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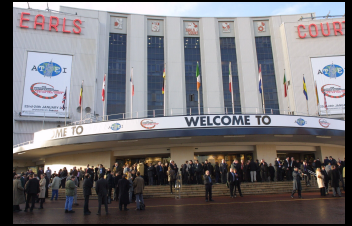
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Happy New Year

From the staff of
Slot Tech Magazine



I received a call from Soaring Eagle Casino's Joe Whitman a month or so ago. He was bragging about his property and what a great place it is and how they have a huge number of slot machines and a small army of slot techs and gee — wouldn't it be just a swell place to hold a TechFest?

Since TechFest 4 (held in Minnesota) was sold-out and some people from America's Great North were unable to

attend, I was (and am) convinced that it is a good idea to hold another shindig in this part of the world.

TechFest 6 has now been officially scheduled for March 4-6, 2003 at the Soaring Eagle Casino in Mt. Pleasant, Michigan. For an enrollment form, please visit the website at slot-techs.com. Of course, TechFest 5 is still on for San Diego in February, 2003. See page 35 of this issue for more details and a schedule of events.

This issue marks the final installment of Gordon Lowe's "Plumber's Guide to Fruit Machines." Thanks to Gordon for a job well done.

That having been said, Slot Tech Magazine is now on the prowl for another European technical correspondent. If you have any experience in this regard, please contact me. Writer's guidelines are posted at the slot-techs.com website.

I would like to devote the remaining few paragraphs left to me to rant a little bit about the nasty cover story in the December 16th issue of Time Magazine about Indian Gaming. This is a one-sided, sensationalistic piece of shit that is typical of the type of "news"



we're getting from the corporate giant of mediocrity, AOL.

As reported in OnlineCasinoNews, Ernest L. Stevens, Jr., Chairman of the National Indian Gaming Association, has written in an open letter to Time that he was disgusted with the article's exploitation of language in certain ways in an effort to influence readers' opinions against tribal casino gambling.

Stevens also charges that, "Your reporters use isolated circumstances to write what amounts to a gossip column. Your story is based on the false and offensive premise that 'Washington' created Indian gaming as a 'cheap way to wean tribes from government handouts.'

I couldn't agree more, Mr. Stevens.

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

A handwritten signature of Randy Fromm in black ink.

Randy Fromm - Publisher



Randy Fromm's Slot Tech Magazine

Editor

Randy Fromm

Technical Writers

Ken Locke
Gordon Lowe
Kevin Noble
Herschel W. Peeler

Advertising Manager

Dennis Sable

Slot Tech Magazine is published monthly by Slot Tech Magazine
1944 Falmouth Dr.
El Cajon, CA 92020-2827
tel.619.593.6131
fax.619.593.6132
e-mail

editor@slot-techs.com

Visit the website at
slot-techs.com

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Sigma Select Series Reel Games

By Kevin Noble



Currently at our site we have 21 Sigma Select Reel games. They are 9 line, 3 reel, and 45 coin max bet 5-cent machines. It is very easy to work on these machines. I have heard a lot of technicians just shake when the name is just mentioned but I am here to clear the air. They currently are one of the manufacturers that we hardly ever get a call to and they are always being played. There is not a motherboard, but a SIB board for communication between the Mikohn system and the game. Until recently, we have had many auditing service reports because of the machine's soft meters and the Mikohn's meters not matching until we upgraded the SIB EPROM. Since then, our service reports have all but disappeared to about one or two a week. There are no set and clear EPROMs needed. Sigma uses a DIP switch to provide protection when the options are set.

The hopper is a Bergman
Page 4

hopper upgraded from the old contact style switch to optic sensors. Because the Ontario Lottery sites are using the IDX, the Sigmas need to have the optics built right into housing of the IDX. The denomination is set by a denomination EPROM located at IC59.

Clearing the RAM

1. Turn off the machine
2. Turn the reset key and hold
3. Depress and hold the RED diagnostic button, at the same time power machine up.
4. The message "ALL DATA W/O SETTING WILL BE CLEARED" will be displayed
5. Release the red diagnostic button and release the reset key
6. Power machine off and then back on
7. This completes the RAM clear (sometimes it takes a couple of tries)

Setting the Options

After the Ram has been cleared it is now time to set the options. First, on Dip Switch # 2, switch #6 should be off in order to disable the setting protect. Remember the option setting is determined by each site's jurisdiction.



diction. These are the current settings used at our site:

- A – Denomination – 5 cent
- B – Hopper Max Pay – 2000
- C – Credit up Limit – 4000
- E – Over in Limit – 2
- F – Attendant Pay – 1
- G – Refill/one Time – 0
- H – Installment Pay – 0
- I – Tower Signal – 1
- J – Mech Meter – 0
- L – Change Button – 0
- M – Repeat Start Bet – 1

Remember, when the options are all set to your site's desired settings, make sure that switch #6 is turned back to the "ON" position. This will ensure that the options cannot be changed.

LAST GAME RECALL

- Turn the reset key "SOFT METERS" appears
- Press bet max until "LAST GAME" appears
- Press spin button to

January, 2003

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access game records

- The reels will spin to last complete game

The following occurs:

- #1 means one game back
- Bet # means the # of coins or credits bet
- Paid # means the # of coins paid
- ATN # means the # of coin paid by attendant
- C.P# mean the # of coins paid from hopper

Games can go back to the last 16

Last Bill Meters Recall

- With main door closed
- Turn reset key and "SOFT METERS" appears
- Bet max until "LAST GAME" is displayed
- Spin to enter last game
- Press bet max until "LAST 5 BILL IN" appears
- Spin button to display denomination,
- Date and time of last bill accepted.
- Max bet to scroll forward
- Bet 1 to scroll back
- Press cash credit to exit

Setting the Game Features:

Setting up of all the game features is done through the feature select menu. Here you will find many features you can set like the type of demo music, turning it off or on, selecting the way the reels will stop (either normally, a vibration, a front or back spin stop). We can also

select the speed of the reels and the way the reels react when landing on a winning combination such as a jump, a wave, or a bounce. The real time clock, the demo wait time and the demo action are also set in the game features menu.

Error Codes and Service Indicators

When an error code is displayed, an illuminated block appears on the display. The block will change to a line when the event or error is cleared. The line will remain on the display until two games are completed. The display will also help with troubleshooting tips by displaying door opens, power up or down conditions, and the bill validator status.

Diagnostic Modes:

- Accessing the Test Modes

Like every other slot machine, they all have their diagnostic tests that allow the technician to troubleshoot a problem. Some of the tests that Sigma uses are the display, BV, reel, hopper, input & outputs, various volume alerts, and of course the all important system self tests.

Calibrating the SIB Board

Before the SIB EPROM was upgraded, we checked the Mikohn and Sigma meters every morning for any meter mismatch. We would alert the Auditing Department

that we had to calibrate the SIB board in order to get the Mikohn meters to realign and that they will be getting a variance. This was one way that we could cut down on the service reports for the technicians. We, as a department, are very happy that the service reports were cut down to almost nothing. These are the steps in calibrating the SIB board:

1. Set dip switch "C" to the on position
2. Set dial (switch #3) to #7 and press button once (dot will start blinking)
3. Turn the dial to #1 and press button once (you have now set option 7 to 1 and the dot will become solid)
4. Repeat this step for option #5, #4, and #1. (these need to set to 1 also)
5. Turn dial to #6, and press the button once.
6. Turn dial back to 0, and turn off "C"
7. Power down the game and unplug Mikohn, power them both up together.

When installing the new 4.49 SIB EPROM, there should be no need to calibrate the SIB board.

Starting Up / New Improvements

There is an adjustment period for technicians when new manufacturers arrive with their new machines. There is definitely a learning process. With that in mind,

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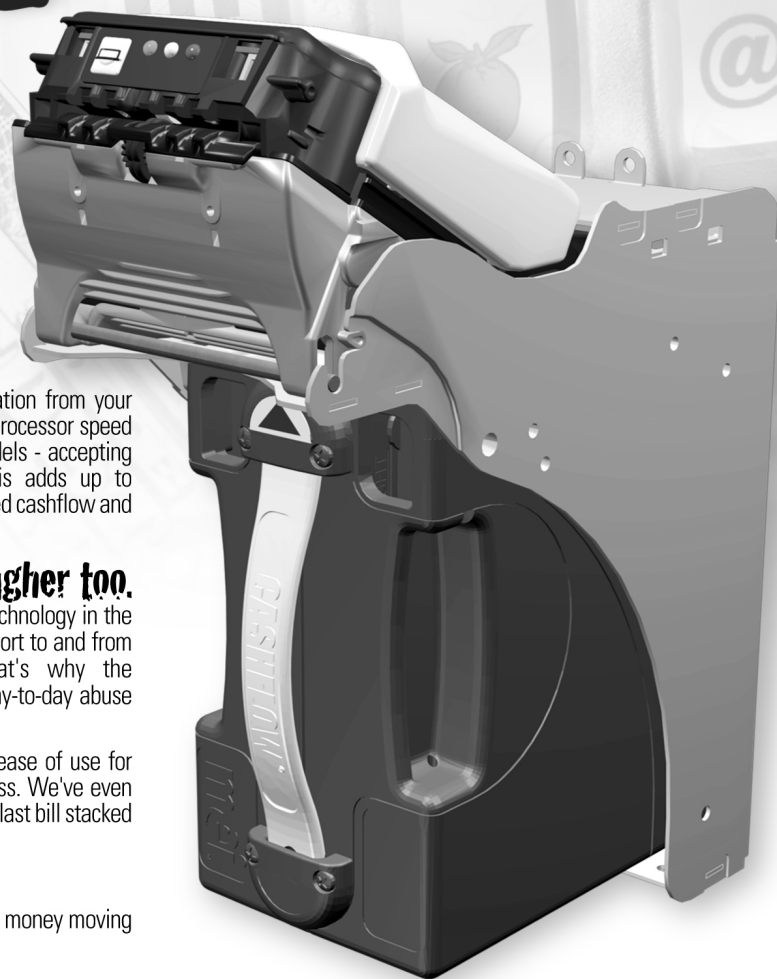
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there are also small adjustments that are needed before the machine goes live to the public. Here are a few things that were found out or passed along to me:

Problem: When opening and closing the IDX door with a paper clip (with door closed), the machine would go into a tilt. After resetting the game, the machine would give one credit.

Solution: On dip switch #1, switch #1 was set "off" (mechanical acceptor). It should have been set "on" (electronic coin acceptor).

- Machine kept freezing up, needed RAM clear to clear. Adjusted TTL voltage to 5.22 volts. The power supply has been upgraded from 80 Watts to 200 Watts. Now there are no pots to adjust,

and the power supply is much more stable.

- SIB boards need to be upgraded to 4.49 to stop soft meter mismatch with Mikohn. With the new upgrade, there is no need to calibrate the SIB.
- All door cams needed to be filed for easy removal of keys.
- The coin diverter linkage needs to be bent out slightly for smoother operation.
- Inconsistent spacers on CPU and CPU shelf. The short spacers need to be removed and replaced with larger ones.

Overview

Each manufacturer has their own way of operating their software. Here are a couple of things that I would like to pass along to you: The BV will not

accept any bills if the credits are over 100. Ninety-nine credits or lower will allow the BV to except any denomination up to \$100.00. The tower light after a tilt condition will stay on for one game. If the door is opened and closed, the tower light will not stay on if a tilt has not occurred. The spin reel button allows the start button to repeat the last wager of coins or credits bet. With option "E" (over up limit) set to 2, this allows for the patron to insert up to 47 coins into the acceptor even though the max bet is 45. The SIB EPROM was just recently upgraded to the 2.49 thus stopping the Mikohn and Sigma soft meters mismatch. The Mikohn coin out and Sigma coin out still do not align. The WBA transport is not the generic type that the other manufactures use. The connection to where the transport plugs in is entirely different.

- Kevin Noble
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A-17951-01 Williams Meter Board Test Fixture

Slot Tech Feature Article

By Herschel Peeler



Williams games, like most others, is sensitive to malfunctions in the area of Hard Meters. Of all the circuits that may fail, this is not the one they want failures to go unnoticed. As such, most games are quick to spot a malfunction in the meter circuit. The good question is, "How do they know when a meter malfunctioned?"

The following schematic is an example of the Williams Meter Assembly. Needless to say, there isn't much to it (but lessons). U1 is a simple crea-

ture. It accepts a 3-bit code (S0, S1, and S2 lines) that represent a binary number (0 to 7). That code selects one of eight outputs of the TPIC6259 that will be selected. Of these eight, only six are normally used, but we could have up to eight. When the Enable input of the TPIC6259 goes low (-G for Gate Enable, active low), the selected output goes low, pulling the low end of one of the meters to ground.

The other end of the meter is tied to +12 Volts through a 10 ohm resistor. The meters only

require 6 Volts to operate and the resistor drops the voltage. The point where the meters come together at R14 should be +6 Volts when a meter is being activated.

U2 is a voltage detector circuit that monitors the voltage at this point we mentioned, and compares it to two reference voltages. R11, R12, and

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R13 make a voltage divider between +12 Volts and ground. The voltage where R12 and R13 meet should be 2.75 Volts. The voltage where R11 and R12 meet should be 7.1 Volts. U2, a LM339, is a quad Voltage Comparator (two of them are not used). U2 (pins 2,4,5) compare the voltage at the top of the meters to the 7.1 volt reference.

<A lesson on Voltage Comparators. We have two inputs: the Inverting side (-) and the Non-Inverting side (+). If the (-) side is at a lower voltage than the (+) side the output will be high. If (+) is lower than (-) the output will be low. Since the LM339 is an open collector output, the output will be either low, or allowed to float (in this case up to +5 V).>

If the top connection to the meters is above 7.1 Volts, the output pin 2 will go high, indicating that the meter may be open.

If the top connection of the meter is below 2.75 Volts, the output pin 1 will go low indicating that the meter may be shorted.

These two outputs are only meaningful while a counter is being energized.

Normal Operation

The game selects a meter, and activates it. The software then waits a few milliseconds for the mechanism to work, then looks at these two output lines from the Voltage

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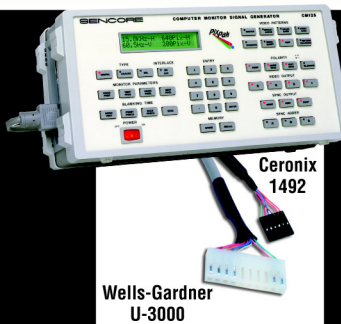
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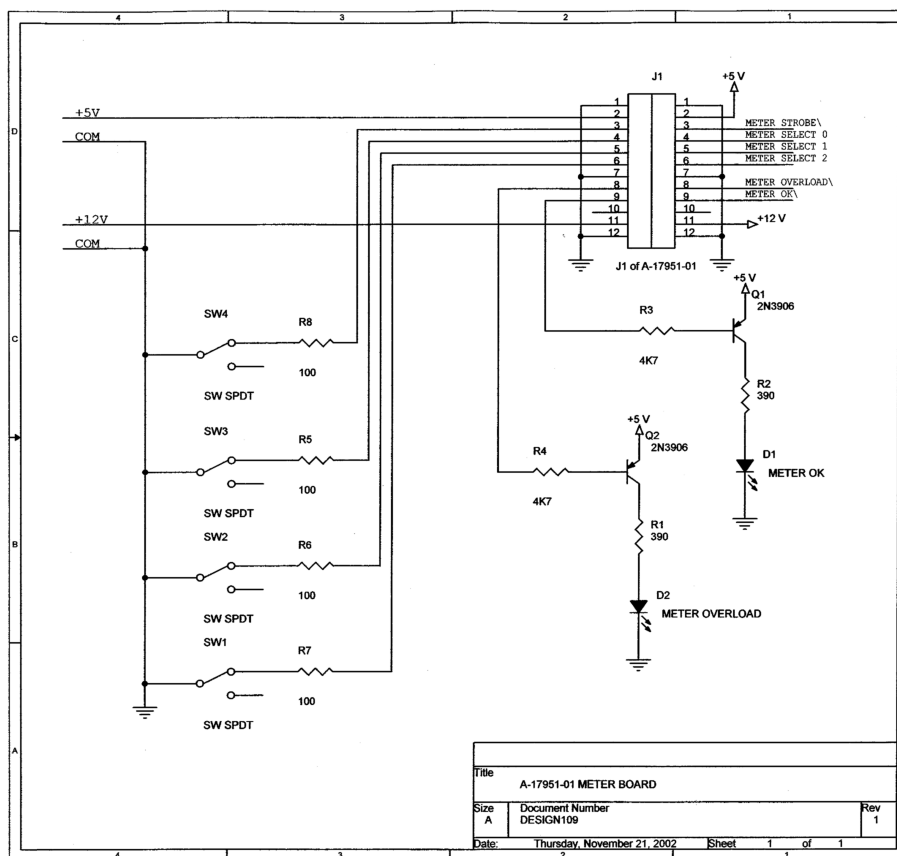
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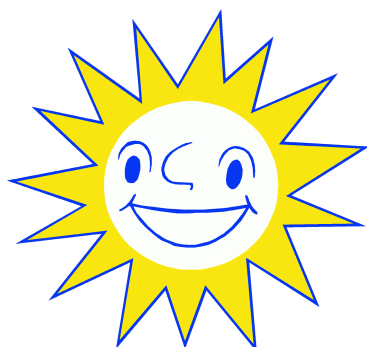
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Comparators. It then releases the meter, allowing it to complete one count (If you have ever watched one of these meters, when you apply a voltage, they click to half a count. When you release the voltage, they complete one count.).

This test fixture allows us to do manually what the game's microprocessor does under software control. We can manually select the meter we want to increment. Pull Meter Strobe low. See what the Meter Overload and Meter Okay lines are doing. Complete the count by releasing Meter Strobe, and seeing that it counts properly.



- Herschel Peeler
hpeeler@slot-techs.com



Atronic's products recently were recognized among the most innovative in the industry. e-motion®, Sphinx Magic® and Atlantica™ were all named in the Top 20 Most Innovative New Gaming Product Awards. The Top 20 Most Innovative New Gaming Products Awards are recognized as the most prestigious honor bestowed on gaming products or services. The winning product will be announced at the American Gaming Summit in Las Vegas in January, sponsored by Casino Journal.

"Atronic has been producing pioneering products since its inception, which have been consistently acknowledged in the awards. How-

Atronic Prominent In Top 20 Most Innovative New Gaming Product Awards

Placing Nominations in Three Separate Categories

ever, this is the first year that so many of our products were recognized at once among the most innovative in the industry. We are excited to build on this success while we continue to inspire the industry," said Michael Gauselmann, owner of Atronic and the Gauselmann Group.

All of the Atronic products named were shown at the G2E trade show in September, where they attracted crowds eager to see the products that will transform the industry. e-motion®, which was the talk of this year's G2E show in Las Vegas, is Atronic's revolutionary new cabinet, highlighted by the industry's most ergonomic design, innovative and beautiful frame lights and its advanced hi(!)bility® platform. e-motion® is the first ever height-adjustable slot machine for greater playing comfort, also featuring stunning frame-lights.

Sphinx Magic® is a multi-level progressive game featuring a stunning tower box, interactive "win one/two way" payloading and Atronic's own "magic card" bonus. Atronic invented the "magic cards" distinguishing Sphinx Magic®, which provide a unique and exceptional bonus event for more excitement on the casino floor. Atlantica (tm) is Atronic's video slot machine with a pioneering level of interactivity for greater playing enjoyment. In the Mermaid's Bonus, the Mermaid character actually responds to players by giving them hints to help them achieve bigger wins.

For more information, contact:

Atronic
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Award Winning Excellence - ATRONIC Achievement during SAGSE 2002

Taking place at the Costa Salguero Exhibition Centre, Buenos Aires, from November 20th to November 22nd Atronic International took the lead in supporting their customers during a difficult period of time for Argentina. Despite the drop in attendance from competitors, Atronic successfully displayed a wide range of the latest Cashline games as well as some refurbished machines at this year's SAGSE. Atronic's attendance at the show was very much appreciated by our loyal customers and resulted in a significant number of sales leads.

One of the main attractions was inevitably ATLANTICA, one of Atronic's latest Cashline games. Its enchanting underwater world theme inspired visitors to take a journey to a land of lost riches, beautiful mermaids, and magical creatures. Visitors were also able to take delight in the hilarious fun of the circus in CLOWNING AROUND! In the Clown Competition Bonus players compete against the slot machine to build the tallest character allowing magic points to add to the excitement. Standing alongside was a further selection of new and creatively themed Cashline games including, I.C. CASH, BEACH PATROL and WAVE WATCHER, plus the successful themes of BABOOSHKA and SPHINX II, in a variety of configurations and cabinets, partly displayed with Atronic's colorful candle toppers. The Atronic booth with its inviting bar area was an attractive meeting point for visitors and all major operators of the region.

Congratulations, commendation and praise was also given to the Atronic International Marketing team, which won the "2002 As de Oro", awarded by the industry magazine Casino de Latinoamerica. For the first time since 1999 the magazine Casino de Latinoamerica awarded its "As

de Oro" to those companies of the Casino sector that have stood out for their progress in Latin America. Atronic International proudly accepted the "2002 As de Oro" for the "Best Marketing Job of a Non Latin American Company." And, to our knowledge, Atronic was the only slot machine manufacturer awarded with this prize. Once again, it displays Atronic's winning formula, Great Games - Great People!

To find out more information about Atronic, please visit the website at www.atronic.com.



The Paparazzi went wild as the Atronic International Marketing team won the "2002 As de Oro", awarded by the industry magazine Casino de Latinoamerica.

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Money Controls Expands Gaming Range for ICE 2003



Money Controls reveals the latest advancements to their gaming range of products at the ICE Exhibition, London's Earl Court, 21-23 January 2003.

For an entire selection of gaming products and the latest industry developments, from coin acceptance and coin payout to bill acceptance and ticket payout, check out the Money Controls stand, number 5630.

New for ICE is the most up-to-date version of the Paycheck thermal printer, which is Plug & Play into industry standard ticket-in/ticket-out applications. Offering exceptional performance and printer reliability, the high speed, secure quality graphic printing and top quality bar code reliability are ideal for a range of coinless gaming applications. PayCheck is future proof with the inclusion of a USB port built into the mechanism, and is available with Check After Print™ verification to enhance security.

Also being launched at ICE is the new Ardac WACS, now with barcode reader for ticket-in, ticket-out applications. A world-proven, self-contained bill acceptor, with a high acceptance of street notes, the Ardac WACS offers high speed and high security, fraud resistance and accepts 95% of the world's currencies including multiple country applications. The Ardac WACS system can determine bill authenticity and denomination with a unique optical scan feature and offers multiple protocols including Ardac and JCM. Ardac Smart incorporates a cassette with optional smart chip, which allows the cassette to link into Ardac Smart, Money Controls intelligent cassette system. This delivers improvements in accountability and tracking procedures, reducing both counting and security costs. The cassette is available in metal, or lightweight, highly durable plastic.

New developments for the Condor Plus include the addition of a toolkit – a programming pod that allows the user to securely change the nominated coin set. This is ideal for customers who only want one coin live at any one time for maximum security but also want the flexibility of having a highly secure and flexible method of coin selection – thereby en-

abling the acceptor to meet all the coin set requirements on a casino floor. High security allied to high speed and now additional flexibility makes the Condor Plus the ideal gaming acceptor. The Condor Plus handles up to 10 coins per second and has programming flexibility for a range of configurations. It accepts over 95% of the world's coin sets and has wide international Gaming Board approvals.

Money Controls offers a complete range of Gaming hoppers, from the Gamesman Side Exit and Gamesman Paytrack with coin escalator for very high coin capacity requirements, to the Universal and Cyclone for large capacity needs where space is restricted – making them suitable for most applications including multi-pay machines.



Money Controls Provides Star Quality Products

STARGAMES Corporation Limited is the latest blue chip company to use products from Money Controls, manufacturer of components for secure money systems.

Famed for the design, manufacture and marketing of PC3 video games and gaming machines, Stargames is one of just three Australian gaming equipment and technology companies listed on the Australian Stock Exchange.

Money Controls has been signed up to provide its Universal Hoppers and Condor Plus for Stargames' PC3 gaming machine platform. As a distributor of Starpoint products in Asia Pacific, Money Controls will also be supplying Stargames with Starpoint buttons.

The Universal Hopper is a large capacity coin payout unit, which offers high security and long life. A single denomination unit, it is designed to handle over 95% of the world's coin sets. Suitable for a wide range of applications, the product is robust and low maintenance, and its anti-jam, field-proven reliability is second to none, making it the industry standard.

With over 100,000 Condors in operation throughout Australia, New Zealand and Asia, Condor Plus provides gaming machine manufacturers with proven technology, advanced discrimination techniques

and high-speed acceptance of coins and tokens.

Stargames markets its products worldwide and is therefore a major client in Money Controls' portfolio.

Commenting on the Stargames business, Bill Murphy, Sales Director for Money Controls Asia Pacific office, said: "Stargames' PC3 platform is "state of the art" technology and they have chosen Condor Plus and Universal Hopper to enhance this standard. A particular attraction of Universal Hopper is its proven reliability, high capacity and above all, unlike most hoppers, Universal Hopper is universal.

Robert Sullivan, Director of Sales and Marketing for Stargames, commented: "We needed to fit components which equally enhance the performance and reliability of the Stargames PC platform. After evaluating a number of suppliers' products we chose to incorporate Money Controls' Condor Plus and Universal Hopper."



Left: Bill Murphy, Sales Director for Money Controls Asia Pacific office, with Robert Sullivan, Director of Sales and Marketing at Stargames.

For additional information, visit the website at www.moneycontrols.com



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- Component Parts for all Kortek/Telco models • New, Refurbished and Older Boards, CRTs and Sensors

New Gaming CRT Touchmonitors from Elo TouchSystems

Elo TouchSystems, Inc. has launched new additions to its family of open-frame CRT gaming monitors. These include 17" and 19" true flat CRT monitors. The CRT gaming touchmonitors are available with the company's breakthrough iTouch "touch-on-tube" surface-wave touch technology and feature a unique injection-moulded minibezel with watertight seal. Elo's complete gaming monitor line will be shown in booth 1830 at ATEI, London, from January 21 to 23.

True Flat CRT Monitors Feature iTouch Touch-On-Tube Technology

Elo's new Entuitive 1788C and 1988C 17" and 19" CRT gaming monitors provide a true flat surface—unlike Full Square Tube (FST) monitors, which are still slightly curved—that simplifies installation of the monitor into cabinets using a flat front. Elo's true flat monitors provide the same flat screen image as an LCD monitor, but at the lower cost-point of a CRT monitor. The true flat monitors take particular advantage of Elo's iTouch 'touch-on-tube' technology, which provides a significantly enhanced on-screen image, graphics, colour quality, brightness and clarity by eliminating the traditional glass touchscreen overlay and placing the touch sensors on the CRT faceplate itself. Monitors equipped with iTouch look exactly like non-touch monitors, and when compared to those with an overlay, can yield up to 20 percent greater brightness

and up to 80 percent less reflection. For customers using a true flat CRT, iTouch is a superior solution to an overlay because these tubes add parallax in the corners because of the thicker faceplate glass, which is then exaggerated by the overlay and its associated air gap. By using iTouch it minimizes this parallax.

Computer-Grade Video Quality

The new true flat monitors, along with the 15", 17", and 19" FST versions, all feature common mechanical construction and electronics design. The computer-grade digital design delivers video quality up to 1024x758 @ 85 Hz with a 0.25 dot pitch. The main board is small (20 x 25cm), and built from rugged epoxy composite PCB material (CAM-1). The entire electronics can be field replaced in a matter of minutes.

Integrated Minibezel and Watertight Seal

"We now have a large family of gaming monitors with small footprints, consistent electronics, mechanical construction and features across all sizes," says Mike Sigona, Elo's worldwide gaming market manager. "All of the CRTs offer multilingual remote On Screen Display (OSD) and



worldwide agency approvals and power. And all of Elo's gaming monitors feature our unique integrated minibezel." The minibezel forms a watertight faceplate seal to keep spilled drinks away from the electronics and stays in place even when the game cover is open. The seal is less than 1mm thick—thinner than a coin—and is virtually invisible to players.

Quality and Reliability at a Cost-Effective Price Point

"The extended family of gaming monitors not only retains Elo's proven quality and reliability," says Sigona, "but manages to do so at an extremely cost-effective and competitive price point. We've worked hard at Elo and found a way to deliver quality and economy in the same bundle. I believe that our customers will be very pleased with our new gaming monitors."

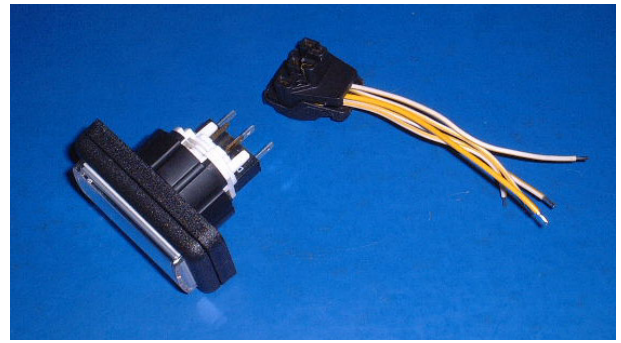
For further information call 800.elo.touch (US) or +32 16 35-2100 in Europe or visit the website at www.elogaming.com

New StarPoint Push Button Connector is Fast and Foolproof

Starpoint has developed a new "fast-fix" connector (in conjunction with AGI) for its Series 2 range of push buttons. All four spade terminals are housed in a single moulded connector head which makes fitting of the push button a one-fix operation. As the number of connections is 75% less than for a traditional push button, the assembly times for the machine can be reduced significantly. In addition, as there is only one way of making the connection, the assembly will be "right first time" without the risk of rework in the factory or inaccurate refitting when the machine is in situ.

This brings the number of push button build options offered by Starpoint to three: traditional spade connector, Starpoint's AT Connector or the new One Piece Connector.

The traditional design requires connection of four separate spade terminals. Alternatively customers can choose the AT Connector which has a single Insulation Displacement Connector (IDC) which offers a one fix operation. The new One Piece Connector offers customers the same speed and efficiency of the AT Connector while still retaining proven spade terminal technology. As the front bezel dimensions of the Series 2 push button remain exactly the same, the One Piece Connector can be used for both new builds and for retrofitting within existing cabinets (subject to the appropriate loom design and switch/lampholder assembly).

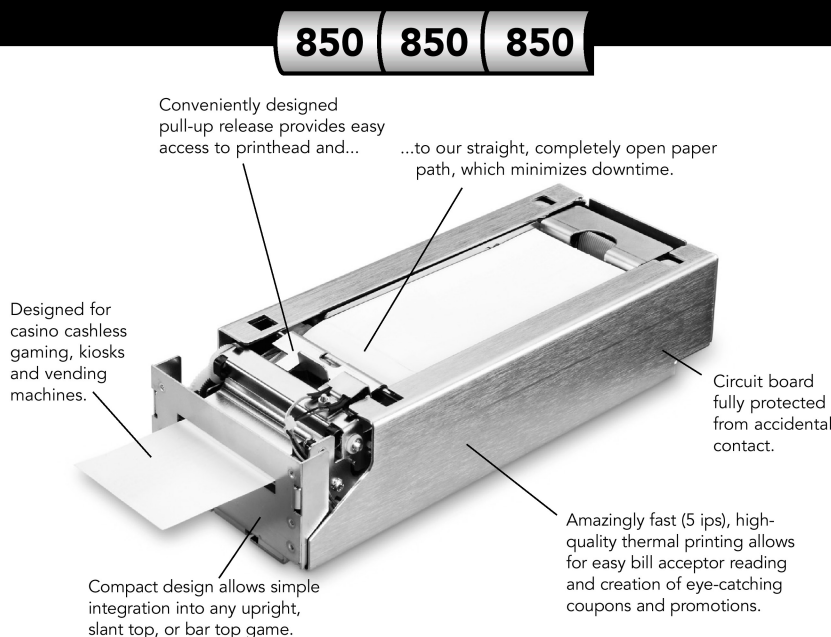


The new One Piece Connector from Starpoint

"Speed of assembly continues to be an important criteria for manufacturers of amusement and gaming machines" said Starpoint's Customer Sales & Development Director. "The new One Piece Connector complements our AT build option, providing specifiers with a choice of two "fast-fix" technologies to suit individual preference."

More information from Colin Crossman at Starpoint: Tel: (44) 208 391 7700 Fax: (44) 208 391 7760 Email: ccrossman@starpoint.uk.com

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Quality and Quantity Underpin ICE 2003

Casino buyers planning their visit to January's ICE show in London will be party to the most comprehensive gathering of suppliers and manufacturers ever seen at an industry event.

ICE 2003 was officially sold out at the beginning of December, two months before the doors open at Earls Court, with organisers opening up a waiting list for the first time in the show's history.

Whilst ICE 2003 is already the biggest on record, with 150 companies occupying 7,300 square metres (78,548 sq.ft.) of booth space, January's showcase will also involve exhibitors from 27 nations covering a complete range of product sectors from slots to security, i-gaming to live gaming and components to consultancy services.

ICE sales manager, Karen Cooke, who was involved with the show for 14 years as an exhibitor before joining the organising team, believes that the blend and calibre of exhibiting companies confirmed for 2003 is as noteworthy as the size of the exhibition. She explained, "Although it's natural to focus on the numbers - and the numbers for 2003 are more impressive than at any other time in the show's history - the spread of exhibitors is astonishing." Cooke continued, "The simple

fact is that the London show provides the most comprehensive overview of the industry. Buyers travel to London secure in the knowledge that the product offering is both complete and contemporary."

The ICE show's popularity with buyers is backed up by the level of pre-registrations, which are five per cent up on the same stage for ICE 2002.

ICE 2003 Sector Overview

Slots/Machines Reel and video slots, together with multi-player machines and electronic betting games constitute the most represented sector at ICE 2003, both in terms of the number of suppliers (36) exhibiting their products and the total amount of dedicated floor space.

Live Gaming With 25 of the world's most renowned names in roulette, table games, dice, cards, chips and other accessories, live gaming accounts for the second largest sector at ICE.

I-Gaming There will be no fewer than 33 specialist suppliers of software and services for internet and interactive gaming at the London show, 31 of them exhibiting within the themed 'i-Gaming Zone'.

Software Game development, player tracking, accounting and full casino management systems are just some of the software packages on offer from 14 specialists in this field.

Payment Systems Offering the latest in validators, hoppers, counters, sorters and mechanisms for coin, note, token, chip, card and other cashless systems, ICE 2003 will feature at least 19 money handling and processing manufacturers and distributors.

Security 11 companies will exhibit their security solutions, from locks, bars and other manual devices to CCTV and advanced surveillance systems.

Spares & Components Whether it's a new design concept for manufacturers to incorporate in their original builds or replacement parts to help maintain smooth operations, visitors to ICE should find what they're looking for amongst 16 suppliers of spares and components.

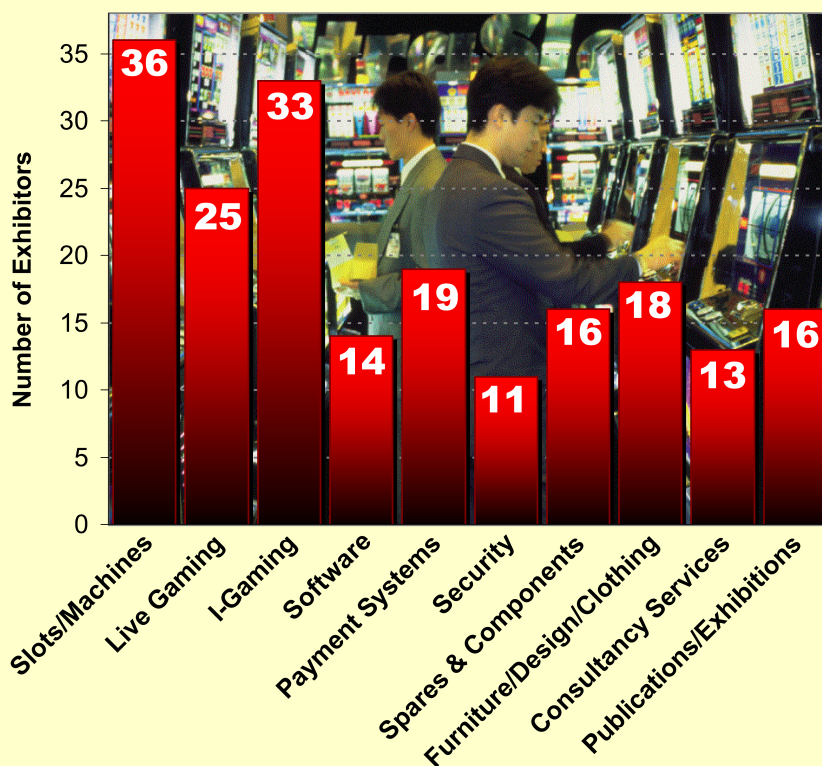
Furniture/Design/Clothing A broad base of ancillary products, ranging from functional to stylish and luxurious, can be found amongst 18 exhibiting companies in this sector. Signage, seating and staff uniforms are just some of the image enhancing accessories in this sector.

Consultancy Services From legal, financial and educational advice to recruitment services and hardware/software systems testing, there are 13 booths at ICE 2003 offering expert consultancy.

Publications/Exhibitions Reflecting the vigour and vibrancy of the gaming industry, a total of 16 international publications and exhibitions will be at ICE.

International Casino Exhibition
Earls Court, London, UK
21, 22 & 23 January 2003
Further info & ticket registration:
www.ateonline.co.uk/ice

ICE 2003 Exhibitor Products & Services



AG&E Sales Locations:

CALIFORNIA

Phone: 800-352-3837
 Fax: 760-251-2714

FLORIDA

2046 McKinley Street
 Hollywood, FL 33020
 Phone: 954-922-9952
 Fax: 954-922-1855

ILLINOIS

9500 W. 55th Street, Suite A
 McCook, IL 60525
 Corporate Phone: 708-290-2100
 Corporate Fax: 708-290-2200
 Sales Phone: 888-438-6299
 Sales Fax: 815-248-4395

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 Las Vegas, NV 89120
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 Fax: 702-798-5762
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List of Exhibitors

See centerfold for floor map

Company	Stand
A.V.I. Import & Export U.K.Ltd.	5807
Abbiati Casino Equipment s.n.c	6010
ACG	5361
Adaptive Micro Systems Europe	5556
Ainsworth Game Technology Ltd	5040
Alfastreet-Pockaj Pohistvo d.o.o.	5460
Amatic Industries GmbH	6130
Andromica Video Systems	5868
Ariella Fashions Ltd	5958
Aristocrat Technologies Europe	5740
Asahi Seiko (Europe) Ltd	5509
ATE Online	5573
Atronic International GmbH	5140
Bally Gaming and Systems	5640
Belgian Gaming Technology	5315
Bell Med Ltd	5171
Bellatrix Gaming Technology Oy Ab	5910
Berwin Leighton Painsner	5180
Bingo Entertainment Ltd	5381
Bingo Technology Manufacturing	5850
Boss Media AB	5070
Bourgogne Et Grasset	5220
Cammegh Ltd	6031
Carat Technology d.o.o	6071
CARD	5350
Caro Developpement	5300
Carta Mundi NV	6030
CashCode Company Inc	5260
Casino City Press	5553
Casino International	5458
Casino Reality	5179
Casino Supplies GmbH	6015
Casino Technology	5060
Casino World	5619
Casinos de Latinoamerica	5806
CEW International S.L.	5049
Chartwell Technology Inc.	5279
Cirsa Interactive	5280
Coincastle Leisure Corporation (CLC) Bvb	5874
Coinmaster Gaming Plc	5940
Creative Edge	5981
Cyberview Technology Ltd	5978
Dallmeier Electronic UK Ltd	5360
De La Rue Cash Systems	5130
Densitron Technologies Plc	6180
DEQ Casinos Ltd	6000
Dot com Entertainment Group	5378
Dyna Co. Ltd	5560
Ealex	5508
EGaming Review / Pageant Media	5571

Company	Stand
Elaut N.V	5340
Eleven Products	5621
Empire Casino Recruitment & Consultancy	5864
EndX	5161
Eurobaz International Ltd	5299
Eurocoin Ltd	5950
EUROMAT d.o.o.	5710
Evona Electronic	5971
Fast Video Security (UK) Ltd	5979
First Multimedia Group	6039
Fournier Playing Cards	5330
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Franco Gaming Ltd	6079
Gamer Entertainment Products	5901
Games Magazine	5272
Gaming & Entertainment Technology	5478
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Gasser Chair Company, Inc	5338
GEFIM Sas	5871
Giesecke & Devrient GB Ltd	5549
GLI - Europe B V	5900
Global Cash Access	5611
Global Gaming Business	6181
Global Gaming Expo	5557
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Gold Club D.O.O.	6230
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I Global Media.com Ltd	5479
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IGC (Interactive Gaming Council)	5507
IGGBA	5572
IGT Europe b.v.	5920
IGW Software	5182
Industrial Powersports	5379
Industrias Lorenzo S.A	5867
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Interblock D.O.O	5080
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John Marks	5401
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Kema Quality	5959
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Konami Australia Pty Ltd	6240
Laverock von Schoultz	5271

Company	Stand
Leo A. Daly	5289
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Livebet Online	5564
Martin Williams Casino Equipment	6040
Matsui Gaming Machine Co. Ltd.	5980
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Novomatic - Austrian Gaming Industries	6160
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Optical Mark Systems	5569
Orion Gaming BV	5430
Osborne Coinage Company / IDX Inc	5550
P&P Projects BV	5808
Patir-Design & Production	5559
Payweb Ltd	5480
Perconta F Zimmermann GmbH & Co	5320
PIMS SCA	5169
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Prestige Seating Technology (UK) Ltd	5402
QUEEN-MARRY.COM	5270
Recreativos Franco S.A.	5420
River City Group, The	5567
Salans	5568
Sega Gaming Technology (Europe) Ltd	5440
Sensormatic AG	5809
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Silverstar	5290
Simon O'Neill Design and Promotions	5876
SMI - Software & Messtechnik Institut	5862
Spintek Ltd	5863
Structured Data Systems Pty Ltd	5879
T Dal Negro SpA	5200
Tain	5278
TCS Group	5510
Tech Art	5552
Technology House Ltd	5575
Unidesa Gaming	5810
Unique Camera Systems	5558
Universal Distributing of Nevada Inc	5960
University of Nevada Reno	5869
Veka Systems bv	5618
WMS Gaming	6140



International View

By Martin Dempsey

JPM At ATEI

This year JPM will be showing some well established favourites alongside some of the best products to be presented to the market for 2003. As well as a new Low Tech Cabinet, a visit to the JPM stand will also let you see the latest and most exciting multi player game yet to be released. With titles such as Easy Money, Fruit Machine, Space Invaders Crystal, Twister and Rameses Riches, JPM have always delivered quality and popular products to the AWP, SWP and Club Markets. However now is not the time to rest on the laurels of their successes and this year sees the introduction of no less than 6 new products for Low Tech, Hit Tech and Club machines.

For further information email:
mail@gamingco.fsbusiness.co.uk

"Royal Roulette" Maintains Momentum For Impulse Gaming

Following hot on the heels of their recent UK AWP successes - Wildfire and Pick Yer Pesos - the rich vein of form being enjoyed by Impulse Gaming is continuing with their latest release, Royal Roulette. The game has en-

joyed exceptional site test performance over recent weeks, and its strong (and topical) theme clearly appeals to machine players.

The casino-style roulette wheel that dominates the top glass artwork is spun each time the player wins a hi/lo gamble on a deck of playing cards.

"With strong orders already taken, I have every reason to believe that Royal Roulette will be another memorable success for Impulse Gaming." For further information, please contact Nick Hardy, Maygay Group Marketing Manager. Tel: +44 1902 792 320. E-mail: mailto:nick@maygay.com



EGO To Develop New Charter For The Future

During a recent very successful and well attended meeting at the Schipol Hilton Hotel in Amsterdam, the European Gaming Organisation was given a clear mandate to develop a new charter. Unfortunately due to illness Secretary General Chris Brammer was not able to attend and the Chair was taken by Keith Fagan. Prior to the meeting a questionnaire was sent to members and non-members to ask whether there was a need for a Pan-European association for the Casino Gaming industry and the result was a resounding yes.

However EGO's traditional role is one associated with the manufacturers only and also mainly to restrict the numbers of trade shows. The next step is an initial meeting of an Operators Group Steering Committee scheduled to take place just prior to ICE in January. For further details of EGO and either meeting please email: marketing@ego.nl

Happ Controls Europe At ATEI

Happ Controls Europe will be displaying a range of replacement parts for all makes of AWP, video, redemption and other amusement machines at ATEI 2003. Products range from replacement electronic coin mechanisms to pool cues and cloths. Smaller items such as lamps, switches and circuit boards to suit a wide range of applications are also available. Happ have a deliberate policy of quality and value for money with all products going through a demanding series of quality control tests before being included in parts lists. To obtain a copy of the latest catalogue and to view some of the products available visits Happ Controls Europe at ATEI 2003. For further information Tel: + 44 (0)1843 871100. Fax: + 44 (0)1843 871122. E-mail europe@happcontrols.com

JPM & SEGA Japan Announce Joint Venture

JPM International announced recently that, in co-operation with SEGA of Japan they will develop a new Video AWP game for release at ATEI 2004. Sales and Marketing Director Heath Samples said "SEGA have made R&D facilities and staff available in Japan to enable to produce a market leading product. With the market experience of JPM and the design and graphics expertise of SEGA we fully expect this

new product to take Video AWP to a new level." "This joint venture is a sound vote of confidence in JPM by SEGA and a clear sign of the intention to make JPM the leading supplier of AWP products in the UK and Europe" said Dave Barron, CEO of SEGA Europe and JPM International. For further details on JPM products contact Heath Samples / Simon Barff on + 44 (0)121 717 7111 or email mail@gamingco.fsbusiness.co.uk

Rising Star!

Claire Carpenter is celebrating her promotion to the position of Project Administrator for Red Gaming. Since joining Red in April this year, she has proved herself to be an invaluable asset to the team. Prior to joining Red Gaming, Claire worked as Holiday Representative for JMC where she rose to the challenge of this varied role and was rewarded for her efforts by achieving Customer Service Representative of the Year! At Red, Claire is now responsible for co-ordinating the timing of artwork, software and builds of machines along with new product specifications. Red's primary machines are all subject to her 'eagle eye' to ensure that they are of the highest standard. For further information please contact Sam Drakeford / Clare McMillan@ MediaWorks. Tel: + 44 (0)113 234 5600. Fax: + 44 (0)113 234 5601. Email: samdrakeford@mediaworkscl.com

Workin' At The Car Wash!

Vivid Gaming is delighted to announce the launch of its eagerly awaited new hi-tech AWP, Car Wash. Based on the classic 1970s American film of the same name Car Wash incorporates a hi-tech circular feature board game with a multi illuminated cash pot. Using popular graphics and audio from the film, players progress through to the groovy afro-styled feature board which contains shots, streaks and additional features.



The Wash Menu awards 4 streak options, including DEE-LUXE with the level of the streak determined by the number of stars activated. For further information please contact: Clare McMillan / Sam Drakeford @ MediaWorks. Tel: + 44 (0)113 234 5600. Fax: + 44 (0)113 234 5601. Email: pr@mediaworkscl.com

ICE To Move In 2004

The 2003 International Casino Exhibition will be the last to be held on level 2 of Earls Court 1. The burgeoning show, which in a decade has grown from just 37 to 150 exhibitors, will make the short move to Earls Court 2 for the 2004 show. Peter Rusbridge, chief executive of organising company ATE, explained: "In ICE we have one of the fastest growing exhibitions in the show calendar. The simple fact is that the current home on the upper level of Earls Court 1 is not capable of accommodating any future expansion, hence the decision to take advantage of the opportunities offered by Earls Court 2." The decision to relocate will be welcomed by exhibitors, many of whom have been lobbying for such a move. With the large rides manufacturers, who were the previous occupants, now being catered for by Euro Amusement Show, ICE organisers have seized the opportunity. For further information email:kcooke@atei.co.uk

3M Touch Systems and Zytronic PLC Announce Worldwide Touch-Screen Distribution Agreement

3M Touch Systems Inc. recently announced a worldwide agreement to distribute a private-label version of projected capacitive touch screens produced by Zytronic PLC, which is based in Newcastle-upon-Tyne, England, and is listed on the

Alternative Investment Market (AIM) of the London Stock Exchange. This new agreement expands 3M's broad offering of touch-screen technologies, while providing Zytronic with an extensive worldwide sales

team and distribution channel to promote its products. For more information visit <http://www.3Mtouch.com/info/pr> or contact Donna Fleming, 3M Public Relations at +1 651-736-7646 or email <mailto:dlfleming@mmm.com>

- Martin Dempsey

AmusEmail

The Worldwide Amusement Trade Email Newsletter
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The Multilingual European Amusement Trade Journal
(Monthly)

AmEx 2003

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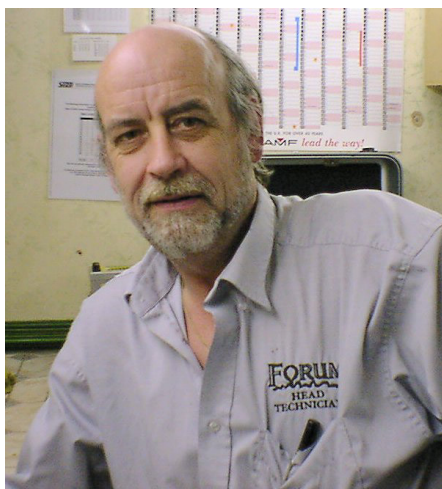
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Fax +353 (0)45 521198 **Mobile** +353 (0)87 220 9732

A Plumber's Guide to Fruit Machines - Part 10 of 10

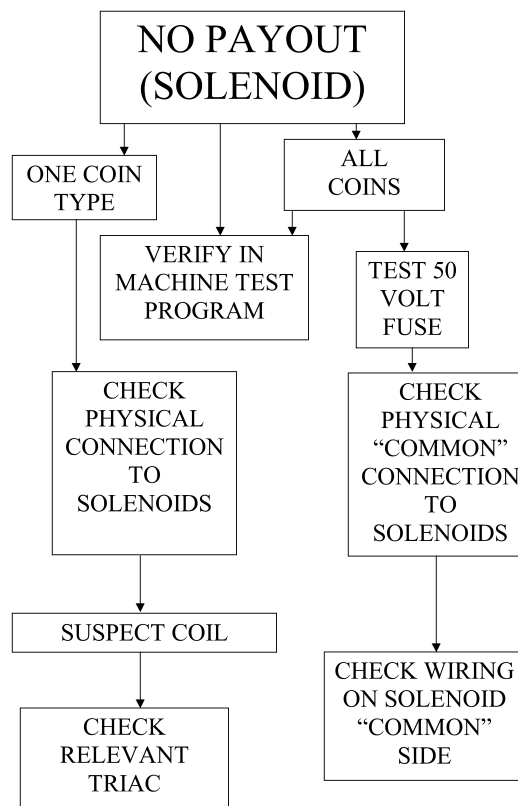
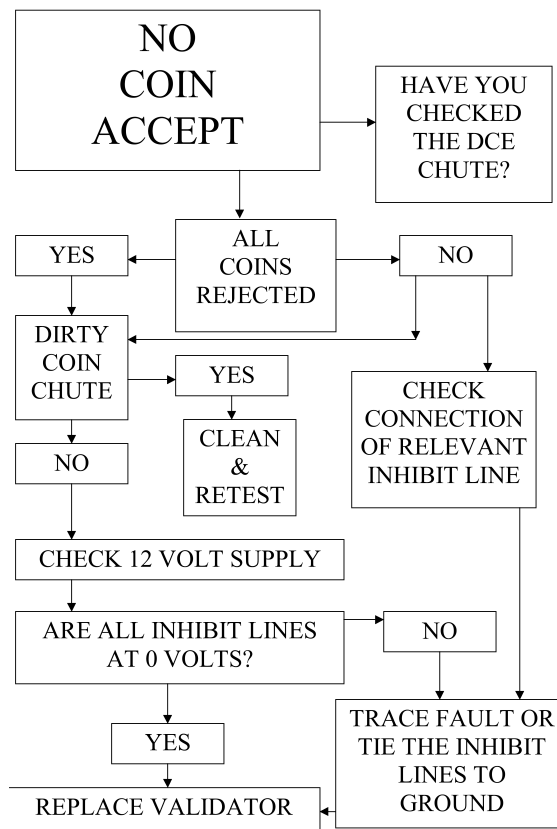
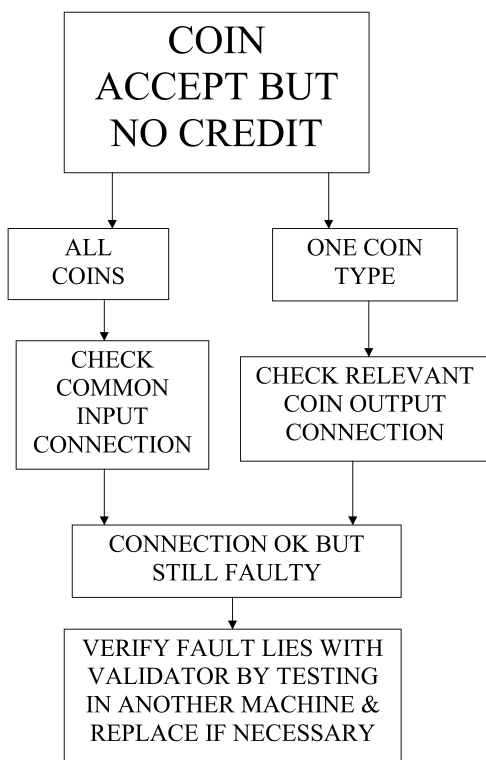
By Gordon Lowe

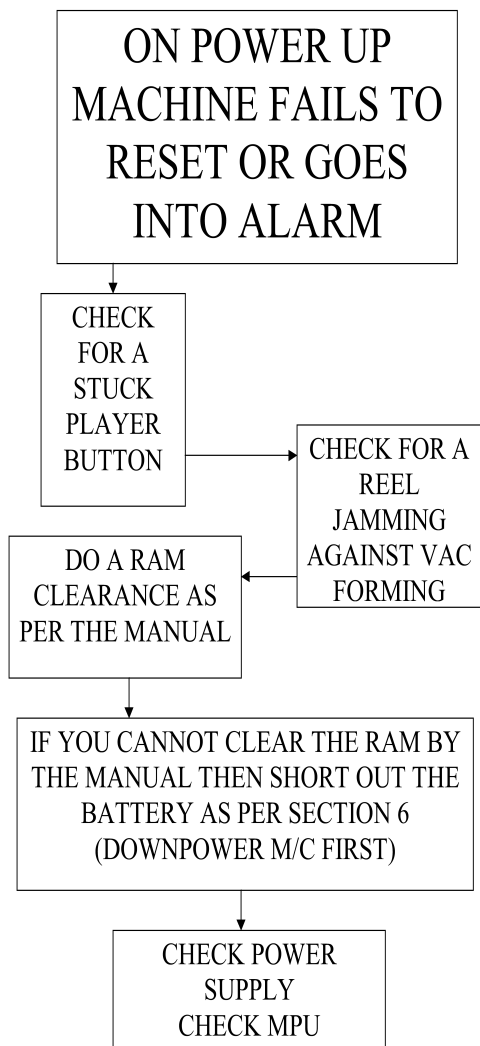
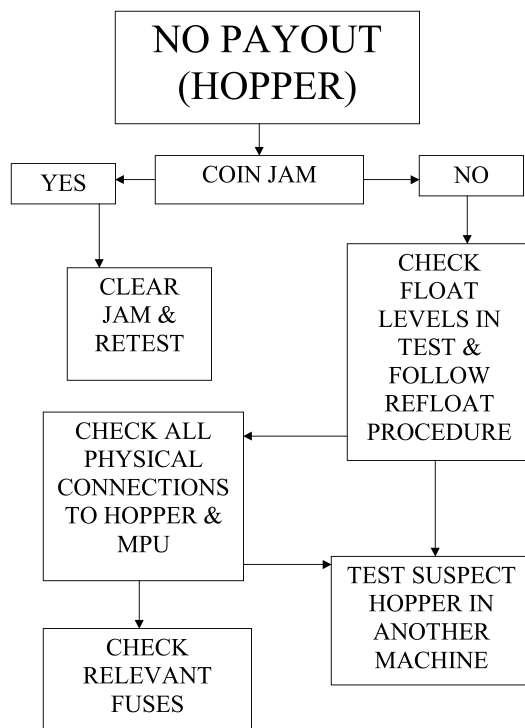
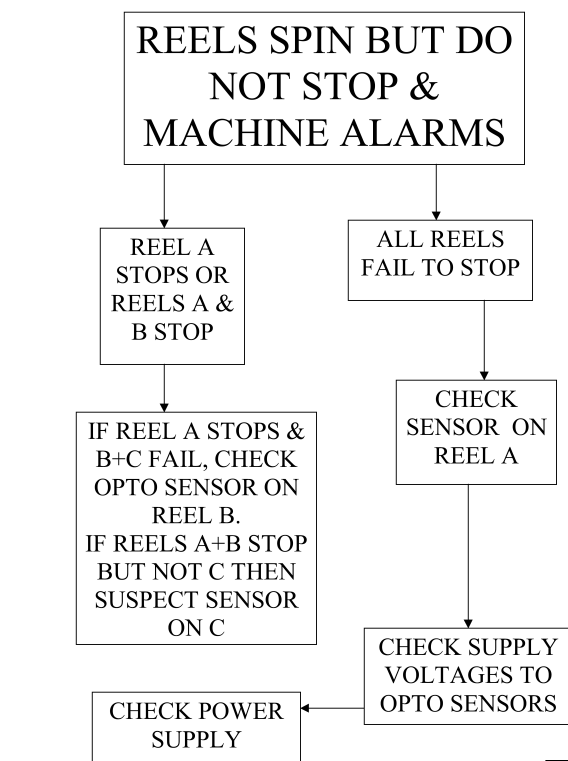


FLOW CHARTS

The following flow charts are intended only as a guide to the most common causes behind machine failure to operate as normal. As has been stated throughout this series of articles, the majority of faults are the result of the simplest of reasons, or carelessness during a previous attendance to the machine.

PATIENCE IS THE KEYWORD!





RAM Clearance Procedures

Important: RAM clearance should only take place when all else fails, clearing the RAM can result in the machine paying out excessive for a short period of time until it arrives at its set percentage.

Shorting of the Battery is NOT advisable

Possible reasons for clearing the RAM: Machine frozen and will not clear, erratic behaviour during game play, multiple credits without reason, spurious payouts. Note that any credits or monies in the bank will be cleared

ASTRA

1. Machine power ON
2. Service door open
3. Press & hold down all 3 Hold buttons
4. Place DIL switch 8 on bank 2 to the ON or UP position whilst continuing to hold down the above hold buttons for approx. 10 seconds
5. Return DIL switch 8 to the OFF or DOWN position and then release the hold buttons.

IMPULSE (EPOCH) (Maygay)

1. Open top door and allow to reset
2. Press and hold RED TEST button
3. Press FUNCTION button on MPU (2 bleeps)
4. Release both buttons - now in test
5. Extended test for RAM clearance follow steps 1-3
6. Release FUNCTION button continuing to hold RED button
7. 3 bleeps - now in test 9.2
8. Hold left hand player button (usually CANCEL) and a countdown 5 to 0 will start
9. When 0 reached RAM cleared and audible noise will sound
10. Alternatively, changing the game card will clear RAM

MAYGAY (old type MPU)

1. Hold the COLLECT button whilst pressing RED test switch S3 on the MPU
2. A countdown will commence 9 to 0
3. After reaching 0 RAM will be cleared and an audible noise will sound.

IMPACT (JPM)

1. Switch off machine
2. Change PRICE OF PLAY or JACKPOT on DIL switches.
3. Power ON the machine and allow to reset
4. Power OFF
5. Return DIL switches to original positions
6. Power ON, RAM now clear
7. An alternative method is to short out C13 capacitor adjacent to the battery on the processor card.

BARCREST MPU4

1. Switch off the machine
2. Fit the program card from another MPU4 machine
3. Power up, power down
4. Return Program cards to their original machines
5. RAM now clear

ELECTROCOIN

1. Power down
 2. Remove RAM chip (IC60 adjacent to battery)
 3. Leave out for approx. 1 minute
 4. Replace and power up
- RAM now clear (verified by machine giving rapid beeps on power up)

It's probably one of the most frustrating things that can happen to a technician. It's also one of the most time-consuming. Sometimes, test equipment will indicate that a component is good when it really isn't.

Generally speaking, troubleshooting is pretty simple. You begin by choosing a starting point through a bit of logical deduction. If, for example, your car doesn't start, you don't begin troubleshooting by examining the windshield wipers. You check to see that you have fuel, spark, etc.

The next step is often to narrow down the problem by making a few voltage measurements. Does the bad circuit have power to it? If not, the problem doesn't lie in the inoperative circuit itself but rather it lies in the circuit that powers it.

Finally, you pinpoint the defective component(s) by turning off the power and testing the parts with a digital multimeter and/or capacitor meter.

All this is well and good but it does depend on the basic tenet of trust. You are trusting that when your meter tells you that the component is good, it really is good. BAD IDEA.

Here's the deal . . . When your meter indicates that a component is defective, it really is bad. No problem. But just because your meter says that a component such as a transistor or capacitor is good, that does not necessarily mean that it actually isn't really the cause of your problem and that it isn't really bad after all.

In some cases, the problem lies with the fact that when testing a component such as a transistor, the meter doesn't really put much of a load on the component. A typical digital multimeter will test a transistor at less than two volts with just milliamps of current. The part might test perfectly good at that point but fail when operating under full load at much higher levels of voltage and current.

In other cases, your meter just isn't doing a proper job of testing the transistor. I see this again and again during the hands-on lab sessions at my two-week Casino School. One of the neat things about the class (for me, anyway) is that I get a chance to evaluate dozens of different brands and models of digital multimeters. You might think that a meter is a meter and that all are pretty much the same. When it comes to measuring voltage, this is true but when it comes to

testing transistors, it is most definitely NOT true.

First, let's take a step-by-step look at the transistor test itself:

The Transistor Test

1. Set your meter to the diode test. Your digital multimeter **MUST** have a dedicated diode test function. If it doesn't, get a meter that does. A meter recommendation is made later in this discussion.
2. Connect the red meter lead to the base of the transistor. Connect the black meter lead to the emitter. A good NPN transistor will read a JUNCTION DROP voltage of between .4v and .9v. A good PNP transistor will read OPEN.
3. Leave the red meter lead on the base and move the black lead to the collector. The reading should be the same as in step 2.
4. Reverse the meter leads in your hands and repeat the test. This time, connect the black meter lead to the base of the transistor. Connect the red meter lead to the emitter. A good PNP transistor will read a JUNCTION DROP voltage of between .4v and .9v. A good NPN transistor will read OPEN.

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Randy Fromm's Casino School

On-Site Technician training

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

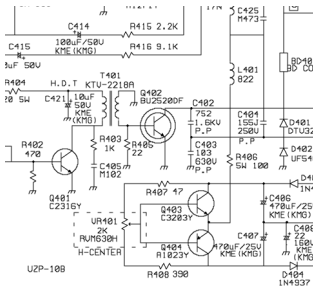
This relatively inexpensive piece of test equipment is easy to operate. Casino School students learn to use the digital multimeter to perform tests and measurements that will pinpoint the cause of a failure down to a single component.

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!



5. Leave the black meter lead on the base and move the red lead to the collector. The reading should be the same as in step 4.

6. Place one meter lead on the collector, the other on the emitter. The meter should read OPEN. Reverse your meter leads. The meter should read OPEN. This is the same for both NPN and PNP transistors.

If the transistor fails any of these tests, it is bad. You may attempt to test transistors in-circuit. However, transistors will often not test properly in-circuit and must be unsoldered and removed from the circuit for proper testing. Don't agonize over whether or not the transistor is bad when testing in-circuit. It only takes 30 seconds to remove the transistor and another 30 seconds to test it properly. Just do it!

The Big Lie

The hands-on transistor testing lab session at the Casino School consists of a collection of 80 transistors. Some of the transistors are good NPN transistors. Some of the transistors are good PNP transistors. Some of the transistors are bad transistors with a variety of different failures.

These are all actual failures that have been removed from repaired equipment (power supplies, amplifiers, controller boards and, of course, monitors). The nature of the

failures vary. Some of these transistors have failed with a collector-to-emitter short. This is a common failure as the "collector current" is the highest current path in the device. Others have collector-to-base shorts. Quite a few have all three leads shorted together, essentially turning the transistor into a three-legged wire! There is even a lab transistor where the emitter-to-base junction is blown open completely and you don't get a junction drop reading at all when you test it with your meter.

All of these types of failures are straightforward and any meter at all will find them without fail. Where some meters (many meters, in fact) run into difficulty is in finding a nasty little transistor failure known as "leakage."

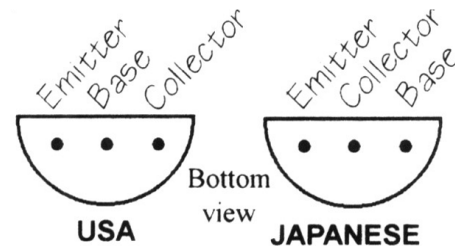
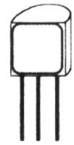
Normally, the PN junctions in the transistor allow almost unrestricted current flow in one direction and all but completely block the current in the other. Between collector and emitter, there

should be virtually no current flow at all when tested with your meter IN EITHER DIRECTION.

Leakage is a type of failure that allows current to flow when none should. It is akin to connecting a resistor in parallel across the transistor between base and emitter, base and collector and/or collector and emitter. The result (as far as the circuit

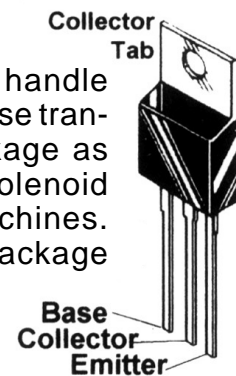
TO-92 Package

This is the smallest transistor that you commonly will find in monitors, power supplies and other circuits (other than SMDs or surface-mount devices). It is often called a "signal transistor" as it can handle only 1 amp of current.



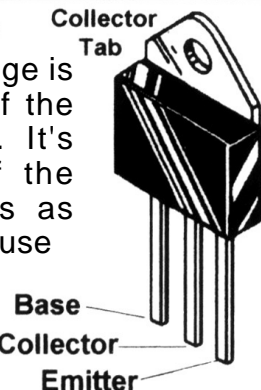
TO-220 Package

This package can handle up to 10 amps. We use transistors in this package as lamp matrix and solenoid drivers in slot machines. You also see this package in power supplies.



TO-218 Package

The TO-218 package is a larger version of the TO-220 package. It's used in many of the same applications as well. Most monitors use a TO-218 package for the horizontal output transistor.



operation is concerned) is that current flows through the transistor when it shouldn't.

The problem in detecting this type of failure is that this "phantom resistance" created by the leakage may not create enough of a voltage drop that it can be picked up by the meter. And we're not just talking about cheap meters here either. Even the venerable Fluke Model 77 meter has failed to pick up some of these bad lab transistors (We KNOW they're bad. Remember, these were all removed during actual repairs where replacement fixed the problem.).

The nature of the BIG LIE is that the meter shows you a normal "open" reading just as it should when, for example, testing between emitter and collector DESPITE THE FACT THAT THE TRANSISTOR IS ACTUALLY LEAKY. You then declare the transistor to be good because it has passed all of the tests as outlined previously. It isn't until you have then tested EVERY OTHER COMPONENT in the circuit and declared them ALL to be good that you have come full-circle and have to begin the process all over again.

What a waste of time! The instant you have tested a defective component and (mistakenly) declared it to be good, you have DOOMED yourself to what will likely amount to hours of unnecessary troubleshooting.

Okay, Randy . . . What do YOU recommend?

My meter of choice is manufactured by Fluke. Fluke has a meter that, in my humble opinion, is well suited to our type of troubleshooting. It has never failed to pick up these leaky transistors.

It is the Model 12b. This is an excellent meter with a number of neat features. It sells for around \$99.00. Among other features, it has a memory feature that automatically samples and holds the highest and lowest readings when measuring something like the DC output of a +5 volt power supply. This is a very handy feature when testing for intermittent problems. We'll look at another of its features later on.

Radio Shack used to sell a really cool little component tester that they call "Component Tester." Catchy little name for a component tester, don't you think? It's just gone obsolete but if you see one on the closeout table, snag it! The part number is 22-330. With three alligator clips, you connect it to any of the three legs of a transistor, SCR or TRIAC. The tester will tell you if the component is good or bad and even identify which lead is which for you. Best of all, it finds the leaky transistors that some meters cannot. There is even an audible continuity beeper. Sweet.

The tester will test Bipolar transistors, Darlington transistors, FETs (field effect tran-



Radio Shack's really cool little component tester part number 22-330.

sistors) IGBTs (isolated-gate bipolar transistors) JFETs (junction field effect transistors) MOSFETs (metal oxide silicon field effect transistors) LEDs (light-emitting diodes) Power diodes, Zener diodes, SCRs (silicon controlled rectifiers) and TRIACs.

Another Type of Leakage or The Dark and Mysterious Tale of the "Phantom Currents."

Phantom currents and mystery voltages also may come from this phenomenon called leakage. While there is a detailed mathematical explanation, let's just take a look at the practical application and how it affects troubleshooting.

Leakage refers to an infinitesimally small amount of electric current that finds its way across the most unlikely paths. For example, when a switch is in the off or open

position, there is absolutely no connection between the switch contacts.

However, imagine that this switch is in a piece of equipment that is located at a seaside resort. Imagine a fine mist of salt spray that fills the air and deposits itself on the outside of the switch. This salt water conducts electricity pretty well. A thin layer of salt-water spray will create a path for electric current BETWEEN THE TERMINALS OF THE SWITCH as opposed to current flowing between the terminals themselves. Leakage can come from other sources as well such as a layer of smoke particles or other contaminants.

Because the molecules-thick film has a high resistance (in the megohms) the amount of current flowing across it is very small. It is therefore referred to as leakage current. But because the input impedance of a digital multimeter is also measured in megohms (so as not to "load" a sensitive circuit when taking measurements) the meter readily picks up the leakage current and presents it to you on the display. It is now your job as a technician to determine if the reading is a legitimate voltage reading or if you're looking at a phantom voltage: leakage.

Here's where experience and intuition really help me a lot. When I suspect I am looking at leakage rather than real voltage (such as in this case where the voltage reads low

in a situation where it's not really a possible or likely failure mode) I try touching my fingers to the metal meter probes themselves as opposed to holding the meter probes by their insulated handles. This puts my skin resistance (typically 400k or so) across the circuit. This resistance acts as a bit of a load.

If I'm looking at real voltage, the reading will be unaffected by my skin resistance. However, if I'm looking at leakage instead, the voltage will drop to zero as soon as I touch the probes.

Naturally, you don't want to do this with high voltages but, to be honest, I have done this many times in the past when I'm working on 120 volt AC circuits with a bit of a leakage problem somewhere. A typical cause is where a machine in a wooden cabinet sits directly on the floor without leg levelers or wheels and the night cleaning crew swabs the deck using a rag mop laden with copious quantities of soapy water. The water is absorbed by the wooden cabinet causing all kinds of potential electrical problems.

In this case, I might read 120 volts AC between two points that are not supposed to be connected in any way. I might look at this as a leakage reading and momentarily touch the two meter probes with my fingers. If I feel a shock, it's "real" (and how...) but if I do not, the

voltage will drop to zero and I'll know I'm looking at leakage instead. HOWEVER, I acknowledge that this is probably a pretty stupid and unsafe thing to do, especially now that I have my new best friend, the Fluke model 12b.

As I mentioned before, the Fluke model 12b is my meter of choice for our type of servicing for a number of reasons. It is an auto-ranging meter so I don't have to fiddle with setting the proper range each time I move to a new measurement. It is fully protected against overloads. It measures capacitance. It tests diodes and transistors. It makes a great cup of coffee (just kidding).

But most of all, the Fluke model 12b has a nifty feature called V-Check. The V-Check feature makes using the meter practically a no-brainer as far as testing is concerned. When you set the Fluke model 12b to the V-Check setting, the meter is first set to measure resistance. However, it looks for voltage in the circuit as well and if it sees voltage (AC or DC), it automatically switches to display the voltage reading instead. Pretty neat huh?

But what does this have to do with detecting leakage? Well, in the normal voltage test, the input impedance of the meter is megohms but in the V-Check mode, the input impedance is just 2K! That's just 2,000 ohms and that presents enough of a load to

suck any leakage current down to zero volts. By using the V-Check mode when looking for power problems, you'll never be confused by leakage currents again because you'll never see them to begin with!

Capacitors

Capacitors cannot be adequately tested with the DMM. Although many technicians claim that capacitors can be tested by using the resistance (ohms) setting of the meter and watching the resistance change as the capacitor charges, I have found this test to be extremely misleading. Capacitors that appear to pass the "charge" test have actually been defective.

The proper way to test capacitors is with a capacitance meter. The Fluke model 12b has a built-in capacitance meter. Unlike the direct current "charge test" provided by the digital multimeter, the capacitance meter tests capacitors by passing an alternating current signal through the capacitor. The meter then measures the voltage that is dropped across the capacitor. Smaller value capacitors (those possessing less capacitance) will have a higher voltage drop than those with a greater value. Technically speaking, the meter is measuring the "capacitive reactance" or AC resistance of the capacitor under test.

Fortunately, using the capacitance meter is much

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The Fluke model 12b has a built-in capacitor meter. A more sophisticated device is available from Sencore. It's the LC103

easier than understanding how it works. All you have to do is connect the capacitor to the meter (be sure to observe the polarity) and read the display. If the displayed value is less than the value that is printed on the component itself, the capacitor is bad.

Don't be surprised if some capacitors have a tested value that is considerably higher than they're supposed to have. This is okay. Electrolytic capacitors often start out 10% higher than their marked value when new. When capacitors fail, their capacitance often will test lower than normal.

HOWEVER, sometimes a capacitor will test EXACTLY as indicated and yet still be bad. Why? How? Well, first of all, as mentioned earlier, electrolytic capacitors usually start out 10% high. If the meter says it has exactly the correct number of microfarads as printed on the part, it has actually DROPPED 10%

from when it was new and it's on its way out.

Additionally, there are a couple of other types of capacitor failures that DO NOT show up as a loss of microfarads. One is an increase of the capacitor's "equivalent series resistance" or "ESR." Another is a phenomenon known as "dielectric absorption." Without getting into detail, either of these failures will allow a capacitor to test perfectly good but still be defective. You'll never find these with a capacitance meter like the one in the Fluke.

Your choice is to purchase another type of capacitor meter (one that checks for ESR and/or dielectric absorption - Sencore makes a wonderful unit, the LC103) or do what I do . . .

REPLACE THE DARNED THING AND SEE IF THE PROBLEM GOES AWAY! 'Nuff said?

- Slot Tech Magazine



Another way to tackle the ESR problem is to use an ESR meter like the Capacitor Wizard from Independence Electronics

Make plans today to join the gaming industry's top engineers, technicians, technical writers and instructors for 3 days of technical seminars and presentations that will enhance your performance as a technician and dramatically increase your value to your employer.

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TechFest is for slot techs of all skill levels, from novice techs who want to learn the basics of BV and hopper maintenance to advanced techs that need to brush up on monitor repair.

Schedule of Events

Events subject to change

Tuesday, February 4th, 2003
Tuesday, March 4th, 2003

9:00 am - 12:00pm
 How Monitors Work - Part 1
 Theory of Operation - Beginning level

12:00pm - 1:15pm Luncheon

1:15pm - 3:15pm
 MEI - BV troubleshooting and repair

3:30pm - 5:30pm
 Seiko Printers

Wednesday, February 5th, 2003
Wednesday, March 4th, 2003

9:00 am - 12:00pm
 How Monitors Work - Part 2
 Narrow Down the Problem - Intermediate Level

12:00pm - 1:15 pm Luncheon

1:15pm - 3:15pm
 Asahi Seiko - Hopper troubleshooting and repair

3:30pm - 5:30pm
 Coin Mechanisms, Inc. - Coin Comparitor technology and repair.

Thursday, February 6th, 2003
Thursday, March 4th, 2003

9:00 am - 12:00pm
 How Monitors Work - Part 3
 Circuit Analysis and Component Level Troubleshooting - Advanced Level

12:00pm - 1:15 pm Luncheon

1:15pm - 3:15pm
 Sencore - Monitor Troubleshooting and Repair - Using sophisticated test equipment.

3:30pm - 5:30pm
 JCM Bill Validators -
 BV troubleshooting and repair



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Randy Fromm's

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