is used to store temporary data and Program and Pay Table information is stored in ROMs.

RTC – Real Time Clock. This is usually a specific IC dedicated to the purpose of keeping track of time. When you set the date and time in a game, it is in this chip that the information is stored. The game uses the RTC to note when events occur and/or use the difference between two readings to tell how long an event took.

ROM – Read Only Memory. These are memory chips that the CPU can read from casually, but not write data to. Programs and Pay Table information is typically stored in ROMs of one kind or another.

- Herschel Peeler
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Unwrapping and Installing an e-motion™ Game

By Michael Brennan



After dealing with the holiday season heartburn and headache of too much egg nog, too much office party embarrassment and too much jockeying for position in retail lines, it's nice to wake up on a non-denominational holiday morning and find gift wrapped rewards. While most would probably light up at the sight of an Xbox 360 done up with ribbons and bows, we'd like to imagine someone out there received delight from finding a shiny new Atronic e-motion™ game under their non-denominational holiday tree.

After the necessary deep breathing to get over the initial excitement of receiving such a gift, one is faced with the question of how to get the gift up and operational as quickly and efficiently as possible. This article serves as a guide for this theoretical gift; the procedure below outlines the steps you should follow in order to get your e-motion™ game up and running.

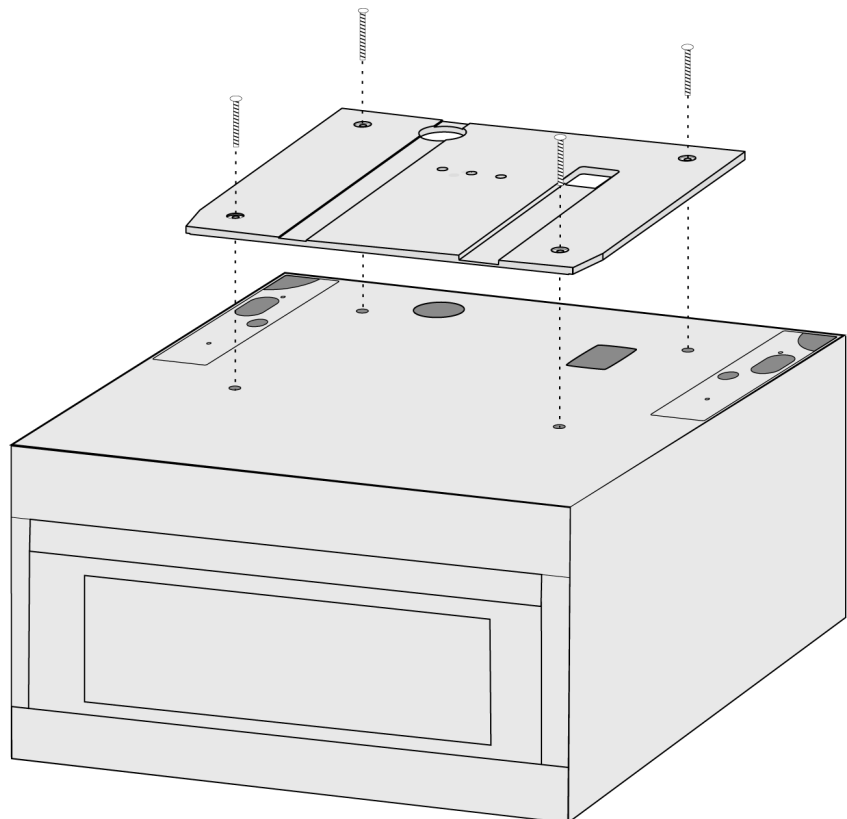
Even if your stocking wasn't busting at the seams from an e-motion™ Cash Fever™ bank, this process may come in handy if you ever need to perform a game theme conversion. Plus, since we will be writing monthly articles focusing on our e-motion™ platform, a logical way to begin is to explain an installation, which can serve as a solid general overview of how our games tick.

STEP 1: Secure Games to Bases

To begin an install and "take it from the top," you have to start at the bottom: the base.

The first step is to secure the game to its base. But before you hoist the 250 lb. stocking stuffer anywhere, you must install the Atronic Installation Station (AIS) to the base. The AIS was designed to make machine installation easier and more precise. Once in place, the game will then slide onto this AIS.

To attach the AIS to a non-Atronic base, you will have to drill 7 holes. Use the supplied template to mark the holes (or use the AIS itself as a guide if the template is unavailable). Drill four 3/8" holes in each corner and drill



The Atronic Installation Station (AIS) is attached to the base. The AIS was designed to make machine installation easier and more precise. Once in place, the game will then slide onto this AIS.



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out one of the three holes in the center. Use the middle of these three holes (but be aware that a metal base with a central support bar may force you to use one of the other two holes). Drill a 2 1/4" hole for AC power and a 3 1/4" hole for the drop hole. On the other hand, to save the time and effort of drilling all these holes, you can use our new 18-inch bases, which are equipped with pre-drilled holes and many other convenient punch-outs. Regardless of which base you use, the next step is to secure the AIS to the base by inserting four mounting bolts through each corner hole. You can now easily slide the machine onto the secured AIS. Be sure you insert the power cord through the large hole after the game is in place. Finish the base installation by running a machine securing bolt through the center hole. The bolt will pass through the bottom of the machine, the AIS, and the base. This will properly secure the game.

STEP 2: Exchange Locks

We have made it easy to change out every lock in the e-motion™ cabinet, especially when compared to our old Cashline platform. There are a total of six locks, and they are all 5/8" Ace type. Locks are located on the logic box door, the main door, the hopper door, and the bill validator stacker door. Two other locks function as the audit "key" and jackpot "key" and are located on the right

side of the game.

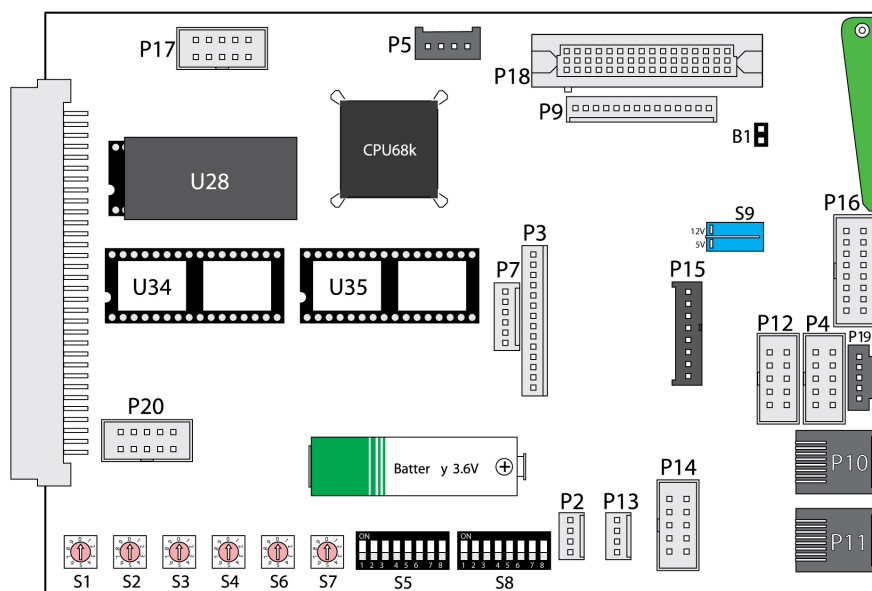
STEP 3: Install Casino Management System

Next, you will need to attach and install the casino management system. These systems mount in one of two places in the e-motion™ cabinet. Standard "smaller" systems are mounted in the upper-right portion of the cabinet door. This area is where all card readers, key pads, and displays as wide as 5 inches are located. Larger

displays that are over 5 inches (like touch screen systems) are housed in a bracket just above the game, extending from the topper arch.

All casino management systems are cabled to the e-motion™ machine's communication board. This "commboard" is set up to communicate with numerous accounting systems through many connectors. Our commboard has connections for two SAS channels, Bally systems, and more. The

Atronic Communication Board



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P4	RS232	SAS Channel 2
P5		Comm Key (Ticket In Dongle)
P9		+12V Power
P10, P11	RS485	A-Link, Mikohn Controller or SAS Channel 3
P12	RS232	SAS Channel 1
P13	TTL	Bally's
P14	TTL	DACOM
P16	RS422	VLC
P19	TTL	SAS Channel 2
S9	Close this to apply +5V or +12V to pin 1 on P2	
B1	Close this to bridge the electrical (galvanic) isolation of ground connection	

board and its connectors are explained fully in the illustration. Also, to enable a SAS-based system, you must physically turn rotary switch S7 to the required address (usually 1) and flip dipswitch 6 on S5 to on.

STEP 4: Ensure That All Connections Are Properly Seated

An important but often overlooked step in any installation is checking all internal and external connections. At this point in an install, our technicians become flight attendants on PCB Airways: they make sure all cables and connectors are properly seated. It's easier to scour the internal slot machine aisles making sure everything is in its upright and locked position in advance, then to encounter a wall of frustration during future trouble-shooting.

STEP 5: Perform a RAM Clear

If you thought the technician/steward comparison was a bit cheesy, get ready for this: What's the important and oft-used slot machine memory procedure that sounds like a new pore-cleansing hygiene product for male sheep? Well, horned mammals, say goodbye to blemishes and say hello to clean skin with RAM clear!

An e-motion™ RAM clear procedure resets chips on a couple of boards, removing information like settings, histories, meters, events, errors, and more. When performing

January 2006

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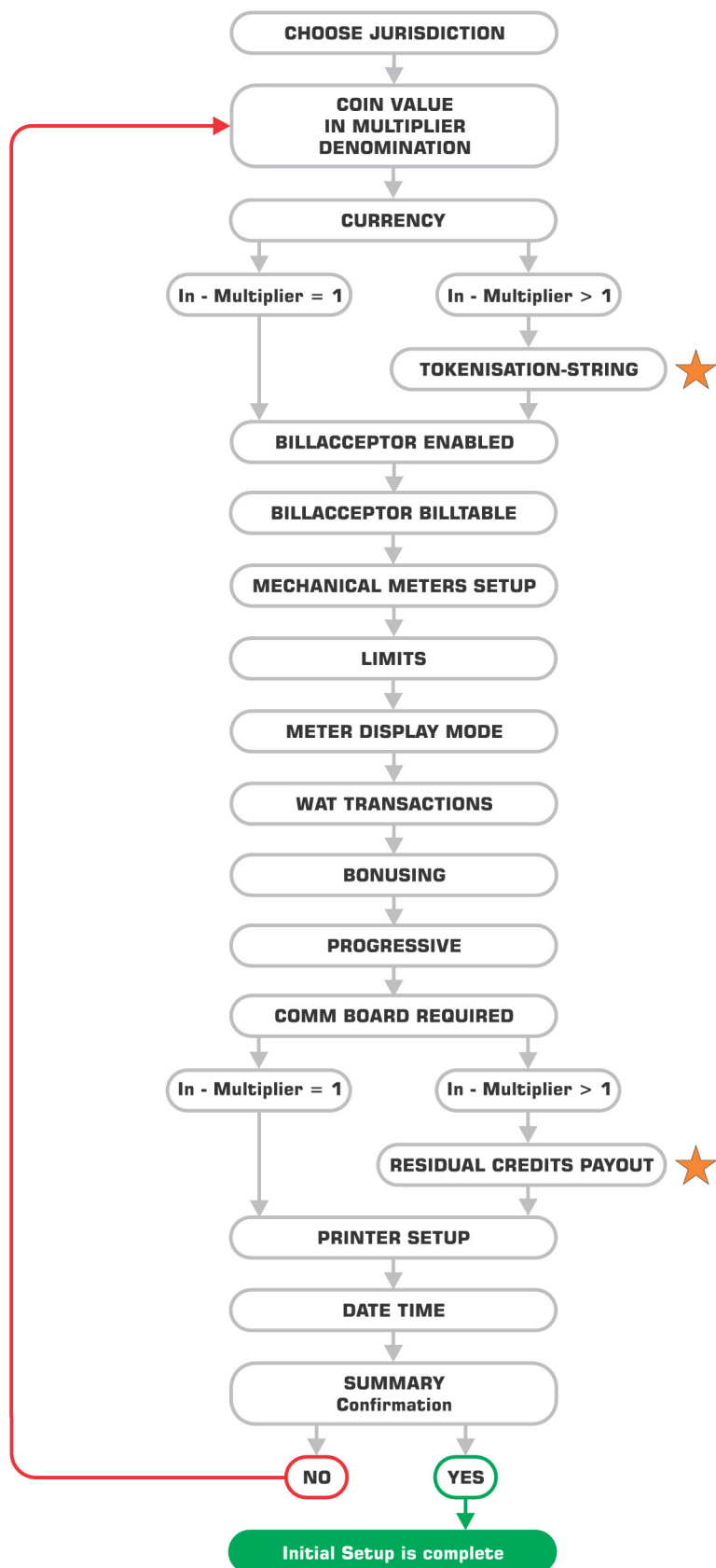
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a conversion, you should execute a RAM clear once all the hardware is connected and double-checked. To make things more efficient, you do NOT have to execute a RAM clear during a new installation. Games are RAM cleared at the factory prior to shipment. You will enter the initial setup software screens (step 6) when you first power up a game during a new install.

But a RAM clear is necessary during a game title conversion or when you need to re-set memory. Begin a RAM clear by turning the power off (located on the logic box) and removing both the main board and commboard from the logic box. On the mainboard, replace the EPROM at U9 with the reset EPROM (labelled “HMB-RRES01”). On the commboard, replace the EPROMs at U34 and U35 with the clear EPROMs (“Q-CB-RAM-CLEAR”).

Reinstall both boards into the logic box and turn the power back on. Wait until a message appears on-screen that verifies a successful reset. Turn the power off and replace the reset EPROMs on both boards with the original chips. After you turn the power back on and wait about two minutes, follow the instructions listed on screen. They will tell you to press the red reset button. This will begin the Initial Setup procedure, which runs through many software setup menus.



STEP 6: Initial Setup Menu Options

After you perform a successful RAM clear, the software setup pages and menus will

automatically appear on-screen. All the setup screens you will encounter are shown in the illustration. Some of these screens contain simple

“yes” and “no” questions, while others are more involved.

For example, the second screen you encounter after the “Choose Jurisdiction” option involves the “Set Coin Value,” the “Set In-Multiplier” and “Denomination.” At this screen, select the value of the coin or token that the coin comparator is set for. The “In-Multiplier” defines the number of credits that one coin will buy. When you enter both of these options, the “Denomination” is automatically calculated. So, if you set the coin value to 1 and the in-multiplier to 4, the denomination will be \$0.25.

Another screen that merits a further explanation is the “Limits” setup screen, where you set the “Credit Limit” and the “Purchase Credit Limit.” Enter these limit values in credits, and the on-screen text will show you how this is multiplied by the denomination to get the limit in currency.

More on credit limits: When a player exceeds the limit by inserting a bill, token, coupon, or coin, the item is rejected and the screen will display a message. When the credit limit is exceeded by a win, the player will be hand paid the entire win.

The “Purchase Credit Limit” must be equal to or less than the “Credit Limit.” It reflects the maximum amount of credits a player can attain by inserting currency.

A nice feature of the initial setup program is that it automatically detects a ticket printer, and determines its make and manufacturer. At the “Printer Setup” screen you can enable or disable the printer. If it is enabled, you must select the validation type, which is dictated by the TITO system being used. Remember, if you set the validation type to “enhanced,” you must also set your validation security. The “Summary” page gives you a final opportunity to verify all the settings. If you advance by selecting “Yes,” you will need to execute another RAM clear to alter these settings. So, if you want to change a setting, select “No” and the software will take you back to the “Set Coin Value” setup screen. Take note that some items that you have selected throughout the initial installation may automatically change to some-

thing else, due to the jurisdiction you assigned and its subsequent requirements.

When a game is equipped with a selectable payable, the payable configuration program will automatically start after you save the initial setup software settings. Use the radio buttons to select the number of reels, lines, bet per line and game percentages. The lines and bets per line must match up with the e-motion™ button panel.

Make sure a coin and bill test is always performed prior to releasing games for play. It is important to verify the proper credit values for all bills and coins.

That concludes the e-motion™ installation procedure. All good things must come to an end; at some point you’re going to have to take down the ornaments and haul your non-denominational holiday tree to the dump. We hope this was informative just as we hope you got what you wanted from the non-denominational fat guy in a red leisure suit. See you next month.

- **Michael Brennan**
mbrennan@atronic.com

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Understanding Video Reels - Part 5

By John Wilson



Last month we waded through the thick of buffer video slot math and studied some immensely detailed topics. Perhaps we're ready for a bit of a break? Let's have some fun this month looking at the video game we are creating. Just like the cooking shows with "one ready in the oven", I'm going to pull out our Slot Tech video game and show you what we have.

Let's take a look at the menu and see what's being served at Slot Tech's restaurant today. First, we start with a base of five-reels, sprinkled with a nine-payline entrée. Next we introduce our ingredients consisting of nine symbols. We mix these together with a generous payable and our masterpiece is complete. Our payable will allow us to select from 470 individual entrees (paying combinations) and the symbols will allow for a game cycle of 6,339,168 games.

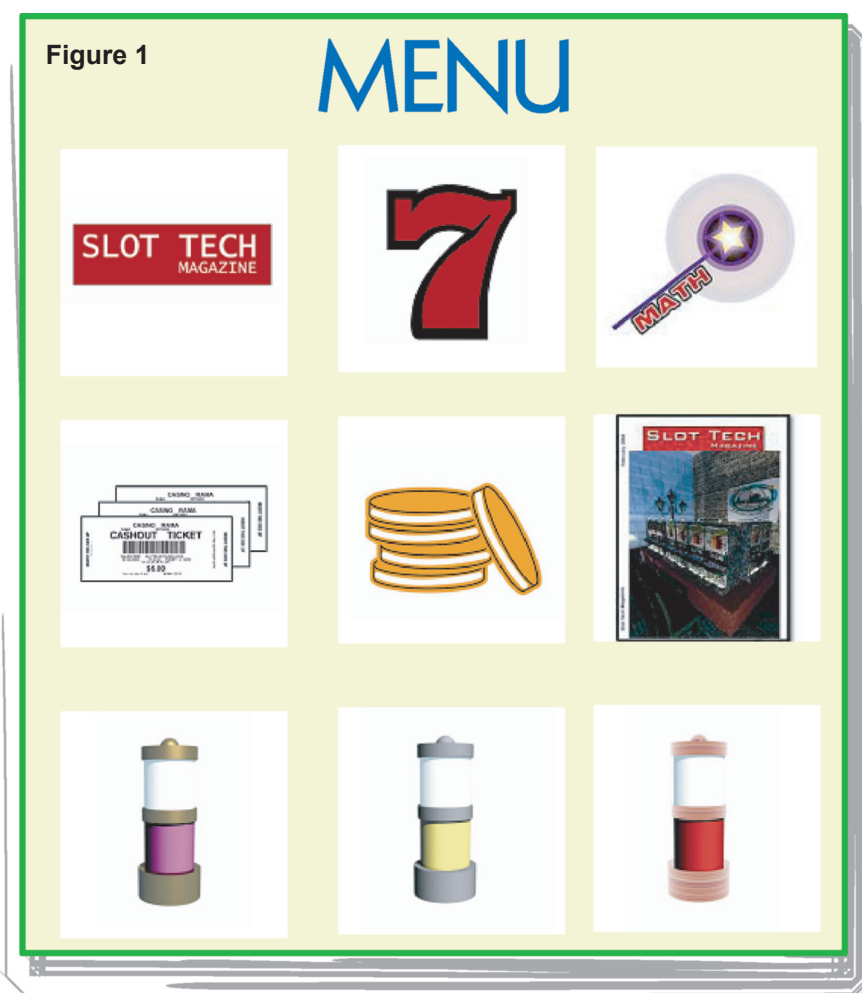
But don't worry, we won't go through the entire payable. We'll simply touch on the highlights and look at the important points.

Game Symbols

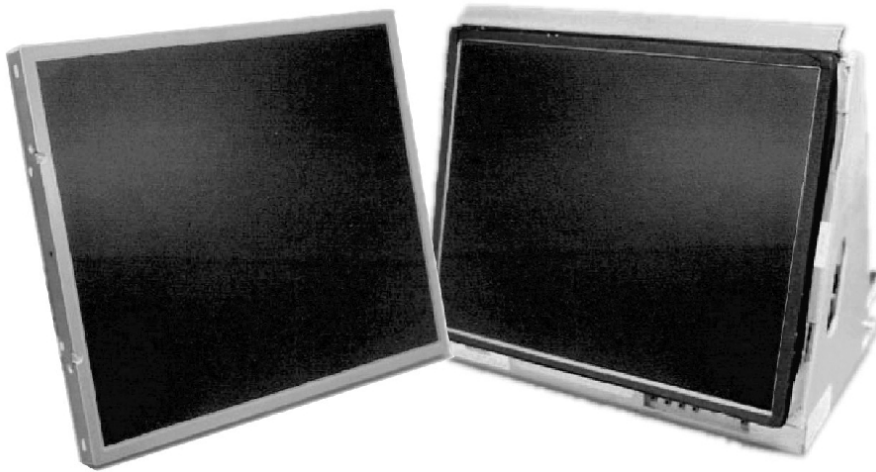
Let's examine the symbols now. Take a look at our list of ingredients in Figure 1. This shows each of the sym-

bols that we're using. Remember though, a mathemagician does not necessarily have to be a good artist! There's tickets and tokens and bright-coloured candles. A seven that's red, a machine with no handle. A magazine cover and a bright logo, too. These are a few of the symbols for you . . .

Figure 1



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The candles will act like bar symbols allowing a payout for any three mixed slot candles (or any four or five, too!). By mixing the symbols we can increase the hit frequency and make the game more exciting. Symbols that have a common theme are easily mixed. For extra excitement we'll also mix the tickets to tokens symbols. The mixed symbols will pay half of the natural payment. Three tickets, therefore, are worth twice as much as two tickets and a token. Next we have to take the symbols and create some reel strips from them.

In creating this game we're using a different angle. Instead of putting the symbols onto the reel strips and then adjusting the stops to see how it works, we're going to determine how many symbols we want on each reel and then create the strips from this.

The jackpot, having the highest payout, will have the fewest occurrences per reel of any symbol. We'll put one on each reel and then move to the second-highest paying symbol, the Red 7. We will want this to occur more frequently, but not too much. We'll put one on each reel except for the very first and last, where there will be two. Remember that we multiply the number of symbols on each reel together to get the total hits per cycle. For the jackpot, there are $1 \times 1 \times 1 \times 1 \times 1 = 1$ jackpot per cycle. For the Red 7, we have $2 \times 1 \times 1 \times 1 \times 2 = 4$ per cycle.

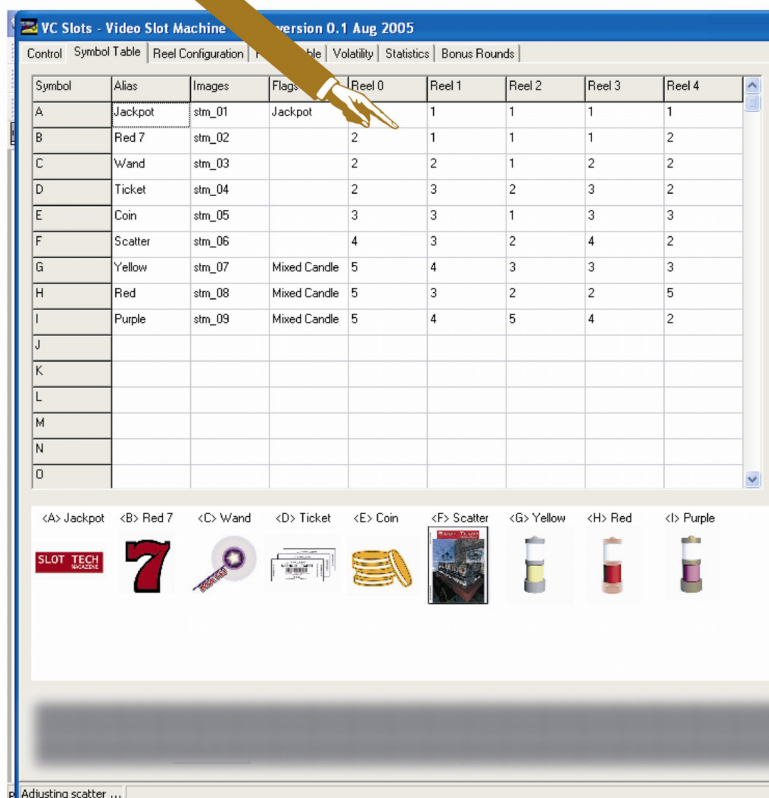
By working through each symbol in this manner, and increasing the number of hits as we get lesser paying amounts, we'll be off to a good start. We end up with Figure 2, which shows each symbol and the total count per reel.

This is a pretty good start to our symbol table. We now need to create a payable showing the winning combinations and the amounts paid for each of them. As you can understand, the symbols that occur less frequently will pay out more. The symbols that occur very frequently will pay out less. The lower-paying symbols increase our hit frequency. It's simple mathematics that dictates this.

Figure 3 highlights this.

A large jackpot award (such as 200,000 credit paid for five jackpot symbols on the highest payline) cannot occur frequently. While we may be able to tweak the frequency of this win, it's at the expense of everything else. Paying a lot of these jackpots means that we can't pay very much else. On the other end of the scale, if we have a lot of symbols that pay a little bit, we can't pay out a large jackpot. The problem on this end of the graph, however, is different from the large jackpot. Players don't really expect to win the top award, especially if it's a "life changing" amount. Bally's Quartermillions games pay a progressive jackpot

Here we show the summary for each reel. We display the number of symbols that we have placed on each reel of the game.



Symbol	Alias	Images	Flags	Reel 0	Reel 1	Reel 2	Reel 3	Reel 4
A	Jackpot	stm_01	Jackpot	1	1	1	1	1
B	Red 7	stm_02		2	1	1	1	2
C	Wand	stm_03		2	2	1	2	2
D	Ticket	stm_04		2	3	2	3	2
E	Coin	stm_05		3	3	1	3	3
F	Scatter	stm_06		4	3	2	4	2
G	Yellow	stm_07	Mixed Candle	5	4	3	3	3
H	Red	stm_08	Mixed Candle	5	3	2	2	5
I	Purple	stm_09	Mixed Candle	5	4	5	4	2
J								
K								
L								
M								
N								
O								

Figure 2

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Figure 3

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	5 50,000 4 5,000 3 100 2 25		5 2,000 4 750 3 75 2 5		5 1000 4 100 3 25
	5 500 4 50 3 20		5 500 4 50 3 20		5 250 4 25 3 10
	5 50 4 20 3 10		5 50 4 20 3 10		5 50 4 20 3 10
Colourful Candles 	5 25 4 10 3 5		5 20 4 10 3 5 2 2	All pays are from left to right except for "Slot Tech Scatter" which pays for symbols on active payline.	

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NEXT >

RETURN
to game

starting at \$250,000 on a twenty-five cent reel spinner. The players don't expect to hit the Quatermillions jackpot but know that eventually someone will. They may dream of winning the jackpot,

but don't rely on it. They do hope to win an intermediate award, though. Perhaps \$1,000 for a quarter machine or \$250 on a nickel machine. With this philosophy, the top jackpot can be relatively in-

frequent. However, it must occur sometime.

With the smaller payouts, the players know they will frequently hit them. Mixed bars on a reel spinner? It's going to happen quite a bit. What about three of some symbol on a video reel? Frequently as well. However, the small payments, like two credits for two symbols, can become more of an annoyance than a benefit. If the player wagers nine credits and wins two credits it doesn't mean very much. A scatter symbol will generally pay twice the wager (at a minimum) for 2 scattered symbols. If you bet nine credits, you win 18. These wins are good for the player, but too frequent and they start to annoy them.

The point is that too many small awards becomes bor-

Slot Tech Magazine Video Slot PAR Sheet Paytable Listing

Pay	R1	R2	R3	R4	R5	Award	Hits	Minus	Total	R1	R2	R3	R4	R5
Jackpot	STM	STM	STM	STM	STM	50,000	1	0	1	1	1	1	1	1
	STM	STM	STM	STM	any	5,000		1	21	1	1	1	1	22
	STM	STM	STM	any	any	1	506	22	484	1	1	1	23	22

The combination of five STM symbols overlaps the combination of four STM symbols.
As a result we have to subtract that value since we've already paid it!

In the case of three STM symbols then the four-symbol combinations and the five-symbol combination must be subtracted as they both overlap. We have paid the five-symbol combination and the four-symbol combination already.

ing and the players lose interest in the game in a hurry. You need enough significant payouts to make the game interesting. Small payouts increase the hit frequency, while large payouts make the player leave with money in their pocket.

Adding in mixed symbols helps to increase the hit frequency. In our game, we have three slot candles with different colors. They all pay the same amount if the colors are the same. In other words, three red candles pay the same as three yellow candles. Three mixed candles pay one-half the amount. This allows us to make more wins for the players. Having symbols that don't mix means the hit frequency will be a bit lower, but

that payouts can be larger. In our game, three red 7s can pay significantly more than three red candles for this very reason.

You might be wondering about wildcard symbols right now. These symbols match any other to make a paying amount. The IGT Cleopatra game has the jackpot symbol (Cleopatra) wild. This also increases the hit frequency. On a stepper slot, the symbols will frequently multiply the win, and do so for each symbol. One Black & White Double Jackpot symbol doubles the natural payout. Two Black & White symbols quadruple the payout. With a five-reel game, however, this gets hard to implement. If we had a five-reel B&W DJ game, with four symbols and

a red 7, the payout would be 2x for each symbol: 2x, 4x, 8x, a total of 16x. What about a 10x? The multipliers are: 10x, 100x, 1000x, and finally 10,000x. That's hard to calculate! For video games (or five-reel steppers as well), there are several options. The symbols may merely be wild and not multiply the payout. Or, they may multiply only once - "One or more XXXX symbols doubles the winning payout." They can work like stepper slots, though, with each symbol multiplying, although this doesn't happen very frequently.

The only problem with wild symbols is that they make our payable more complex. Consider the example:

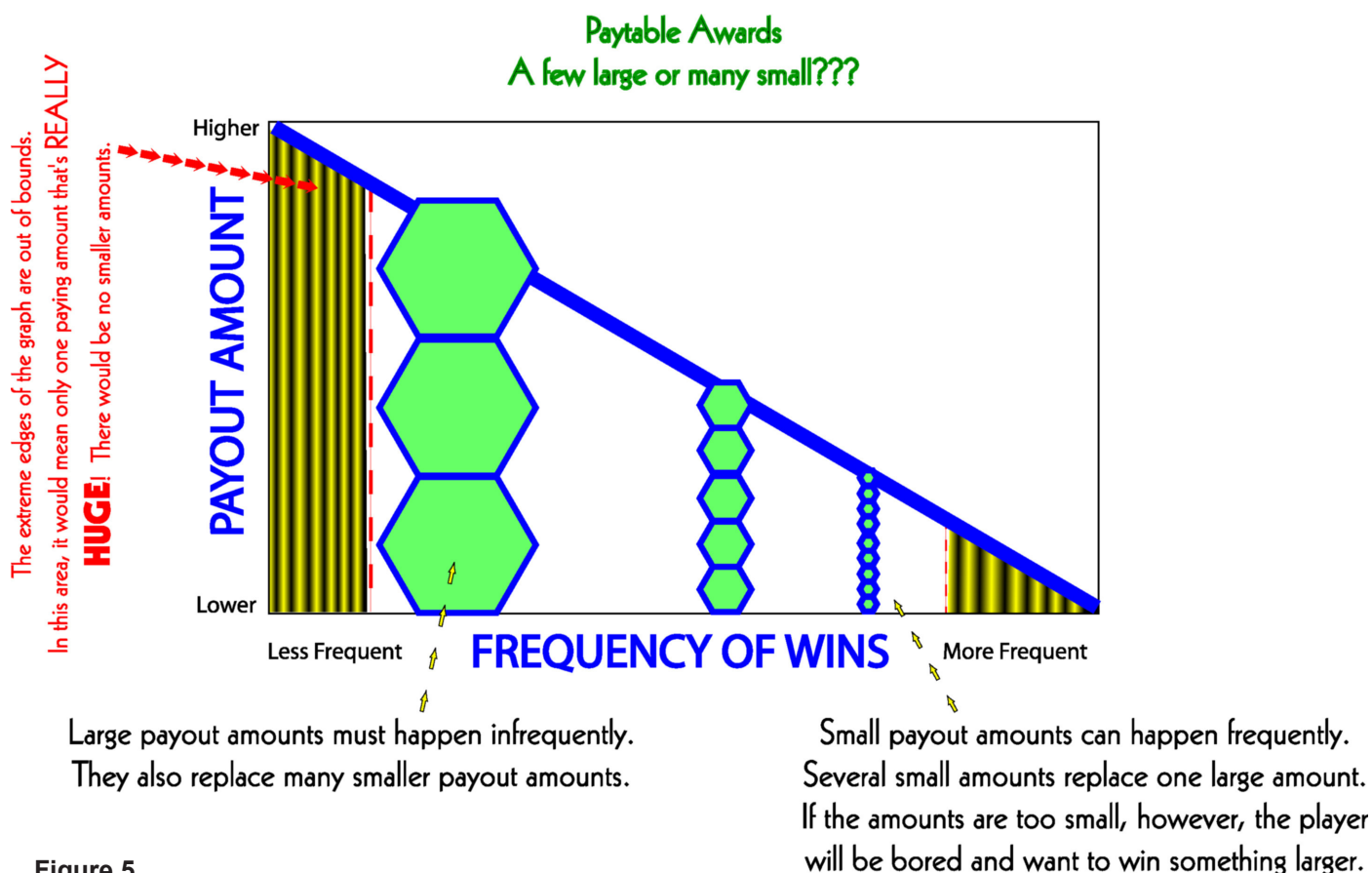
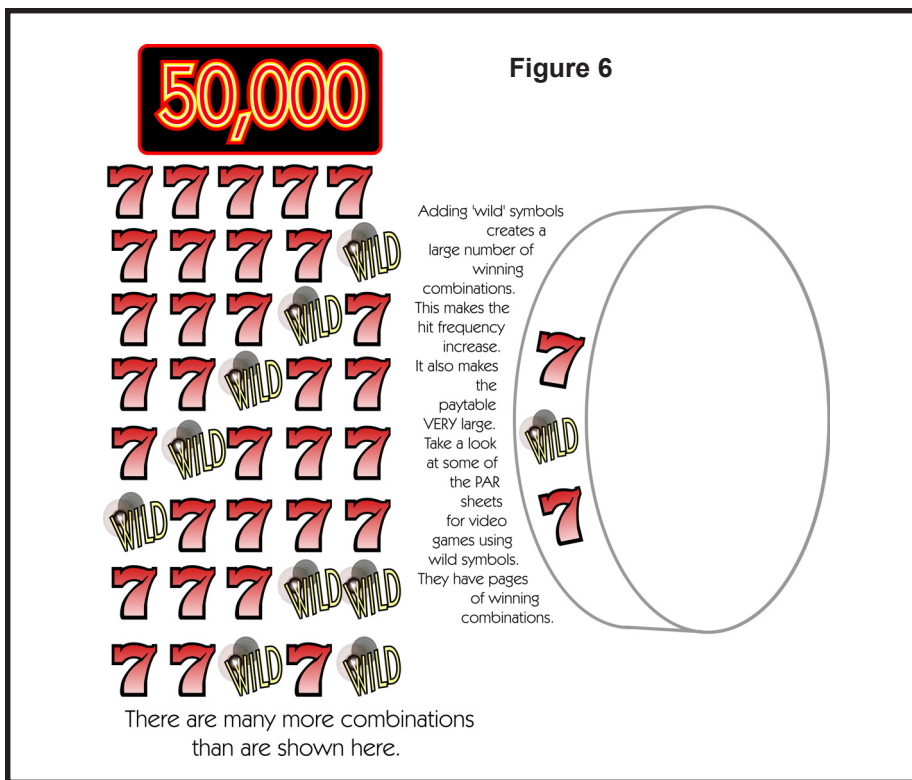


Figure 5



That's a LOT of combinations!
I wonder if we missed any?

7 7 7 7 7	2,000
7 7 7 7 w	2,000
7 7 w 7 7	2,000
7 w 7 7 7	2,000
w 7 7 7 7	2,000

someday, a player is going to get the missing combination and wonder why they didn't get paid for it. And that's not good.

But what about two wilds? Three wilds? Four wilds? Figure 6 shows us the combination. Mixing any three symbols for five reels results in 240 combinations. Any three symbols for four reels (only left to right) makes 78 (this assumes, of course, that we don't count combinations of 4 the same). 3 on 3 is 24. Add these up and that means any three mixed symbols paying for 3, 4, 5 from left to right only is 342 payable entries. Pay right to left or anywhere on the reel and you get a LOT of combinations to enter in the payable. The real problem occurs when you miss one. Suppose you create this game and only entered 341 entries. You might not notice the missing one. However, somewhere,

Let's take a look at our completed game. Figure 5 shows our payable (in a much reduced size). We don't need to examine every entry for the payable; that would take several months! Also, we'll study our reel strips and symbol table. We've come up with a reasonable pay table, reasonable hit frequency, and some nice symbols. We have a hit frequency of 27.29% per payline. This is really, really great! A hit frequency of around 4% per payline is very common. Some games have a higher hit frequency, but almost 30% is tremendous! The overall game hit frequency is going to be around 80%. Can you think of what this might mean? Other than the fact I should immediately sell the

game to a manufacturer and retire in the sunny Caribbean? It actually means that our math isn't correct. The payout is 202.29%. No wonder our hit frequency is so high.

We haven't touched on the special features, either. There isn't a bonus game right now. The scatter pay has been simplified in order to make the math simpler. The magazine scatter pays for two or more symbols scattered anywhere on a payline. Most scatter pays work if the symbols appear anywhere in the window. Ours pays if the appear anywhere on the payline. This will have a large hit frequency since there are so many more combinations that can occur. In fact, scatter pays account for almost 45% of the total wins (or hits), and over 7% of the total payout. If we remove this entirely, though, the payout drops from 202% down to 195%. We still have a long way to go. The hit frequency would also drop to around 15%. That's still very good.

What can we do to fix this? Take a few moments before next month and see if you can come up with any solutions. What better way to spend your free time than trying to fix a mathematical problem?

Will we be able to make the game work? Can we reach the magic payout range between 87% and 97%? Can we have a reasonable hit frequency? Will the game still be interesting? Exciting? Join us next month when we recruit a couple of gaming experts for the final installment of Video Reels. I suspect they'll be able to fix our game!

- John Wilson
jwilson@slot-techs.com

January 2006

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Quick and Simple Repairs # 9

By Pat Porath

WMS Bluebird Ithaca 950 setup option

I received an email from a friend of mine, Chip Cippola, who is a tech in Arizona, about a tip on optioning the Bluebird games with the Ithaca 950 installed. I thought I would pass it along. We don't have any 950s at the casino where I work but I'm sure we will get some eventually. Chip said that when you are setting up the games, the "Seiko Netplex" option must be selected or the game will not work. I thought that I would pass that tip along. Thank you very much Chip (He also reads Slot Tech Magazine).

IGT S2000 Main Power Problem

I was called over to a bank of quarter "Wheel of Fortune" games and they were all offline. None of them were communicating. Ok, what is going on here? Earlier in the day, part of the power was lost in the building. In our shop, none of the lights were working but we had power to the outlets. With the help of the bench lights, the drill

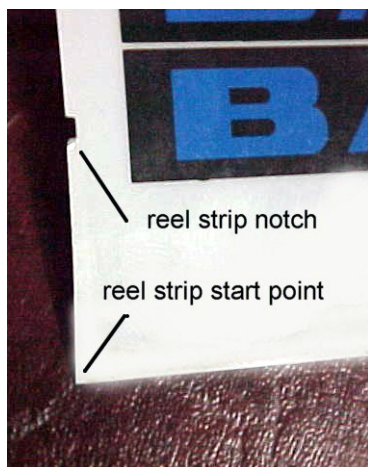
press light and a halogen work lamp, at least we could work on a board if we needed to. Later the power came on completely and then completely went off for a minute and then came back on. Anyway back to the IGT, could it be a main fuse? A fuse in the power supply or what? We were checking the game out and it was completely dead. No power anywhere. I got the drop key and went under the games to see what was going on and I thought for the heck of it, to unplug the game from one socket to another. Bingo, the game now had power; I'm not sure if the socket went bad or not. The power was established and the rest of the bank of machines came back online. It isn't very fun when you have power issues.

Bally 6000 Conversions

First of all, a slot machine conversion is when the glass, chips, and maybe the player buttons are changed on a game into a new one. Instead of purchasing a new game, an old game can be converted to a new one. We recently converted a few Bally 6000

games and it was a little bit interesting. I was the one to do the testing on the games. Since they accepted "Promo Cash," I was able to download money into the credits to test the games instead of dealing with cash and a cashbox. On the first game, something wasn't right. Were the reel strips off a little? Were the game chips correct? Something wasn't correct. I hit mixed bars on the payline, with two coins in on a "Blazing 7's" program and there wasn't a payout. Oh boy, something was definitely wrong. I played it some more and no winning combination was on the payline and the game paid out.

Finding out that the reel strips were incorrect, how do I go about making them correct? On the strips (it is a "Blazing 7's" program) there are two different sets of notches on the strips. When looking closer, it was written in small print "upright" and "slant." Ok, I have an upright game, so I know where the notches go. When looking at the reels, there are the reel strip notches and then there



This is is an IGT reel strip. Notice the notch that is cut out of the reel. The notch on the reel strip needs to match up with the notch on the reel basket or the symbols will be out of alignment with the payouts.

are arrows. Come to find out the strips were attached at the arrow and not in the notch. With the reels properly assembled, the test came out ok but this shows why it is important to do certain tests after a game is worked on. It would not have been a good situation if a customer would have encountered the problem. Recently, someone must have been cleaning the reels on an IGT Sizzling 7 game because I was called to a reel problem and the number three reel strip was out of place; It was off by one symbol. That's not good when I had to explain to the player that even though it looks like you hit the mixed 7s on the payline, it's not a valid win because of the reel strip. If it was for a large amount of money, I may have had to call my slot manager. It looked like someone had cleaned the reels and the number three reel slipped out of its notch.

On IGT games, there is only one set of notches on the reel strip so you simply match the reel basket notch to the reel strip notch and make sure it is secure. On an older WMS upright game, there is a small "optic flag" that passes through the reel optic. The flag is moveable and can come off so when a reel basket needs to be replaced, make sure you know where the reel strip starts and where the "optic flag" goes. Otherwise, the reel symbols won't be correct with the payouts.

Atronic E-motion Conversions

We recently did conversions on nine of our Atronic games. It is SUPPOSED to be simple but rarely is. It seems like there is always something that happens. As with most video conversions, you replace the glass, the CD, the chips and maybe a few buttons. The glass was replaced so we started to work on the software. The chips were replaced and a clear was done. We powered up the games and they came up with an error like "voucher text not initialized" and a communication error. The game options were set at what were supposed to be the proper settings but the games would not come up. Luckily, come to find out from an Atronic tech, the WAT game option had to be set to "enable." We had them set at "disable" because the games were not a wide area progressive or an

in-house progressive. Not really sure why but with the WAT set to "enable" the game would then "talk" to our CDS tracking system. Also with the conversion to a "Dancing Spirit" program, it was found out that a "bet two ways" button was needed. I was testing the game out and it was taking two credits away from a one line, one bet. Usually a game only takes away one credit. We took the repeat button and hooked it up to the "bet two ways" slot and bingo. With a bet of one per line and playing one line, it took one credit. With the "bet two ways" button pressed, it took two credits. That was a new one on me.

IGT S-plus Reel Game Won't Let You Into Hopper Test

There was a shortage on a game and the "hopper tension" spring was incorrect on the coin out escalator. Because of that, it was counting coins as having come out of the hopper while actually they are bouncing in and out of the coin out optic because the hopper was low on coins. In a nutshell, the game thought it was paying out coins even though it wasn't. A slot tech went to do a hopper test of the game after the spring was repaired and it wouldn't let him. What? The game wouldn't let him do the hopper test. There wasn't any logic to it either. There were zero credits on the game and there were zero coins in to be played off. Hmmm. Loose

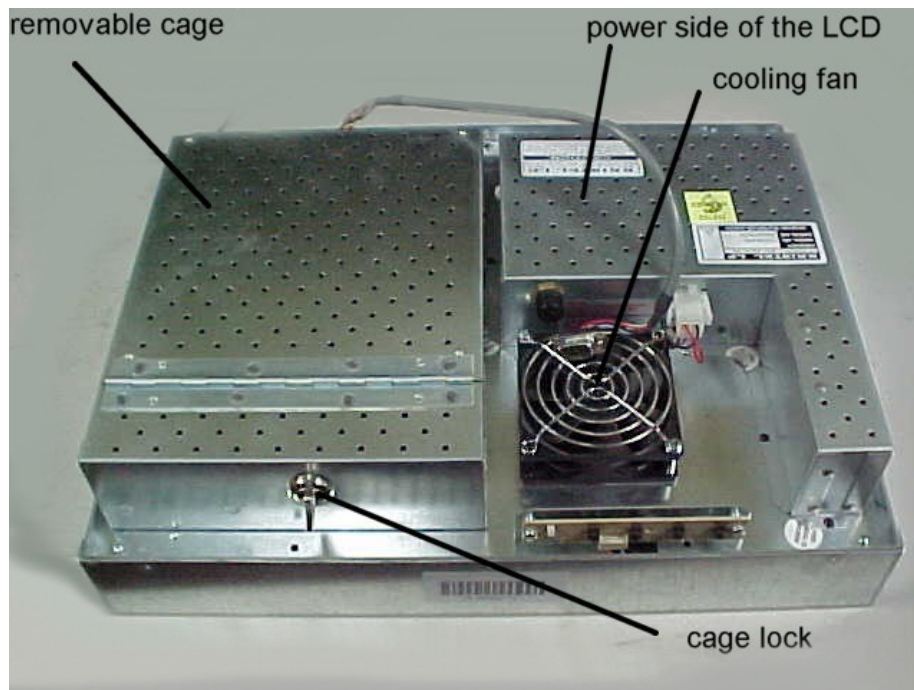
mother board connection? Corrupt RAM? Could it be something in the wiring? Come to find out the problem was in the wiring. The spin button connections were wired wrong. The problem was corrected and the hopper test came up fine.

IGT S2000 with a Mikohn Mystery Payout System

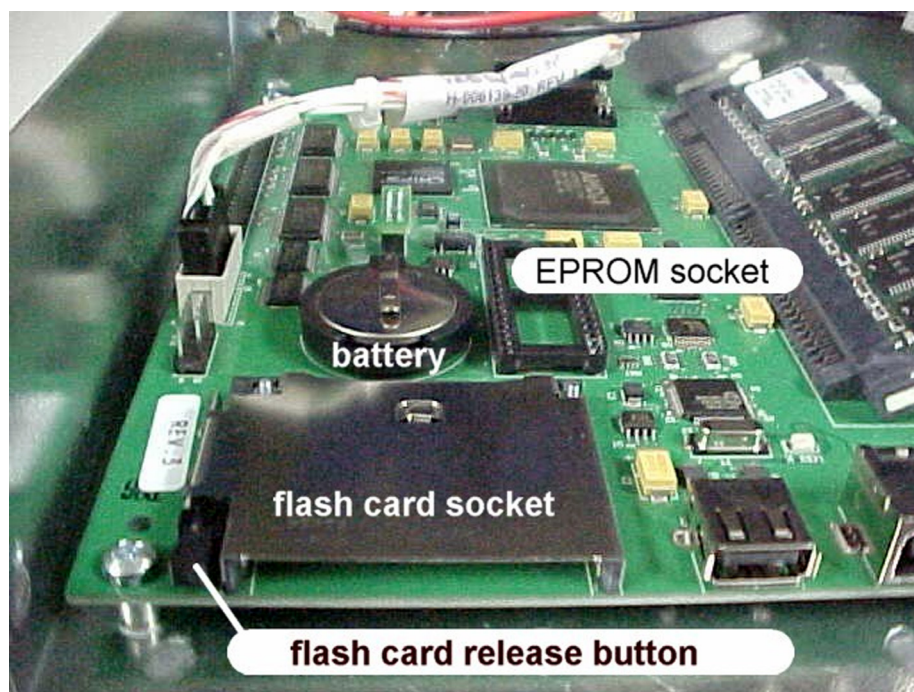
While I was walking to another game that needed to be worked on, I noticed the upper Mikohn display in the game was black. No dollar amount and no graphics. The unit was D.O.A. (dead on arrival). After finishing the work that was needed on a different game, I looked at that display unit on the IGT game. The connections seemed to be alright; they were nice and snug. So . . . why not, let's try a reboot on it. The incoming power cord was obvious. I unplugged it for a few seconds and plugged it back in again, and the display came right back with the dollar amount and the graphics. However, the dollar amount displayed was a couple of dollars less than the rest of the games in the system. I waited a few minutes and sure enough, it caught right up to the other games.

Aristocrat with a 750 Ithaca Printer, Showing "Printer Disconnected"

I Had an Aristocrat game with an error of "printer disconnected." I opened up the



This is the back of an LCD for a WMS game. Notice the cage area that contains the EPROM and the flash card.

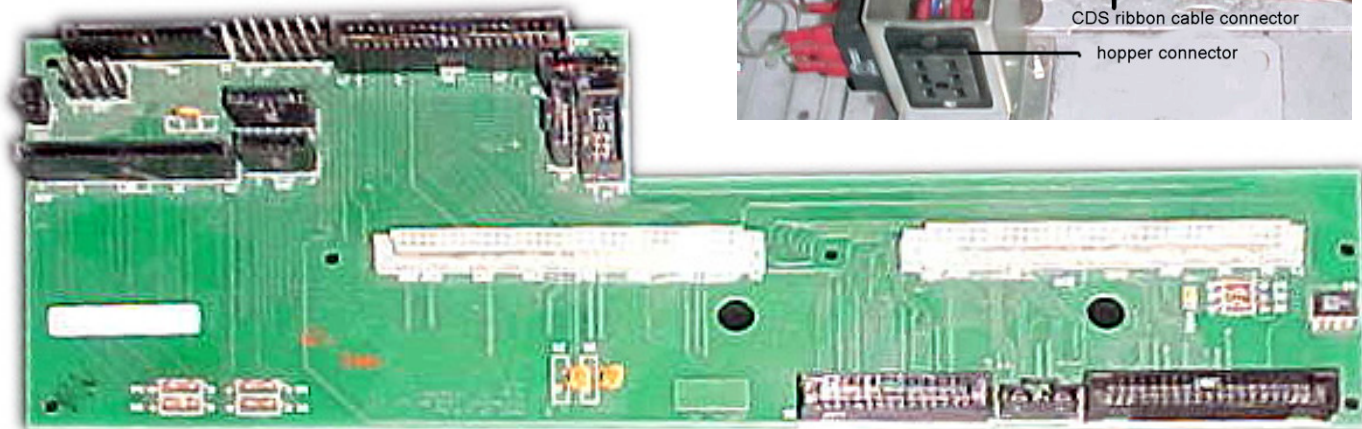


Here is a picture of the inside of a upper LCD that is used in a WMS game. As an example, it is used in a "Password" game. Notice where the battery backup is, the flash card socket, the flash card release button and the EPROM is located.

game and checked the connections. They all seemed ok. The printer had power because the LED was on. I did notice that the paper was in upside down. That may be why the customer received a

blank ticket. I also THOUGHT (sometimes a mistake) that if the paper was reinserted properly that the error would clear. No such luck. I fed the paper in a few times, pressed the paper feed

button a few times and the paper would feed ok, but the error still wouldn't clear. I rebooted the game twice, opened and closed the main door and still no luck. Armed with a replacement printer, I replaced it and printed some test tickets. The game was fine. Be careful not to hold the service button too long while testing, otherwise it will continue

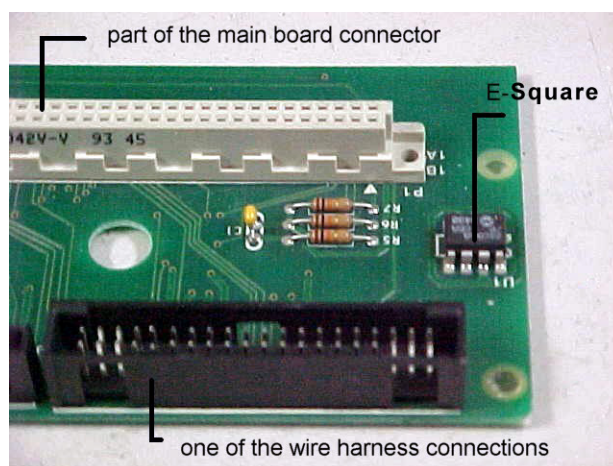


to print three or more test tickets in a row.

Editor's note: Hey, Pat. Did you ever find out what was actually wrong with the printer you replaced?

Williams Bluebird with a Bad Upper LCD

On a "Password" game that we have on our gaming floor, the upper LCD went out on it. The procedure for changing it out is a little different than a regular main monitor LCD. The upper one has an EPROM and a flash card that needs to be swapped. Instead of taking the chance of bending a leg on the chip and messing with the card, simply unlock the cage, pull the connectors, and take it off of the LCD. It saves a little bit of time too. Install it on the replacement unit and it should be good to go. I learned this when a Williams tech did that to one of our "Monopoly" games and thought it was a pretty good idea. I can't find much information on repairing the LCD units yet. When I do, I will pass it along.



Here is a closeup picture of a backplane board for an IGT S-plus, showing the E-square chip, one of the main board connections and one of the wire harness connections. Notice the chip is soldered in place. Some are socketed, some are soldered.

IGT S-plus Code 65, EPROM Error That Didn't Want to Clear

Usually a code 65, an EPROM error, is pretty easy to clear on a game. This time it wasn't that easy. I tried the "ram chip scratch trick" and that brought the game back so I could test it with the coin in button. I gave it credits and the game spun fine. Ok, no problem, the game is back online. Not hardly. A sec-

ond after I closed the door, it went back into the code 65. I tried it again. I used the reset key and the test button and so on but nope! It went back into a code 65 again. Well, it may be a bad main board, so I replaced it and cleared the RAM error. Got the game running and back to a code 65 it went. So far I did a partial RAM clear and changed out the main processor board and no luck.

Time to consult other techs. I talked to our bench tech Jim Randall and I also talked to our slot manager Robert Jewell. They both pointed to the E-square chip on the backplane board. Ok. I changed out that board. With

all of these things done to this game, what else could happen? I almost forgot to mention that I got a code 12 when I replaced the main board. I didn't notice that it didn't have a battery so I had to head back to the shop and replace that. FINALLY, the game was playable, the main door was closed, and the tilt didn't come back. There was also a "closed" signal showing on my CDS display, which meant I shouldn't have lost my game options. I opened & closed the door and sure enough, it said opened and closed.

A note to remember: Whenever changing a main processor board or a backplane

board, BE SURE to check the game options. Some of the game options may default and be incorrect so be sure to check and verify options.

Now, with the game options correct, a replaced backplane board, a replaced main processor board, and a full ram clear, (I can't really say the total time that I put into that game. I'm embarrassed) the machine was back online and good to go.

- Pat Porath

pporath@slot-techs.com

Slot Tech Press Release

TransAct and JCM Formally Combine Gaming Sales Efforts

TransAct Technologies Incorporated has announced that it has executed an agreement on its previously announced letter of intent with JCM American Corporation, to combine the gaming sales efforts of both companies. JCM is a manufacturer of currency handling systems, including providing products, software and services to the gaming, vending, banking, amusement, and petroleum industries.

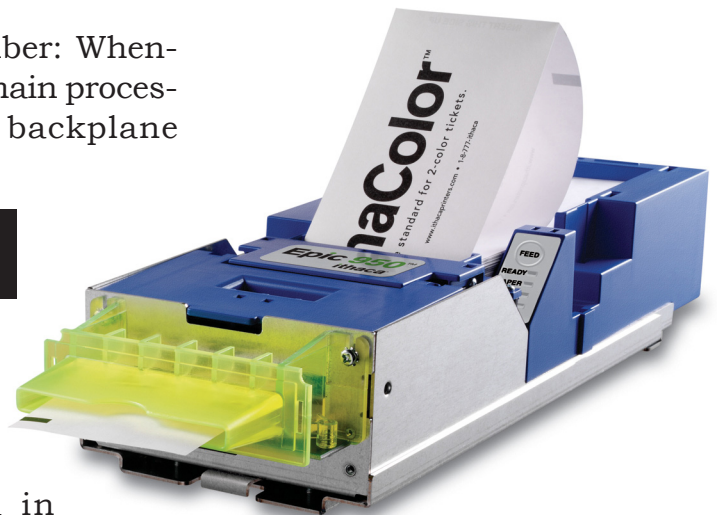
JCM's sales force has started offering TransAct's gaming thermal printers in North and

South America in combination with JCM's many bill acceptor and currency handling products. In addition, the companies are working together to offer world-class service and support for TransAct printers by utilizing the network of sales and service centers that JCM already has in place.

JCM President Aki Isoi said, "We are very pleased to have finalized this agreement with TransAct, a company that we see as being as innovative and dedicated to the industry as we are. This agreement

creates an environment that is above all, convenient for our customers. By combining our sales team efforts, we have created the most convenient, customer-focused team imaginable -- a value-driven, one-stop shop for the best currency handling, printing and monitor products anywhere."

Bart C. Shuldman, Chairman, President and Chief Executive Officer of TransAct Technologies, said, "We are excited to have signed this



Slot Tech Press Release - Continued

important deal with JCM. This venture combines each of our core strengths, JCM's bill acceptor and other products with TransAct's printers. As a result, we are in a great position to offer the very best printers on the market today, while leveraging both TransAct and JCM's relationships to create the most value and convenience for our customers. For TransAct this means that in addition to our sales team, JCM's many salespeople across all jurisdictions and around the country, will be selling our slot machine printers while selling their bill acceptor solutions. This is a huge win for TransAct and one we believe will help to grow our market share quickly."

About TransAct Technologies Incorporated

TransAct Technologies (Nasdaq: TACT) designs, develops, assembles, markets and services world-class transaction printers under the Epic(R)

and Ithaca(R) brand names. Known and respected worldwide for innovative designs and real-world service reliability, TransAct's impact, thermal and inkjet printers generate top-quality receipts, tickets, coupons, register journals and other documents. The company focuses on two core markets: point-of-sale (POS) and banking, and gaming and lottery.

TransAct sells its products to original equipment manufacturers, value-added resellers and selected distributors, as well as directly to end-users.

The Company's product distribution spans across the Americas, Europe, the Middle East, Africa, the Caribbean

Islands and the South Pacific. In addition, TransAct has a strong focus on the after-market side of the business, with a growing commitment to printer service, supplies and spare parts.

For further information, visit TransAct's web site located at <http://www.transact-tech.com>.

About JCM

JCM American Corporation is the industry leader in currency handling systems and provides products, software and services to the gaming, vending, banking, amusement, and petroleum industries. Since 1995, its products have validated an esti-

estimated \$2.2 trillion in currency for the gaming industry alone. From its international headquarters in Osaka, Japan, and subsidiaries in Dusseldorf, Hong Kong, London, Sydney and its

U.S. headquarters in Las Vegas, JCM's progressive spirit continually sets worldwide industry standards with innovative products such as the World Bill Acceptor (WBA(R)), Universal Bill Acceptor (UBA(TM)), Trident(TM) Table Safe System and Intelligent Cash Box (ICB(R)).

For more information, visit <http://www.jcm-american.com>.





Ireland's Amusement & Gaming Industry Prepares For AmEx 2006

AmEx 2006 - The 27th Irish Amusement & Gaming Trade Exhibition, will be held at the newly refurbished Lynch Green Isle Hotel, Dublin on Tuesday 7 and Wednesday 8 March 2006. Opening hours will be from noon to 6 pm both days!

2006 will see the return of international technical guru, Randy Fromm, who will conduct a series of technical seminars under the banner "Tech-Fest Ireland 2006". Details of the seminars and registration information will be published shortly.

Accommodation can be booked with Lynch Hotels, Central Reservations, which can be contacted by phone at + 353 65 6823000 or at 1890 66 99 00 (Within Ireland Only) or by email at cro@lynchhotels.com

Confirmed exhibitors include Ainsworth (UK) Ltd, Almotech, AMS / Project, Amusement Sales & Service, Brent Sales / Namco Europe, Carnaby Gaming Machines, Carvill Vending, Cash Automation, Crown Direct, Deith Group, Electrocoin, Excel Leisure, FX Simulation, Genesis Games, ITM Leisure, J.H.S. Associates, Kimble, Laser Electronics, Master Billiard Supplies, Oasis Retail Services, Olympic Sales, Q Leisure, RSL, Sam Leisure, SB Machines, Scan Coin Ireland, SGI Imports, Sound Leisure, Star Leisure, Superleague (Ireland), Suzo Happ Group, The Novelty Capsule Co, Thomas Automatics, Tobycos, Toon Tastic, Town & County Services and Whitehouse Leisure.

AmEx is organised by MD Associates, supported by IAEA - The Irish Amusement Equipment Association (Member Of Euromat) and promoted by Coin-Op News.

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Heber To Launch Firefly X10i At ATEI 2006

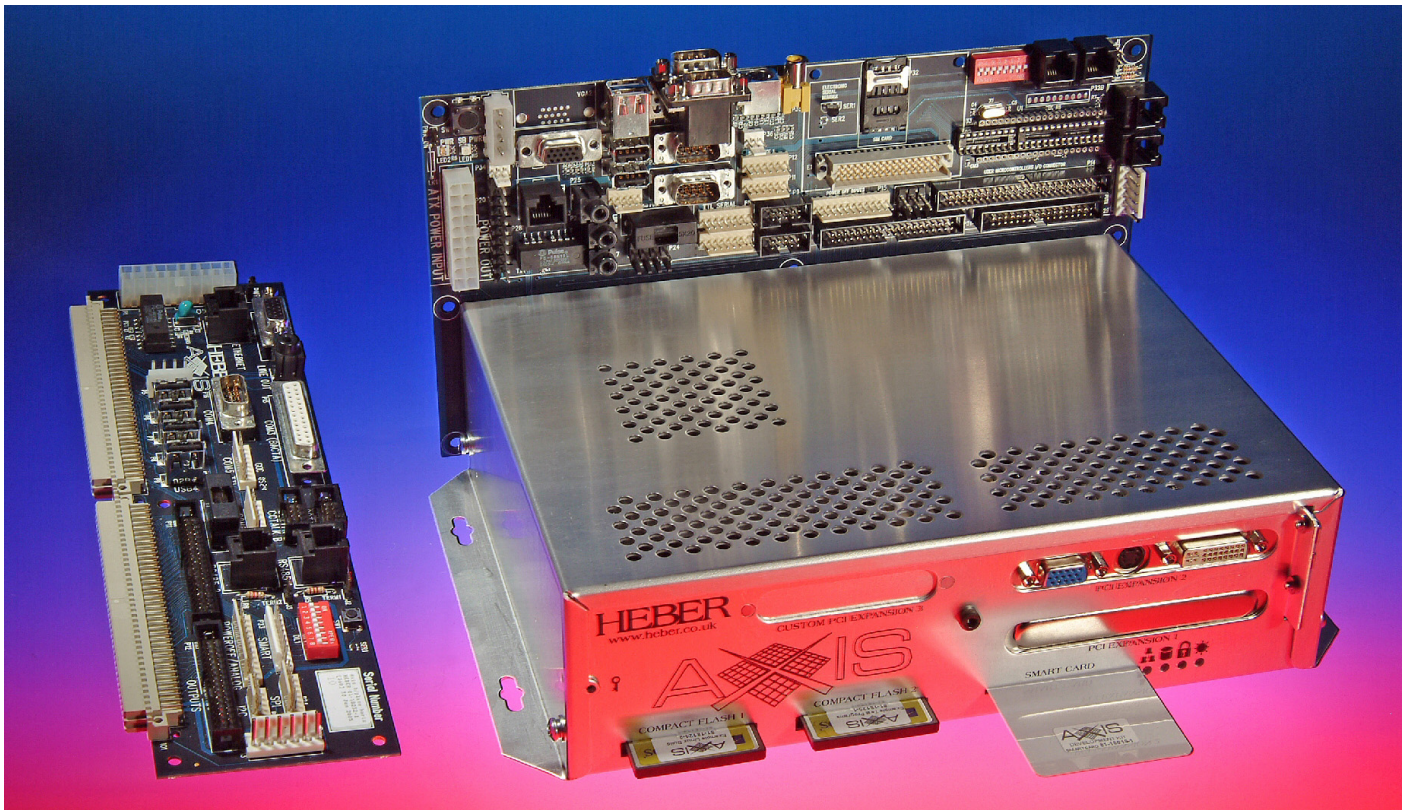
Heber Limited, designers and manufacturers of electronic control systems for the Gaming and Amusement industry will be launching Firefly X10i at ATEI in London, in January 2006. Heber will also be exhibiting its Axis System, Pluto 6 Dual Video and the newly launched Pluto 6 Dual Video Development Kit at the Earls Court show.

"I am delighted to be launching Firefly X10i at ATEI" said Neil Webster – Marketing Manager. "ATEI is the largest gaming and amusement show in the world and is ideally suited to showcase all of Heber's gaming systems to an international audience."

Firefly X10i is the latest version of Heber's USB I/O controller that adds gaming machine functionality, realtime monitoring, and security to any PC based gaming system, including Heber's Firefly 700 high powered multimedia gaming system. Firefly X10i has increased memory with 448KB battery-backed SRAM and 32KB EEPROM now fitted. The new controller meets the GLI-11 specification and complies fully with the 2006 European RoHS Directive. Drivers for both Microsoft® Windows® and Linux systems are available with Firefly X10i.

ATEI is an important show for Heber, and an ideal opportunity to meet existing customers and as well as forging new relationships with new customers. Heber has the same stand position as last year (Stand 430) and has a brand new stand design for the 2006 show. Heber is also launching its new look Company identity and will have a new website.

For further information about Heber Limited visit www.heber.co.uk or phone +44 (0) 1453 886000.





"On behalf of Table Mountain Casino I just wanted to express our thanks to you and your team. I couldn't have asked for anything better."

Brian Rankin - Slot Technical Manager

On-Site Slot Tech Training Customized Classes Available

Randy Fromm's Casino School is a practical, no-nonsense look at how gaming machines work and how to repair them when they don't. **No previous knowledge of electronics is required** to get the most out of the school. The Casino School is geared for those who want to learn how to fix gaming devices without having to learn complex electronic theory or purchase expensive test equipment.

Be prepared for six hours of accelerated learning each day. Class begins at 9:00 am sharp each day and continues until 4:00 pm. The Casino School provides each student with reference materials and troubleshooting guides that will be valuable aids for repairing equipment on location and in the shop.

Students learn how to work with:



THE DIGITAL MULTIMETER

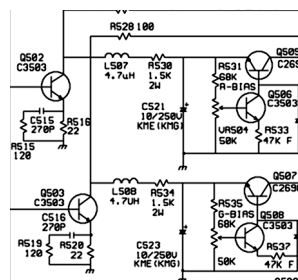
This relatively inexpensive piece of test equipment is easy to operate. Casino School students learn to use the digital multimeter to perform tests and measurements that will pinpoint the cause of a failure down to a single component.

ELECTRONIC COMPONENTS

The individual components used in games are introduced. Parts such as resistors, capacitors, diodes, potentiometers and transistors are covered individually. Students learn how the components work and how to test them using the meter.

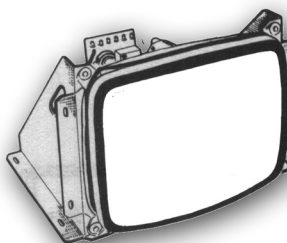
SCHEMATIC DIAGRAMS

Schematic diagrams are the "blueprints" for electronics. Learning to read schematics is easy once you know how the parts work!



POWER SUPPLIES

Power supply failure is a common complaint in many different types of systems. Power supply failures are discussed during the class, along with shortcuts for troubleshooting and repairing them.



MONITOR REPAIR

The monitors used in video slots are designed for quick, easy, and safe repair. Students will learn the theory of operation of all types of monitors and how to repair monitors down to the component level. Of course, monitor safety will also be discussed.

You do not have to send your slot techs to Las Vegas or Atlantic City for training. The Casino School brings the training to you. Contact Randy Fromm's Casino School today to reserve a date for your tech school

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Slot Tech Magazine is strictly technical. As such, the magazine's contents are not time critical. The repair information and technical data contained in past issues is just as valid today as it was the day it was published.

Additionally, current and future articles more-or-less assume that readers are already familiar with what has been covered in past issues. This editorial policy assures that Slot Tech Magazine's contributing writers are not limited to "writing down" to the level of a novice technician but are free to continue to produce the most comprehensive technical articles in the gaming industry.



Randy Fromm's

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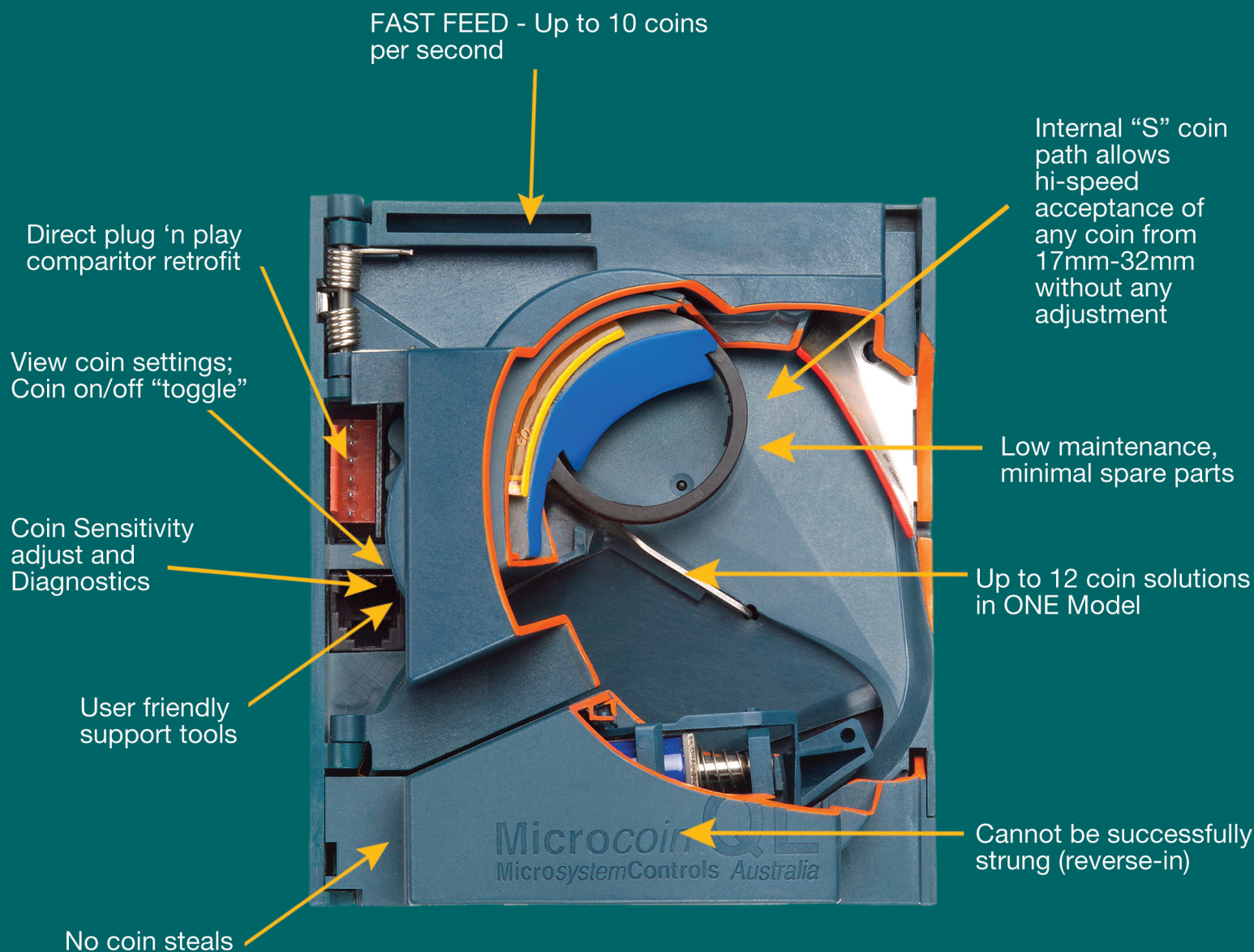
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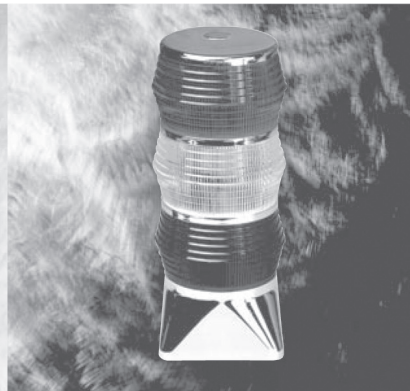
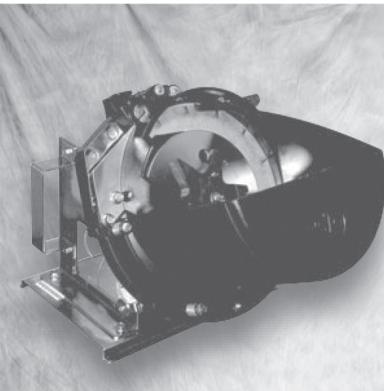


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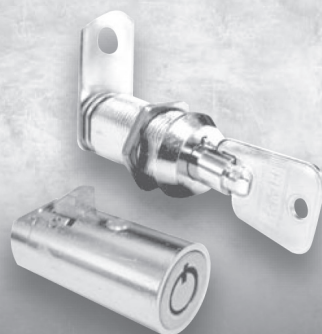
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