

November 2009

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Slot Tech Magazine”

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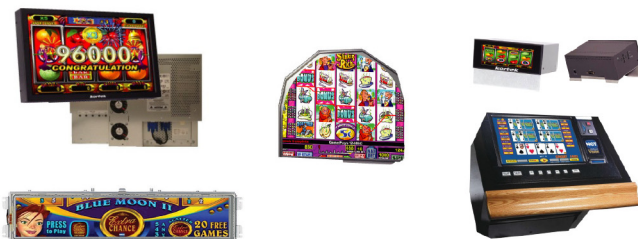
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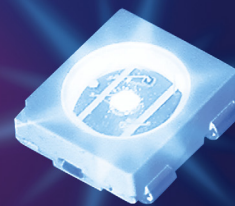
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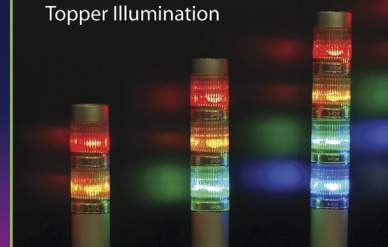
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Amusement machines and gaming devices run parallel courses in two different worlds. With hardware that is more or less identical (power supplies, displays, bill validators, CPUs and I/O) it is easy for a qualified technician or engineer to make the jump from one to the other. Some of us sort of straddle both worlds. WMS was a pinball company. I had the pleasure of knowing Harry Williams, founder of Williams Pinball and inventor of the "tilt" mechanism. Bally made pinball machines as well. I couldn't tell you how many Konami arcade games I've worked on.

So, when Incredible Technologies showed up at G2E last year, I wasn't surprised. IT (as it is known to the amusement industry) is widely credited by operators nation-wide as designing and building the highest earning and most innovative amusement machines in the business. This month, Slot Tech Magazine is pleased to present an exclusive introduction to the company, their hardware and their new "Breeze" cabinet that finally tames the heat beast inside a slot machine, without wasting power and without adding fans. Incredible Technologies will also be exhibiting at TechFest 20, which will be held December 8-10, 2009 at the Hard Rock Hotel and Casino in Hollywood, Florida. For more details, visit the website at slot-techs.com.

One last thing. Fluke has a new, reasonably priced DMM with a detachable readout display! The display communicates wirelessly with the DMM and can be attached magnetically to, well, just about anywhere! It's a stroke of genius and I certainly don't have to tell you how useful this will be for working on slot machines. See page 11 for a peek at the Fluke 233.

See you at TechFest.



Randy Fromm - Publisher

Printed back issues are available for only one year from the date of publication. All single issues of Slot Tech Magazine are \$10.00/ea. For further details on the contents of each issue, please refer to the website at slot-techs.com. To order, fax a PO or e-mail a note listing the issues you need.

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Randy Fromm

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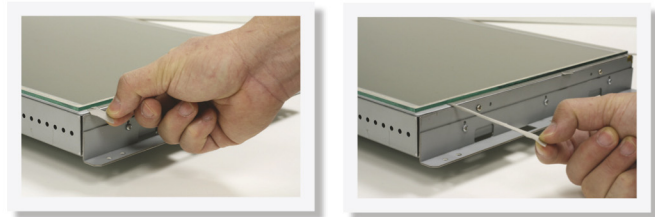
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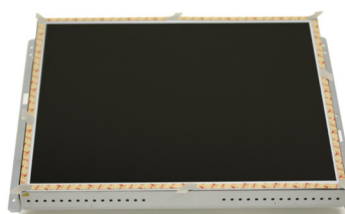
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Incredible Technologies

Another Coin-Op OEM Brings Fresh Ideas to Gaming

If a path for gaming industry success were to be mapped out, it would often include achievements in coin-operated amusement games. Just walk through any casino tradeshow and take a look around - from game designers to sales executives, history has shown that gaming owes much to the coin-op amusement industry. Enter... Incredible Technologies.

Incredible Technologies - or "IT" as they're known in the amusement biz - is currently the largest manufac-

turer of coin-operated skill-based amusement games in the United States. And if you haven't heard their name before, you've certainly seen the fruits of their labor - most notably their wildly popular video golf franchise, Golden Tee® Golf. In its 21-year history, over 10 million players have teed off on the game's virtual links and pumped in over \$3 billion - making it the most successful amusement video game in history. The company's other flagship product, Silver Strike Bowling™ can be found in nearly 20,000 bars and restaurants worldwide.

Much of that success can be attributed to the company's owners, Elaine

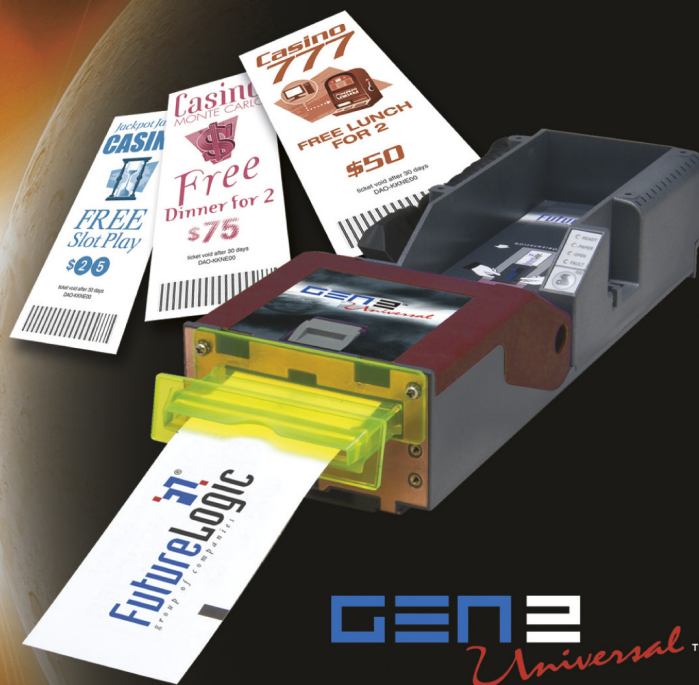
Hodgson and Richard Ditton. 25 years ago during the arcade boom, Hodgson and Ditton had the vision to recognize a business opportunity in the tavern/adult gamer market. At the time they made a strategic decision to develop quality entertainment products for adults - a strategy that paid big dividends as arcades fizzled during the rise of the home console market in the mid-1990's.

"We've been fortunate with the risks we've taken," said Hodgson, IT's President/CEO. "The ability to adapt and innovate has kept our company relevant for over two decades and continues to keep our team on the cutting-edge of technology."



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Once again, Incredible Technologies is looking to leverage their experience, this time in another adult gamer industry - Class III casino gaming. At G2E 2008 the company debuted their Magic Touch® video slot, poker and keno system - a sophisticated gaming device that represented years of behind-closed-doors development. For the past year the gaming system's revolutionary features and outside-of-the-box appeal has generated buzz throughout the industry, and the company anticipates that Magic Touch units will hit casino floors sometime during the fourth quarter of 2009.

As Incredible Technologies prepares to go head-to-head with the giants of gaming - some for a second time - the company is forming a strategy with their technology that's designed to differentiate their products from the competition. High-powered hardware, sustainability and high-earning games are a requirement for any successful gaming manufacturer, and this is where IT excels. But it's with the design of their Breeze™ Upright cabinet and NEXUS™ hardware system that Incredible Technologies lives up to its name.

Breeze Gaming Cabinet

The philosophy behind IT's gaming cabinet design is summed up by its brand

name. The Breeze Upright was developed to package high technology with functionality and simplicity.

"It was our goal to create a cabinet and hardware set that is easy for technicians to live with," said Steve Jaskowiak, IT's Vice President of Engineering. "In coin-op, we learned that the easier our games are to service, the more successful they are. Our research shows that lesson holds true in casino gaming as well, so we developed our hardware and cabinet with that sentiment in mind."

As director of the largest and most respected technical service staff in the amusement industry, Jaskowiak says that his team has perfected the realities of designing cabinets to survive in harsh environments.

"During the past 25 years we've placed games in over 100,000 of the smokiest, dustiest, most unforgiving tavern environments on Earth," Jaskowiak explained. "In that time we've

developed dozens of cabinet styles and hardware sets. We've learned what it takes to keep uptime at a maximum for our customers."

Drawing upon that experience Incredible Technologies set out to minimize common failure points and utilize new, reliable technologies to simplify their design. For example Incredible Technologies is introducing NVRAM that doesn't require a fickle battery backup. Additionally, Jaskowiak explained that solid-state USB technology plays an important role in the overall hardware package. "We researched common industry components and circuitry wiring, then challenged ourselves to shed weight using USB wherever we could."

With wiring "rat's nests" eliminated, Jaskowiak's hardware team then sought to manage temperature and airflow - one of the most common causes of hardware failure in both gaming and coin-op. That challenge fell to Senior Electrical Engineer Jeff Siegrist.



At G2E 2008 the company debuted their Magic Touch® video slot, poker and keno system - a sophisticated gaming device that represented years of behind-closed-doors development.





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"We didn't want to just throw a bunch of fans inside the cabinet to keep it cool - fans fail too often," Siegrist joked. "Instead we started with our motherboard design and determined that we could actually eliminate a video card – a very common failure point. We looked to mitigate heat where possible and leverage the space within the cavity of the cabinet for maximum airflow."

It's this same open space that earns the Breeze its name and it's not just because of the airflow. "Because of the hardware refinement process, we were able to mount our components such that a service technician's hands can easily reach any critical point," Siegrist said. "We even had enough extra space to hang a small flashlight inside the cabinet - we want everyone who services our machines to know that we had them in mind with our design." The Breeze also features an independently movable LCD on a swing-arm to give technicians maximum visibility and access.

As a final tip of the hat to the technicians who will be servicing their new cabinet, Incredible Technologies had "tool-free" in mind when designing the Breeze. "We're as close to tool-free as possible," Jaskowiak said. "The cabinet door requires no tools to open

and nearly all service can be completed with a Phillips-head screwdriver and 11/32" nut driver."

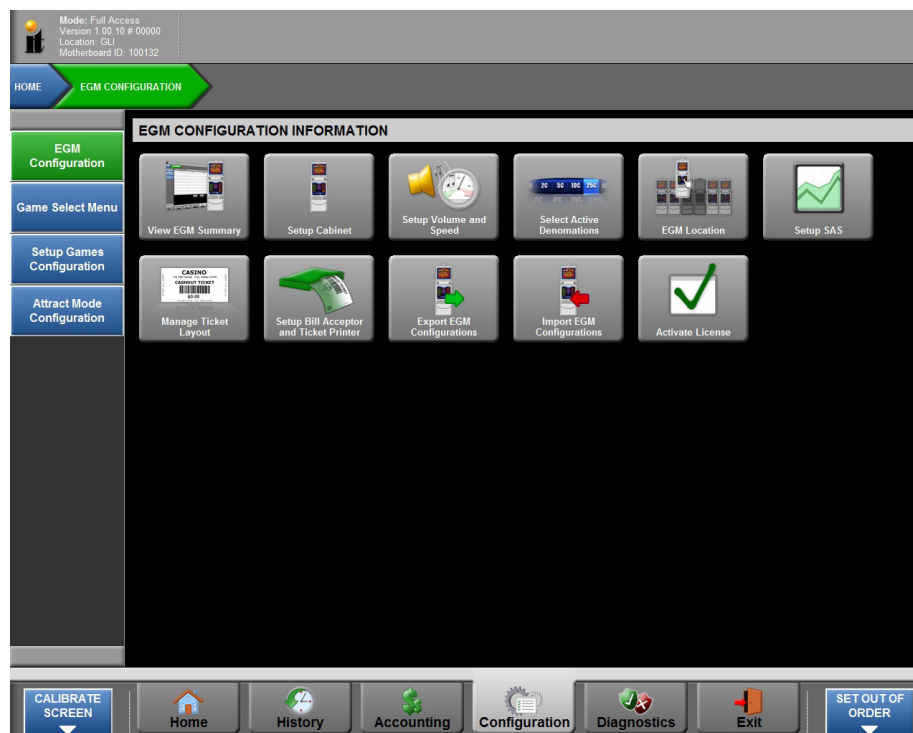
Magic Touch Configuration

Beyond innovation in their cabinet design, Incredible Technologies invested a considerable amount of time and effort in their configuration utilities for Magic Touch. They created a wide array of robust menu systems, dynamic adjustables and diagnostic tools, similar to the systems found in their amusement products. At the beginning of the design process the company's software engineers used their product's clean slate as an advantage in the implementation of Class III gaming protocols.

"We thought that if we couldn't make it better,

then what was the point in making it?" said Software Engineering Director Tony DeFeo, regarding the start of the Magic Touch creation process in 2007. "Our plan was to build a system that was easy to configure, upgrade and license new titles. The hardware team was forming their plan at that time as well, which gave us the advantage of leveraging new technologies that other manufacturers were not able to transition to. It was an exciting time," he added.

Magic Touch features IT's proprietary NEXUS hardware system. NEXUS is a four-piece, USB-powered configuration with separate thumb drives for the game's operating system, game code, storage and licensing information, and jurisdictional rules. In



The machine features a wide array of robust menu systems, dynamic adjustables and diagnostic tools, similar to the systems found in their amusement products.

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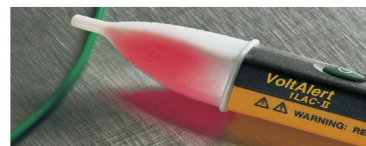
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addition to achieving the company's goals, DeFeo says that it will actually be technicians that benefit the most.

"We're not the first to eliminate EPROMS, but we are the first to streamline game configurations to a matter of seconds with our USB system. Once a game is configured to an operators liking, they can export those settings to a thumb drive for instant installation in other Magic Touch games on the casino floor."

Innovations such as IT's configuration import/export capabilities are credited to the company's ITNet server team (the same team responsible for the award-winning ITNet platform in their coin-op division). Director of Server Software Scott Schoenberg believes that the simplicity of IT's system will redefine expectations in the field. "We've built operator controls for a host of configurable data points and the level of our meter data is incredibly detailed, including per-cabinet, per-theme, per-denom and per-pay table," Schoenberg said. "We also created an intuitive menu system based on web technology, giving us flexibility in the future to utilize various aspects of the configuration menus in our operator services websites."

Magic Touch operators are also given the ability to

select pay tables for each game theme with half-percent precision, an unheard of granularity in the world of slot pay tables. In addition, IT advertises a feature they call Versatile Volatility™ which empowers operators and players with the ability to choose volatility within a theme.

Think of the innovative ideas that their predecessors WMS, Bally and Konami have brought to the gaming industry. Incredible Technologies joins them

once again and they plan on writing their own coin-op-to-casino success story. IT will be showcasing their products in booth 2456 at the G2E show where you can see for yourself that they really do have the Magic Touch.

For more information, contact:

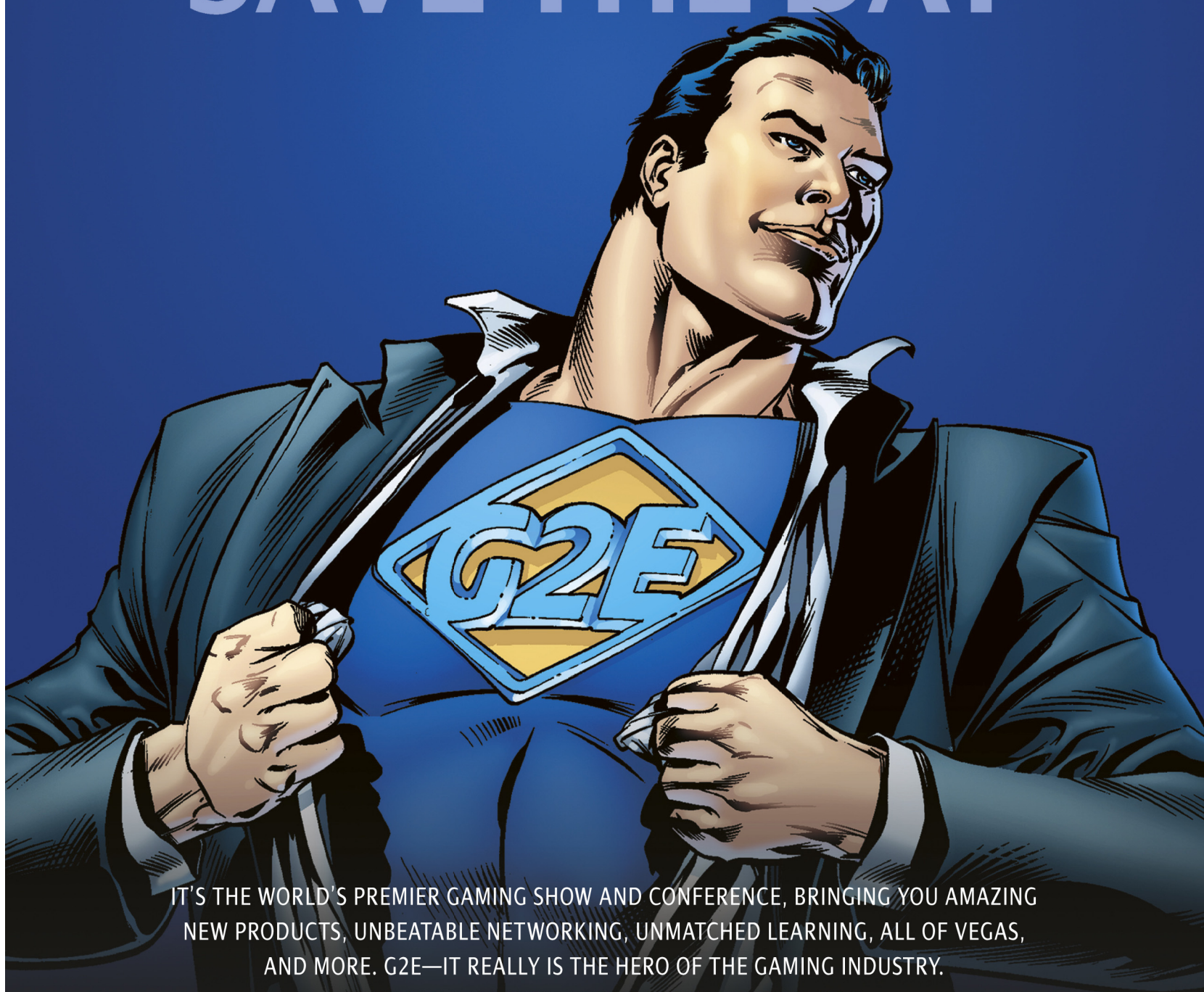
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Editor's Note: Part one of this article appeared in the October 2009 issue of Slot Tech Magazine. You may read this and other back issues of Slot Tech Magazine online at slot-techs.com.

Things might just start to become somewhat complicated, and that's when you need the schematic close at hand. You need to know which pin of the flyback does what and just how much voltage should be present for correct operation of the monitor. The different voltages are all tapped off different windings. The fact that there is high tension being pumped out to the anode via the high voltage cap doesn't necessarily dictate that one of the other secondary windings might not be faulty in the meantime.

One of the major drawbacks one encounters when faced with a faulty flyback, is the fact that it is quite expensive. Another drawback is that it's not always possible to find the replacement

A Hair Raising Experience

Understanding the Flyback Transformer and its Associated Circuitry - Conclusion

By James Borg

parts. There are companies that manufacture compatible transformers, but I've found that these, even though they work, won't always get the picture as it was originally. A slight variation in the windings is all it takes, and it's readily seen when you power up the display. You have a choice to make. It's a case of either living with it, or dumping the display. Unfortunately, modern high tension transformers don't seem to last as long like they used to before. There are various reasons for this, such as cost effectiveness, production costs and the higher level of stress these babies are being subjected to. If you think you have a faulty flyback on your hands, obviously the best and easiest way to totally eliminate any doubts would be to just replace it. That's all well and good if you have one to replace it with. If you don't, then you're a bit stuck and you'll have to do some testing on the unit to see if it's actually faulty or not. There are many ways an LOPT can develop a fault, or even more than one at the same time. There are common or repetitive

faults that tend to crop up along the way:

1. Shorted turns in the primary winding. This would kill any hope of ever seeing a picture on the screen. Apart from that, it could also kill your HOT after being forced to work totally out of spec and develop a nice juicy short circuit, which might lead to that tick-tick-tick noise mentioned earlier. The B+ will surely drop at this stage and components around the area might be killed off too.

2. The case being cracked and hence there would be arcing to an earthed point. This can be heard, seen and smelled at the same time. If the case isn't cracked, you can see parts of it bulging out from the epoxy, a bit like a wart. The result of this would be that the transformer will get hotter than it should get and eventually will die a death. This can also kill the HOT in the process.

3. There could easily be arcing between the various windings, be it in the primary or in the secondary ones. The ones in the sec-

ondary will easily upset other parts of the monitor, like the frame, and even the heater filament.

4. Internal component damage. These could be a capacitor or a high voltage diode in the secondary windings.

5. The focus and the screen voltage divider internal circuits could develop a fault. This would obviously be seen by the screen blurring and varies in brightness when it pleases. The divider itself consists of a resistor network where the top potentiometer is the focus and the bottom one is the screen, or G2. This is one reason why at times when you adjust the focus, the screen brightness changes, or the other way round.

Most flybacks have around ten pins sticking out at the bottom. Each of these is important in one way or another and they are not there for the love of it.

Apart from these pins, a transformer will also have three flying leads, some have four, and some even have more. The most obvious and the thickest of them all would usually be coloured red. This is the one carrying the high tension to the anode on the CRT. At the end there's an insulating cap.

In the eventuality of this cap being damaged by any

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reason whatsoever, this can easily be replaced if one wishes. Actually, it would be a good idea to replace it as otherwise you'll probably end up with sparks flying all over the place instead of staying contained in the 'hole' in the CRT. There is another flying lead, which could also be red, but thinner than the one with the cap on. This is your G2, or the screen. The voltage on this is adjustable and typical values would be from 200v to 600v, depending on the size of the monitor's tube and design. The other flying lead, which can be white, or black or any other colour, is the focus. This also is adjustable and varies between 4KV up to about 7KV, again always depending on the size of the monitor's tube and design. Some flyback transformers have two focus flying leads coming out of them. Usually, the screen and the

focus leads are connected to the CRT neck board. The focus, which in the picture below is black, is usually fitted into the CRT neck board's socket.

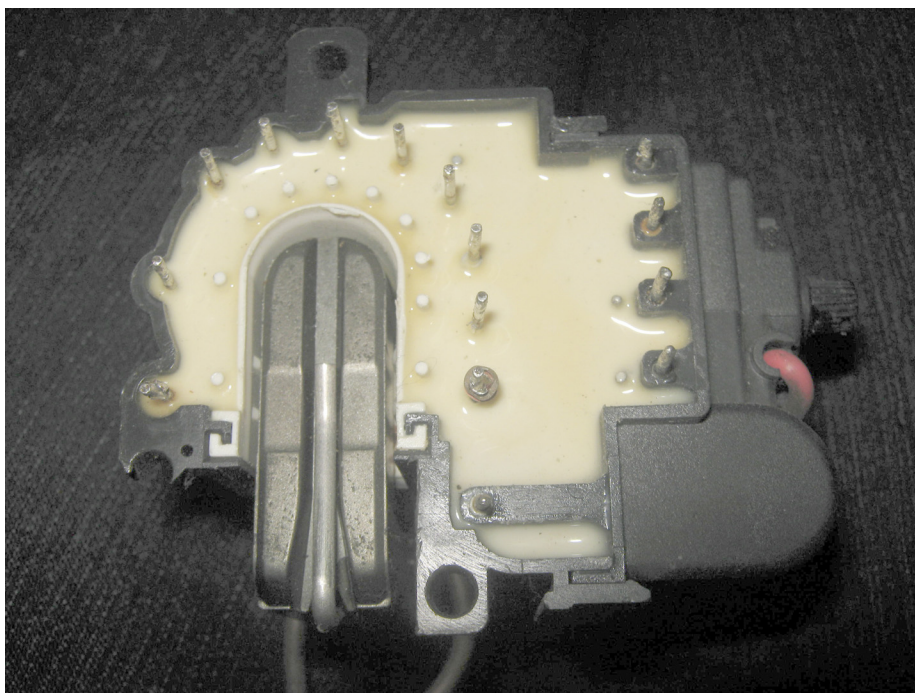
Both the screen grid, G2, and the focus can be adjusted from the flyback directly by means of potentiometers found at the back of the transformer. As a rule, the bottom pot adjusts the screen grid, and the top one adjusts the focus. There are types of flyback transformers that have two separate focus potentiometers, each focusing a particular area of the screen. Some transformers also have a one turn tapping off the ferrite itself which is used for synchronization with the switched mode supply unit. This helps with picture stability and noise rejection.

The pins on a flyback as

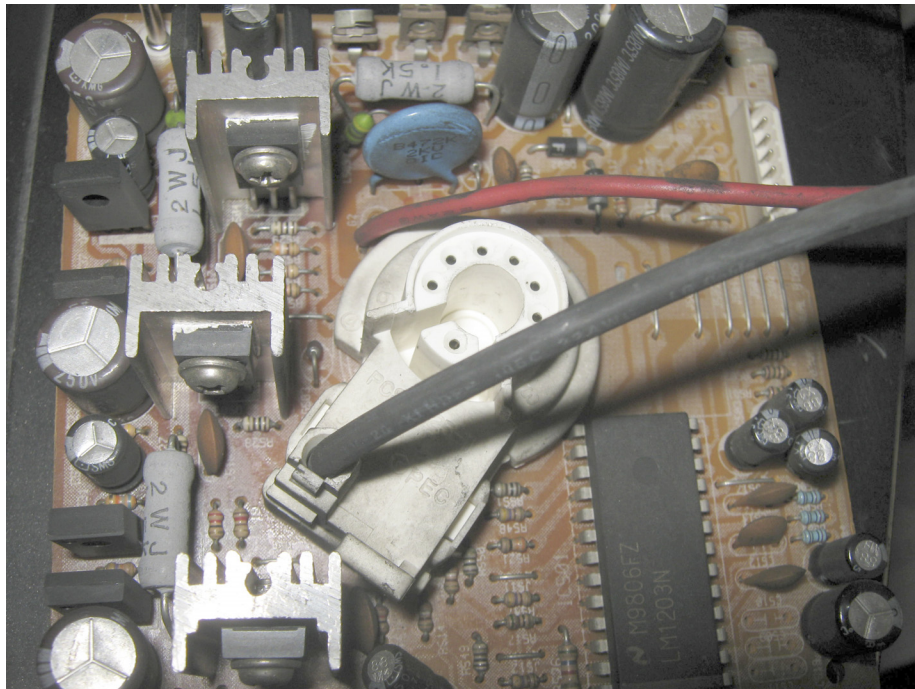
mentioned above can usually be summarized as follows:

- A) B+ pin,
- B) The pin which connects to the Horizontal Output Transistor (HOT),
- C) ABL (automatic beam limiter) pin,
- D) AFC (automatic frequency control) pin,
- E) G1 pin,
- F) The pin that feeds the heater filament,
- G) X-RAY protection pin
- H) The Ground pin.

A) This is where the juice enters the primary winding of the flyback. It's usually between 85v to 180v.
 B) The flyback's primary winding is between this pin and pin A. This is connected directly to the horizontal output transistor at the collector. This can be a normal transistor (for an example a BU2520DF, BU2508DF etc. or even an FET). This winding is especially at risk if the HOT shorts, resulting in excessive current flowing through the primary winding and damaging it, with you having to replace the transformer afterwards anyway. Fitting in a new HOT might work but this will get too hot too quickly and might even blow again if the flyback's not replaced in the first place. The use of a multimeter to check out the primary winding isn't much good here and there are specially designed testers (called "ringers") that cater just for this job.



Under Side of Flyback Showing Pins.

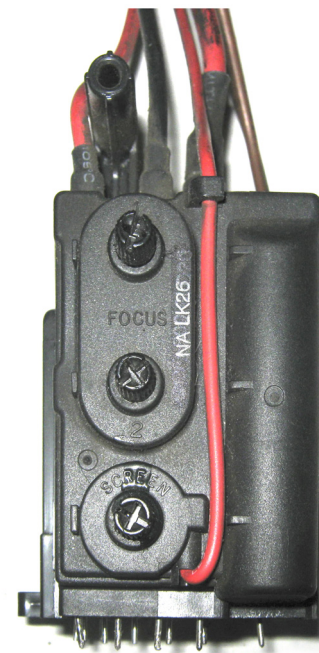


Focus and Screen Cables on CRT Neck Board.

The screen lead, which in the picture above is red, is usually soldered directly on to the printed circuit board, however, I've also seen this fitted in the CRT neck board's socket as well.

When the HOT blows, don't be surprised to find the juice line feeding circuitry would be blown too. Some monitors use an IRF630 to feed the flyback its juice.

So it's always advisable to check the B+ line when the HOT actually has been shorted out. When fitting a new HOT, it is always wise to apply some heat sink



Screen (G2) and Focus Pots on Flyback Transformer.

compound on to it. This helps a great deal in dissipating the heat generated. The heatsink to which this transistor is bolted on to should remain warm. If

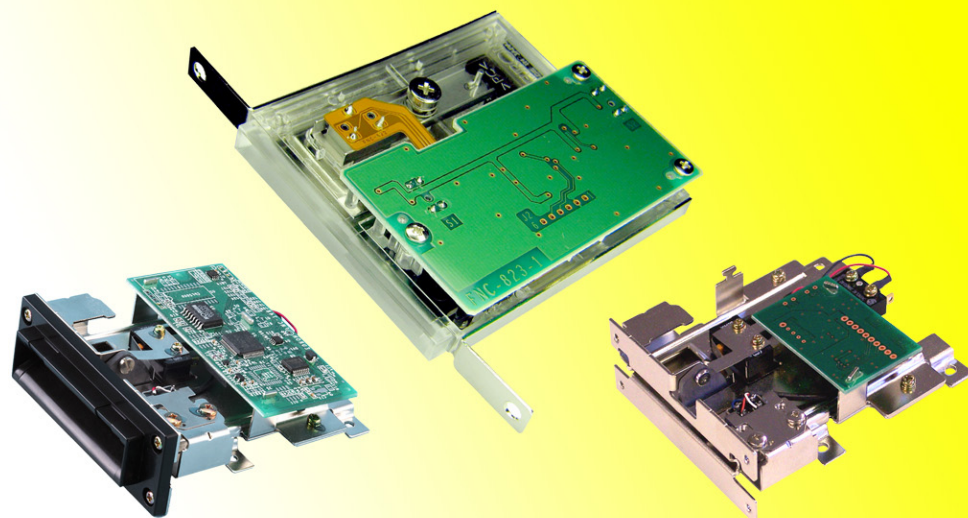
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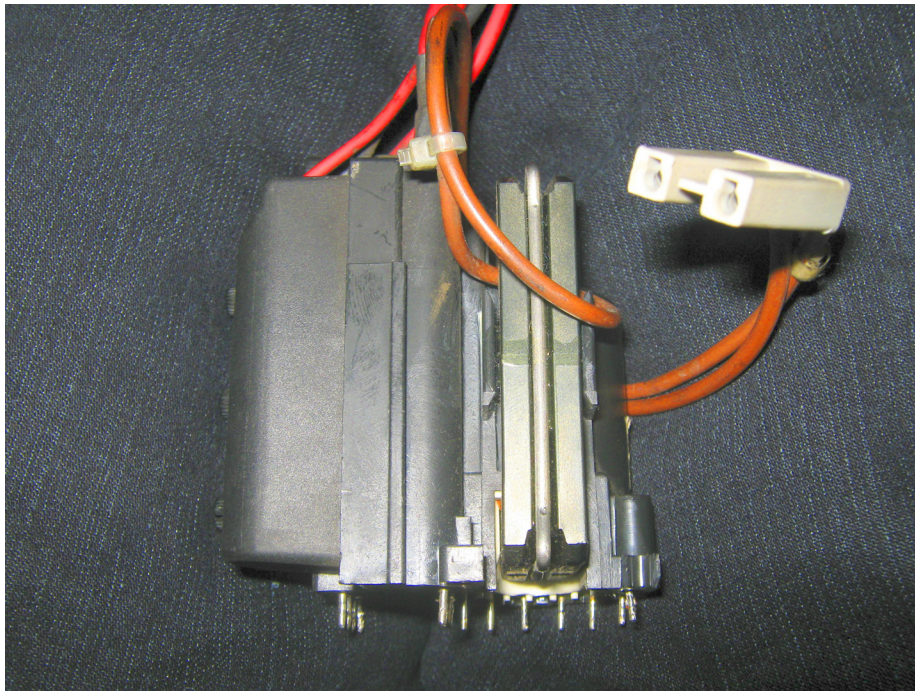
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after a while, this gets way too hot, then there's something wrong. It could be the case that the transistor you fitted in is not of the correct specs or the flyback could have some problem in the primary circuit driving the HOT hard. If left unattended, this will eventually end up FUBAR. In order for a flyback transformer to work, the B+ supply line must enter the primary winding and at the same time, a horizontal output transistor has to switch on and off at a specific frequency, depending on the resolution used.

The HOT switching is generated by the horizontal driver circuitry. The switching pulse originates usually from an integrated circuit, which will pass through transistor drivers, through the horizontal driver transformer, and finishing off on the base or the gate of the HOT itself. If this pulse

arrives at the HOT, but the B+ isn't present, then the flyback transformer will not pump up the high tension required. This pulse has to be at the right magnitude and frequency for it to drive the HOT properly. Many factors determine if the high tension will start to be pumped out of it.

(C) ABL (automatic beam limiter). This is usually referred to as a contrast circuit for the simple reason that whenever there's a problem with the contrast, a good point to start off from is the ABL on the flyback itself, and work your way backwards towards the electronics. Most times, a carbon resistor has decided to increase its value or a FUBAR capacitor is giving the impression that the tube has arrived at the end of its lifespan.

(D) AFC (automatic frequency control). This is an output pulse from the

flyback to the horizontal oscillator to synchronize the frequency of the monitor. Once this line fails, the picture will be shifted to either side of the screen and won't be able to be brought back to its original position no matter how much you try to set the Horizontal Centering potentiometer, even with the sub potentiometer on the monitor board.

(E) G1. This voltage is zero in some monitors or it is a negative voltage. Also known as the "control grid," Its function is to restrict the electrons coming from the cathode. It is a way to control the brightness of all three electron guns and also limit the maximum beam current of the CRT. If for some reason, this voltage is incorrect, the result could be a very bright picture with retrace lines, referred to as flyback lines. It is also possible, that with such a bright picture on the screen, there is obviously a heavy flow of electrons involved, which is basically a heavy flow of current, which can overload the power supply and send it to overload mode or even shutting itself down. In practice, the monitor would start up normally, then gradually the screen will get brighter and brighter, then it suddenly dies on you.

(F) The pin that feeds the heater filament. This is more related to older monitors as the newer ones supply the heater filament directly from one of the secondary windings of the switched mode power sup-

ply circuit.
(G) X-RAY protection pin. This is purely for safety reasons. This protection is activated when the anode voltage is too high. An AC signal is sent from the flyback to a circuit that rectifies it and measures the resulting DC voltage. If the voltage is too high, the horizontal section is disabled, preventing the generation of the high tension. The danger of being exposed to this radiation would hence be eliminated, but sadly enough, so would your picture. A typical fault symptom would be the sound of the high voltage dying off after a fraction of a second of operation just after start up. This is a good place to use the aforementioned NE-2 neon lamp. If it flashes once on startup, it's likely gone into X-Ray protection mode, often caused by bad electrolytic capacitors in the power supply. The increase in the X-Ray generation could be due to higher voltage supplies than rated, like the B+ for example.

(H) The Ground pin. Don't need to say a great deal about this, apart from the fact that it's important that this pin is soldered on properly to the monitor. I think that many of the faults one can encounter in a real life battle with a monitor with the possibility of having its flyback transformer which could be in one way or another FUBAR, have been mentioned here.

- James Borg
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Schedule of Events

Tuesday, December 8th, 2009	Wednesday, December 09th, 2009	Thursday, December 10th, 2009
9:00 am - 12:00pm Power Supply Repair Presented by Randy Fromm	9:00 am - 12:00pm CRT & LCD Monitor Repair presented by Randy Fromm	9:00 am - 12:00pm Ceronix CRT and LCD Monitor Repair presented by Troy Nofziger - Ceronix
1:15pm - 3:15pm MEI - BV Troubleshooting and Repair presented by David Oldham, Suzo Happ	1:15pm - 3:15pm 3M Touchsystems - Touchscreen Technology presented by Paul Hatin and Mark Roberts - 3M Touch Systems Field Application Engineers	1:15pm - 3:15pm Transact Technologies presented by Russ Wigé presents servicing and troubleshooting Transact brand, thermal ticket printers.
3:30pm - 5:30pm FutureLogic Printers Troubleshooting and Repair presented by David Oldham, Suzo Happ	3:30pm - 5:30pm Incredible Technologies slot machine.	3:30pm - 5:30pm JCM Bill Validators presented by Jack Geller

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Aristocrat Viridian Bill Door Switch on an Upright Game

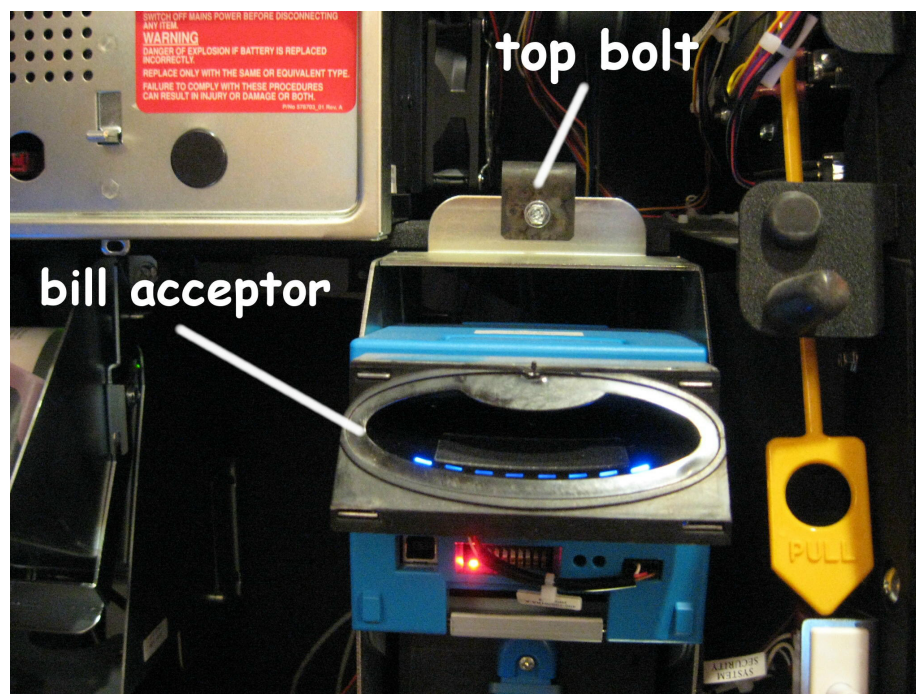
Did you ever wonder how the whole complete bill acceptor assembly came out of an upright Viridian? I was recently shown how easy it is. A call was received from a slot attendant that the “bill door” switch would not show closed. When I looked at it (located at the right hand side) there were two small bolts that hold the switch in place. The trouble was that a stubby sized Phillips screwdriver was even too long to fit into the area, so an “offset” one would be needed. At this point I was shown how to remove the complete unit. Near the top part of the bill head, there is one small bolt that needs to be removed. Next, there are two metal buttons located on the bottom of the assembly. Push the buttons upward

Quick & Simple Repairs #56

By Pat Porath

and pull the unit out. All that's left is a couple of connectors to unhook and that is it. Simply turn the

assembly upside down and the bill acceptor switch is very easy to access. It can be easily removed if broken, or tested with a meter,



whatever the case may be. With our game, the metal tab that is located on the micro switch needed to be slightly bent upward so when the bill acceptor door was closed, it pressed onto the metal tab better. This way it would work properly. To put the complete bill acceptor assembly back in place, slide the top part of the unit in first, then the bottom part. No doubt a lot easier than messing with the two small bolts with an off set screwdriver.

IGT AVP “Jokers Wild” Progressive Bill Acceptor Problem


While making a round on the gaming floor, I noticed an IGT AVP Jokers Wild progressive game had a bill acceptor error. It read something like “bill acceptor lost communication.” I reseated the UBA and noticed something. Neither the green or the red LED on the bill acceptor lit up. This was kind of unusual, why did it seem that it didn’t have any power? I reseated it again, only with the same result. Next, the bill acceptor and the GEN 2 printer were removed to check connections. I also looked at the back of the bill acceptor for any bent pins but they were OK. With both units removed, I started looking around to see if anything was out of place. It wasn’t long before I found a connector that went to the bill acceptor that wasn’t plugged in all

the way. When I found it, I shut the game off and then plugged it in all the way. When the game was turned back on, I had lights on the bill acceptor which meant now it had power. After it booted up, the bill acceptor cycled like it was supposed to and the game was fine. A loose connection behind the printer was the problem. Another game online.

IGT “Tabasco” Rebooting Itself

For some odd reason, we

had an IGT “Tabasco” S2000 Vision game (Three reels on the bottom and a LCD up top.) that would reboot itself a few times within an eight hour shift. A customer would be playing, the game would come up with a “com link failure,” it would reboot, then it would be OK for a while. What was going on? Why was the game rebooting? For troubleshooting (well, trying to troubleshoot) I swapped the upper LCD with a game that looked like it was exactly the same.




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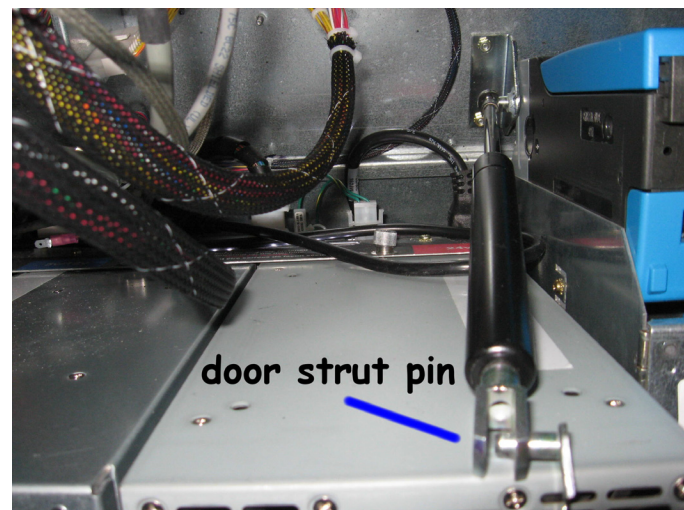
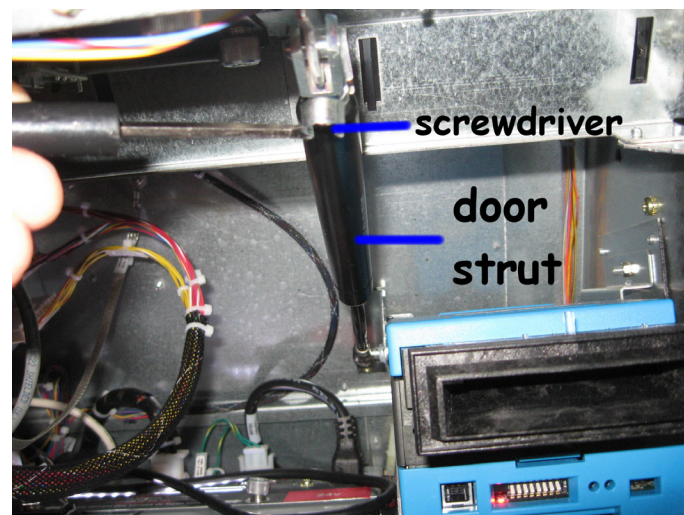
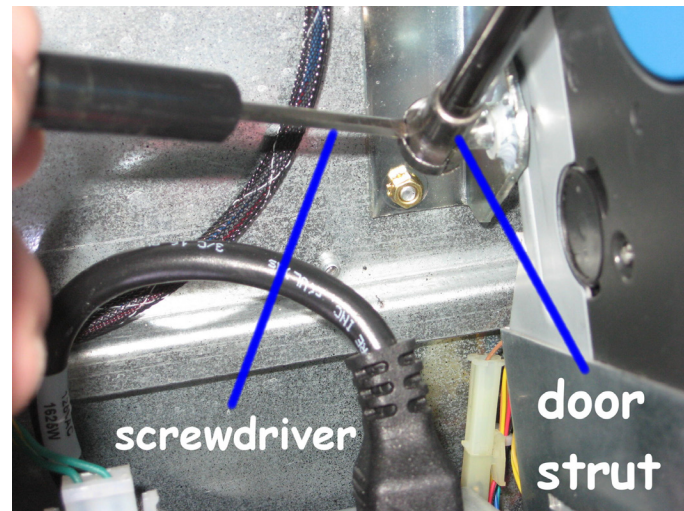
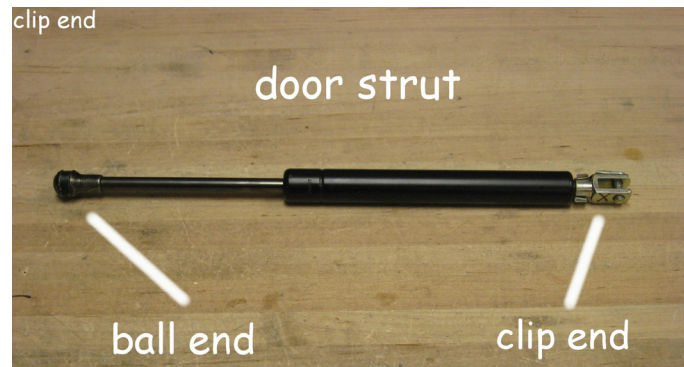
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It appeared to have the same “Tabasco” program but when I swapped them, the games did not like it at all. I had a “protocol” error. Maybe the “scratch RAM trick” (removing the RAM from the socket and shorting all its pins together) would help, but it didn’t. The LCD power supply was replaced too (located directly behind the LCD) but that didn’t help either. So, the LCDs were swapped back to their original games. What if the problem is in the LCD? A co-worker opened up the unit to take a look at the cooling fan located on the inside and found the problem right away. There was a pile of caps that were domed on top! The top of an electrolytic capacitor is supposed to be perfectly flat. Domed caps are bad caps. They were replaced and so far so good, the game hasn’t re-booted yet. So, something to keep in mind, if you have an IGT S2000 Vision that is re-booting itself, check the caps that are inside of the LCD assembly.

Bally CineVision main door struts

Have you ever run into a “Bally CineVision” or “Reel Vision” (slant top) where the main slot door wouldn’t stay up on its own? We recently replaced a bunch of the door struts on our Bally CineVision and Reel Vision” games. When the main door was opened, it wouldn’t stay up. If nobody was nearby to help you, you would have to prop a screwdriver in the door or use your head to hold it up to work on the game. What is the remedy, you may ask? To replace the door struts. Each game has two of them, one on the left side and one on the right. After time, they get weak and they don’t hold the slot door open like they should. To replace the struts is quite simple. First unsnap and remove the pin on the strut, it will be either gold or silver in color. Gently wiggle the door to pull the pin out but make sure you have the door securely with your hand. Next, on the ball end, push and turn a small flathead screwdriver into the clip that holds the strut on. Some pressure is needed. Once the clip is released, the strut should pull



right off of the game. Now that the strut is removed, replacement is very easy. The ball end only needs to be pressed on. It should snap right into place. On the pin end, take the pin out of the new one before it goes into the game, this will make replacement a bit easier. Lift up the pin end and slide the pin through the hole with the door opened all the way. Next, snap the pin clip into place so it will not wiggle out of the game. Then, slowly let the door stay open on its own, open and close it a few times just to make sure the struts are in place correctly. That is about it, pretty simple.

WMS Bluebird “System Halted”

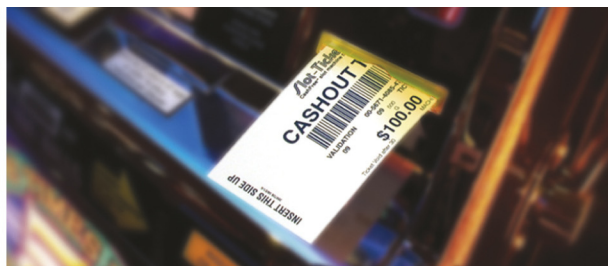
When I arrived on this particular morning, I was told that a game CF card had gone bad in a WMS Bluebird game. I thought it was kind of unusual, but I have seen them go bad before. It seems to me that CF OS cards fail more often than the game card. How can you tell if a game card is bad for sure? Swap it with the game next door if the program is the same. At the casino I work at we are somewhat lucky. If the game is a regular “house” game with a potential jackpot of less than \$100,000, the MPU lock doesn’t exist and we don’t need the gaming commission at the moment. We have the luxury of simply swapping

game cards. Of course we absolutely HAVE TO document that the “security tape” was broken. (Security tape, EPROM seal, game tape, game seal, all basically the same thing.) If NOT documented, a tech could be terminated on the spot.

Anyway, back to the “system halted error.” Since I was told that the game card was bad, another tech and I wanted to verify; just to make sure. They were swapped with the game next door and on the functional game it came up with the same exact error, which meant that it was bad. The tech ordered the replacement and it came in the very next day. Living in the

“Great Upper Peninsula” of Michigan, we don’t always receive “overnight” packages. We usually do, but not always. When we got it I asked if it was going to be “plug and play” (which means install it and it’s good to go) and he said yes. No RAM clear, no need to set game options. I admit I had my doubts, because as techs most of us know how things can go wrong but it went perfectly. The card was installed, power turned on, and the game was booting up great. After boot up was complete, the game was up and running.

- Pat Porath
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Editor's Note: Herschel mentioned that the Slot Tech forum seems to have some new techs on it that don't know much about slot machines. He suggested a short presentation on this venerable slot machine and I agreed. Here it is. - rf

AC Power Distribution

Here is where the AC power plug actually plugs into the game. Here is where we have fuses, power switch and a bunch of connectors with Black, White and Green sets of wires. Any set of three wires with these colors anywhere in the game is probably 110 V Ac and can bite fatally. We have two basic types of outputs, Switched and Unswitched. Switched power comes on when you throw the power switch. Unswitched is on all the time the game is plugged in. Typically we power the Player Tracking / Accounting system from unswitched power so it retains power even when the game is turned off for security reasons. Circuitry in the Accounting system monitors door openings even when power is off.

Power Supply

The Power Supply converts the 110 VAC line current

Basic IGT S2000

By Herschel Peeler

into +13 V and +25 V as needed for other circuits in the game. Most power supplies in the 960 series games are pin compatible and put out the same +13 and +25 V, but the current delivering (in Amps) capability may differ. There are other outputs from the power supply, but this paper only covers basics.

Motherboard
KA Backplane. Almost everything plugs into the backplane for signal distribution. The power supply plugs into the backplane. Most devices get their power through a connector on the backplane. The MPU plugs into the backplane and all devices get their signals through the backplane to the MPU.

MPU

(Specifics of this will vary depending on which MPU board you have. This is only a general description.)

The S2000 is the spinning reel version of the i960 family of IGT games. It is built around the Intel 80960 (aka i960), from which these games get their name. The 80960 is the microprocessor that really runs the game. It initiates most actions the game performs through the Output section of I/O and monitors what is going on through the Input section of I/O. The 80960 itself is the CPU (Central Processing Unit). CPU, Memory and I/O make up an MPU. Both these and the backplane make up the Logic Assembly.

The Base (or Boot) EPROM has most of the basic rou-

tines to run a game. Diagnostics and basic game play operation programs are here. This EPROM contains programs the 80960 runs. This is vaguely comparable to the BIOS chip in your PC.

The Paytable EPROM (Game EPROM) may only contain details of the pay table. This is mostly just data. What reel stops pay how much.

SRAM is static RAM where temporary data is stored. EPROMs can't change their data as the game is played. If the information changes it has to be stored in RAM. The advantage of EPROMs is that they retain their data even when power is lost. RAMs lose their data when power is lost. That is why the RAM has a backup battery to keep power to the RAM when the game is turned off.

SENET

SENET is the simpler I/O bus in IGT games for communicating to simple devices. Player Panel switches and lamps, key switches, panel lamps, and such are SENET devices. The SENET is comprised of Door I/O and Cabinet I/O cards. We can have 16 inputs and 16 outputs on each card. We can have up to 16 cards in a 960 design. We typically only have one Door I/O and one Cabinet I/O in an S2000 game. Other devices may be on SENET also. The Reel Lamp Controller, on games that have back-lit reel mechanisms, is also a SENET device. All these devices are connected in parallel. Any one of them malfunctioning can bring down all other SENET de-

vices if it hangs up one of the lines on the SENET bus. Each device on the SENET has an address associated with it. The SENET controller on the MPU board references a device by its address then sends and receives 16 bits of data to and from it. SENET is a proprietary standard IGT owns.

NETPLEX

NETPLEX is another serial I/O scheme. NETPLEX devices are always smart devices with their own microprocessor. They communicate to the MPU by ASCII codes. Each of these devices have microprocessors themselves and work in compatibility with the Base EPROM in the MPU. If the Base EPROM does not support the device the game can't use it. Just like you must have a software driver for a specific printer in your PC.

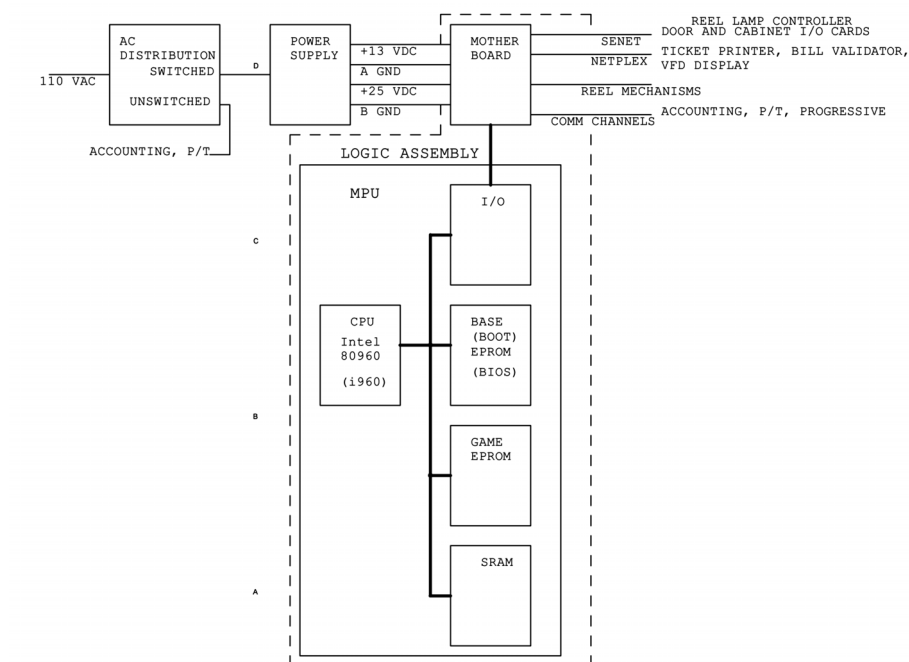
Bill Validators, Ticket Printers, and in S2000 games the VFD display are NETPLEX devices.

Reel Mechanisms

The reels are basically stepper motors. Instead of just running when power is applied the MPU controls the motion of each reel one step at a time through pulses. You can feel how big each step is by moving a reel manually. You can feel each step as it rotates. The MPU can spin a reel fast, slow, make it go backwards, or make it jiggle.

Each reel mechanism has a home sensor built into it. This is a set of optics that senses when the reel is at home, reel position one is on the pay line. The MPU knows how many steps past home each stopping position is.

In the play of the game the MPU will generate, typically, two random numbers for each reel. One for how many times the reel will make a



complete spin and another for what position the reel will stop at. These numbers are determined in a matter of microseconds after the player hits the Spin button. The outcome of the game is determined before the player can get his finger off of the button. The spinning of the reels is just for the entertainment of the player. This has to be in the makeup of

the game. It is a requirement that is power loss should interrupt a game play the outcome of the game after power is restored must be exactly the same if power were not lost. The only way we can do that is determine the game at the earliest moment and store the numbers in battery backed up RAM.

- Herschel Peeler
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About Randy Fromm: I am the publisher of Slot Tech Magazine. First published in 2001, Slot Tech Magazine is a monthly trade journal focusing on casino slot machine repair. I have been repairing electronics for the gaming industry since 1972. I really enjoy what I do and I love showing others how easy it can be. ***No previous knowledge of electronics is required.***

For more information, including course offerings and complete pricing information, please visit the website at slot-techs.com

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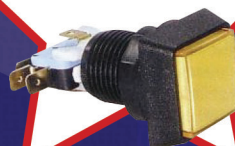
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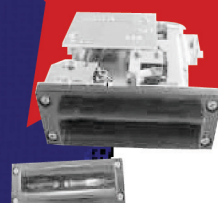
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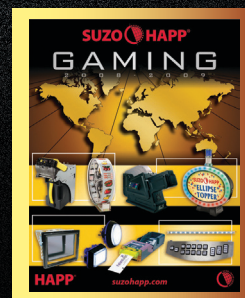
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