

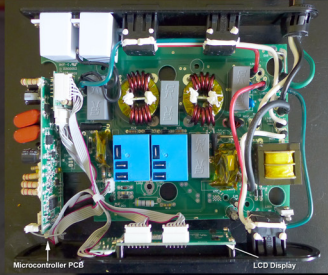
April 2014

# Slot Tech Magazine

Slot Machine Technology for the International Casino & Gaming Industry



Slot Tech Magazine



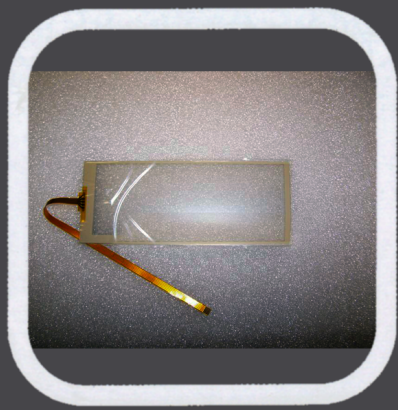
Bad Power Causing Machine Failures?  
Introducing  
Innovolt's Power Manager

On the cover: WMS showed these slot machines at G2E 2013

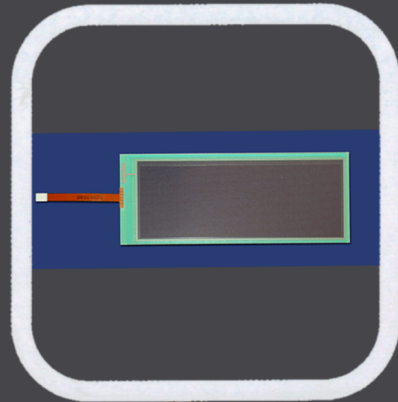
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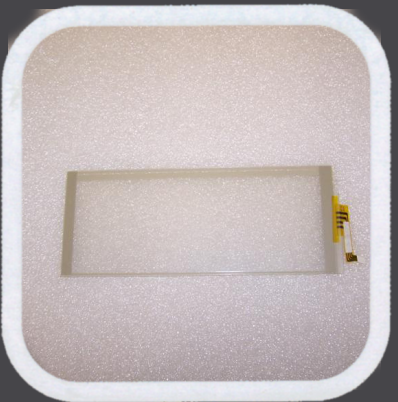
# Player Tracking System LCD Display Parts



5 wire touchscreen Bally Iview  
Hitachi LCD



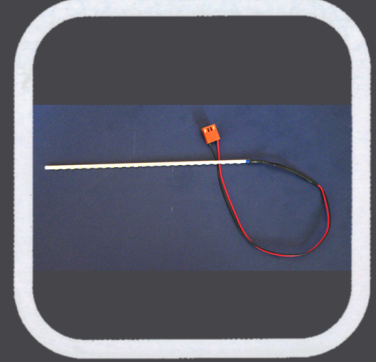
5 wire touchscreen Bally Iview IDW  
LCD



4 wire touchscreen IGT NexGen  
LCD



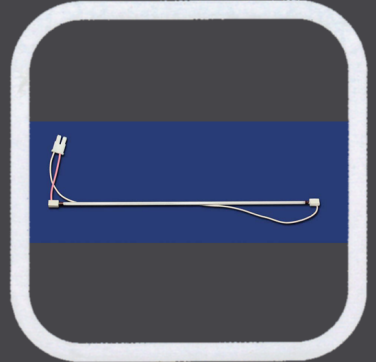
LED Strip for Bally Iview LCD



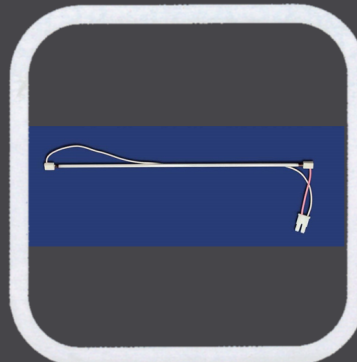
LED Strip for IGT NexGen LCD



CCFL assembly for Bally Iview  
IDW LCD



CCFL assembly for IGT NexGen  
LCD



CCFL assembly for Bally Iview  
Hitachi LCD



Protective Mylar for IGT NexGen  
LCD

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Page 20-Innovolt's Power Manager

Page 22-Subscriptions

Dear Friends of Slot Tech Magazine,

As technicians, we fix broken stuff (duh!). But we should also be considering what is, perhaps, the bigger picture. We ought to consider what causes stuff to fail and if there might be some way to prevent it in the future.

We've been covering the subject of destructive dust lately. Dust destroys fans and fan destruction leads to all kinds of other failures. We know the importance of installing air filters to prevent future fan failures. This month, our International Correspondent, James Borg (Malta) gives us another glimpse into the dusty, dirty world inside a slot machine. Turn to page four.

"Dirty" power is a preventable problem as well. Preventing future failures due to problems with the 120 VAC power is what Innovolt's new "Power Protector" and "Power Manager" are all about. If your casino is plagued with machine failures caused by power "issues" you'll be interested in this. If you lose machines every time you run a generator test, you'll be interested in this. If you lose machines every time you move from shore power to ship power (and vice versa) you'll be interested in this. If you lose machines due to electrical storms, you'll be interested in this.

Interested? Turn to page 18.

*Randy Fromm*  
Publisher-Slot Tech Magazine



Randy Fromm

## Randy Fromm's Slot Tech Magazine

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# Death by Dust

By James Borg

have stood up nicely to the vicious punishment imposed upon them on a daily basis by unhappy customers, and even with the passage of time, e-motions can still make their presence known.

Was it turned off on purpose or did the mains plug come undone after the machine had been recently relocated following some structural work? On opening up the cabinet, another possibility came to mind.

The neon switch inside was glowing bright red (which meant that there was juice entering the machine) but not a lot else seemed to be happening.

As sturdy as these machines are, they do suffer from illnesses. Luckily enough, they don't suffer many casualties and their weak points are minor faults which tend to crop up once in a while.

One known problem is the DVD ROM drive itself, which



**A sick machine is an eye-sore.**

gives errors mostly when the machine is starting up. This eventually leads to the total refusal of reading the media. Should one decide to change the DVD ROM Drive, make sure that the drive is just a player and not a recorder as otherwise, it won't work in this slot machine. Another fault, secondary as it might seem, is the electronic ballast's failure, a Teknoware TM80041 unit. If you are a bit finicky about the appearance of your machines,



**The neon switch inside was glowing bright red, which meant that there was juice entering the machine.**

**T**here's nothing worse than admiring a neat row of flashing, active slot machines, resembling proud soldiers standing to attention in their 'first best' uniform, when one of the brave souls suddenly passes out. No sign of movement is evident and things don't look so brilliant. Medics are called on the scene and the lifeless person is taken away to be made to feel better again. However, in the case of slot machines, a medic usually has to assess the situation, perform first-aid, diagnosis and most probably emergency surgery on top of everything else, on the very spot where the machine has fallen. A sick machine is a cause for concern, for when such a catastrophe occurs, apart from the machine losing revenue, it is also a great eye-sore to behold.

The unfortunate slot machine was an Atronic e-motion. For their age, they





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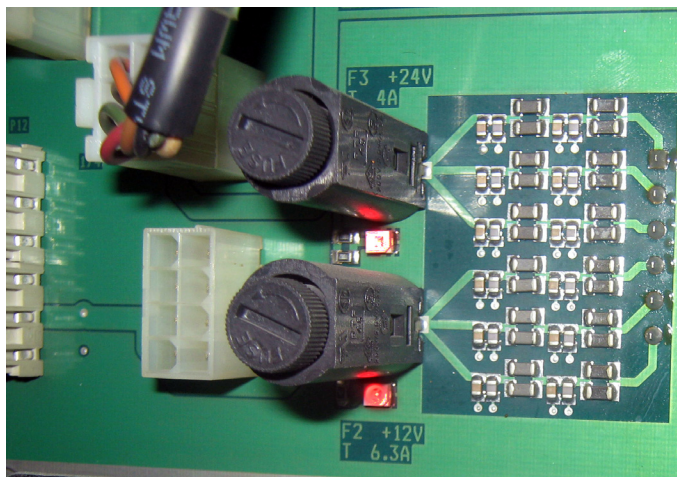
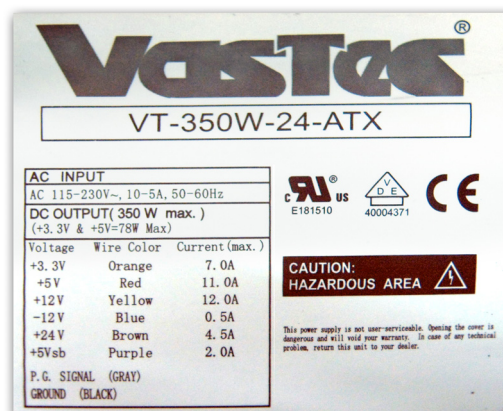
a dead ballast will be seen from miles away. The only drawback with replacing it is that it can set you back a little as these units aren't exactly on the cheap side. The last common fault I know these machines tend to suffer from is failure of the Power Supply Unit and my patient had all the symptoms.

The PSU for these machines isn't a standard off-the-shelf type of unit, as it has a 24V supply rail, rated at 4.5 Amps. Technically speaking, the machine will work nicely without this 24V, as it's only used for the hopper and to operate the motor to raise and lower the "playfield" (two screens at the front of the cabinet). Since we stopped using coins a while back, the hopper is an option we have done without.

As luck would have it, the PSU seemed to have indeed died a death, and a quick look at the cooler fan is a good indication of the situation. Buried deep underneath the settled layers of dust, the 12v fan was completely stationary. There wasn't even an initial kick, as if it was trying to rotate, but didn't. At this point in time, you have three options, as follows:

- A) Either the supply itself is the problem. (Replace the supply)
- B) The cooler fan stopped rotating. (Replace the fan)
- C) No juice is entering the PSU. (Locate where the juice circuit is broken)

Had the supply's fan jerked and stopped, it would lead to the conclusion that there could be a fault in the cabinet's electronics, causing an overload, which would stop the supply working in its tracks. A good way of locating the source of the overload, if any, would be to touch one of the multi-meter's probes to Earth, namely on the chassis, and with the other probe, prod the individual supply rails one at a time to see if there's a lower resistance than acceptable (power OFF, of course). It's easy to compare resistance readings from a working machine. This I did, but there were no





# It's in our DNA!

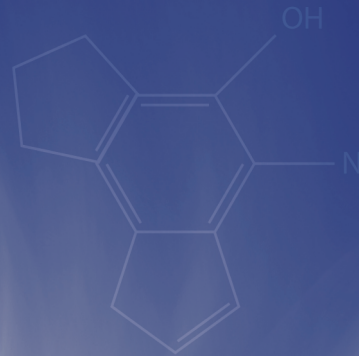
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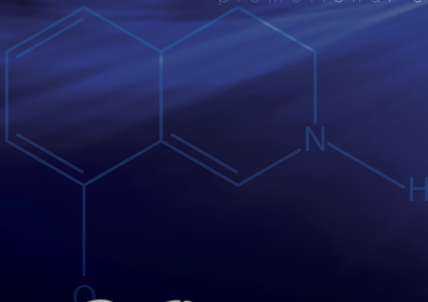


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major differences.

Another visual aid is to study the backplane. On this board, there are three surface mount LEDs. These should be glowing RED, indicating voltages are present. One indicates 5V, one 12V, and the other one is for the 24V. There are two fuse holders: one is for the 12V and the other for the 24V. In my case, none of the LEDs were on. I have had cases of a fuse being loose in its housing (which would break the voltage on that supply rail) but it wasn't the case this time.

Unfortunately, after examining all the evidence, I was looking at a replacement power supply. As luck would have it, yet again, I didn't have a replacement available—cue for shock and horror! I had to improvise, once more. It's amazing what a slot tech can do when faced with desperate situations. However, on a positive note, one gets to become quite an expert at repairing equipment, just by the use of a magic wand.

The next best thing to the original part is a standard ATX PSU, like the ones used in computers.

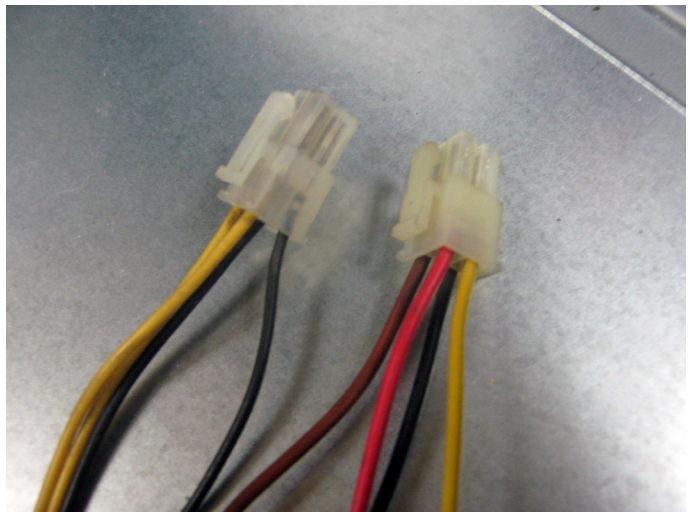
The one I had available was pulled out from a clapped-out P4 computer, which had a FUBAR motherboard. There is one slight snag with using a standard ATX PSU with the E-motion machines, and that is that one plug needs to have its wiring modified slightly.

Before wasting time messing about with the plugs, I wanted to make sure that the supply was fine. A good and easy way of doing this is to jump start it by shorting out the 'PS-ON' green wire to ground. In normal working conditions, this is usually connected to the Power-On switch on the computer. All the switch is doing, is shorting the 5 volts on the green line, to ground, which activates the supply. Once the 'PS-ON' line was pulled to ground, the cooler fan started working.

A quick check with a multimeter showed the supplies were all present, and correct. At this point in time, it was a relief, as I don't like leaving machines down if I can help it, especially over something as daft as a PSU.

The second phase of the operation was to modify the ATX 4 pin MOLEX 12V P4 connector. The one on the left comes from a standard PC PSU, while the one on the right belongs to the e-motion's supply. There are a few differences, as is obvious. For all intents and purposes, the brown wire, 24V, is not one of Earth shattering importance and life can go on as usual without it.

Once all the plugs were inserted into their destination, there's nothing better than hitting the power-on switch, and taking







# TechFest 29

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**SLOT TECH  
MAGAZINE**

Slot Machine Technology for the International Casino & Gaming Industry

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TechFest also includes instructions on LCD monitor repair, power supply repair and more, presented by Randy Fromm, publisher of Slot Tech Magazine and your host for the event.

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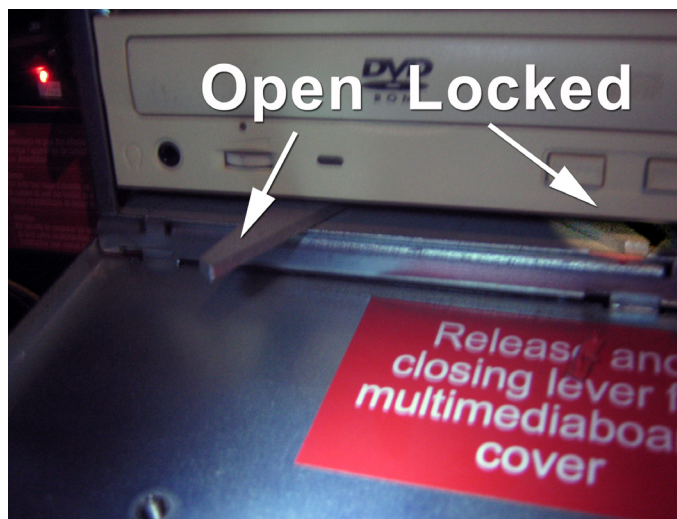
one step, or two, backwards, whilst admiring the whole machine as it comes to life. Erm . . . of course, that only holds true in an ideal world. Along the passage of time, I sadly discovered that mine certainly isn't.

The little neon in the mains switch did come on and so did the two LEDs on the backplane. The 24V didn't, which was a good job, otherwise I would have had to try and explain to the world of science, how a voltage materialized out of thin air.

So, it was just a question of waiting and holding my breadth, eagerly expecting the screens to come on with graphic information, flashing lights, and other wonderful things which make Atronic, great machines. Another success, another occasion to etch another notch on my rifle butt. However, it is true what they say, that when you don't want to wait for something to happen, time seems to come to a halt. I know these machines take their time to start up, but I think growing a beard during this period of waiting sort of led me to believe that something was not quite right.

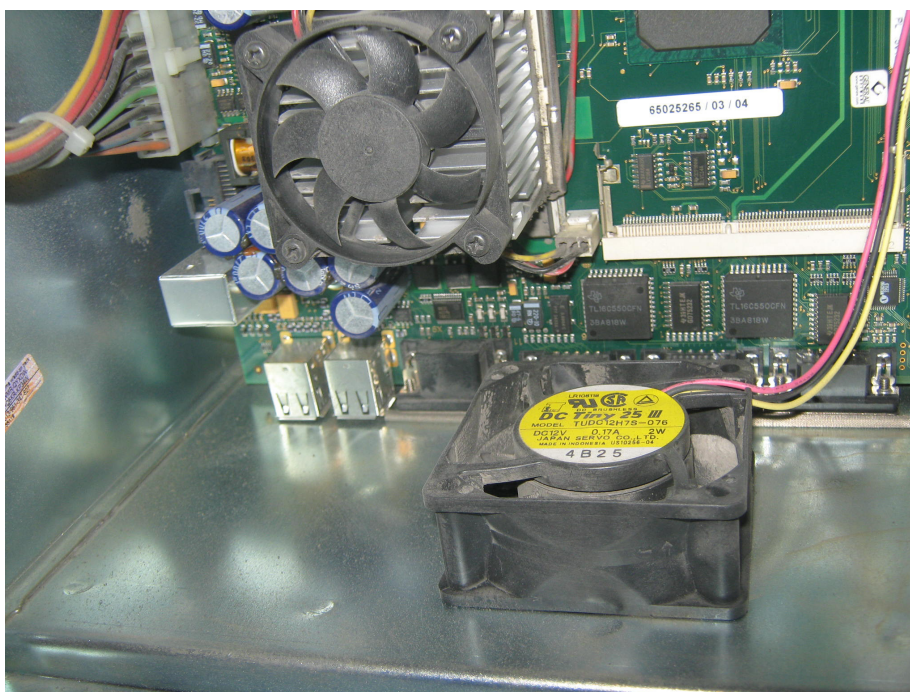
I turned OFF, and back ON, the machine a number of times, without any form of success. Alas, I had no option but to do the dastardly deed and take a peek at the electronics. Reaching the motherboard on these emotion machines can be a bit tricky and if you don't know the magic password (and no, it's not Open Sesame) you can have a whale of a time to figure it out.

As everything else in life, once you know how to do something, it becomes easy. The way to access the main board is to go through the logic box, which is top-right as you look at the inside of the cabinet.



This is the place where the DVD ROM Drive hides. Once the logic box's door comes down, right at the bottom, underneath the DVD ROM Drive, there is a label, in red, which says: "Release and closing lever for multimedia board - cover." This lever has to be pushed towards the left, which releases the locking mechanism of the multimedia board's metal cover. At first glance, it is a daunting sight to behold but the second time round, your eyes get adjusted to it, and after breaking it down to different areas, it's pretty reasonable.

A couple of items which stuck out like a sore thumb, were the cooler fans. These were too dirty for comfort, and they didn't





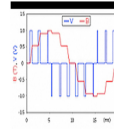
like it one little bit.

The one on the metal frame was totally dead, and the one on the CPU, was noisy, and just waiting for the final blow before it stopped rotating completely. The fine dust accumulated inside the unit didn't help matters a great deal and it signaled the doom of these two vital parts. The importance of having the cooling system operational, is high. Without adequate ventilation, components in the equipment will overheat dramatically, causing irreparable damage. This might not seem evident initially, but in the long run, the effects will gradually surface with disastrous repercussions.

The fan on the metal frame, as important as it is for dissipating the flow of air in this confined space, isn't as important as the one actually seated on the CPU's heatsink. A CPU doesn't like working at elevated temperatures as its operation could become erratic. It could easily cause a game to freeze mid-way in its tracks or do some other horrible thing it's not supposed to do. Having said that, it would not be the easiest thing in the world to explain about CPU cooler fans and the effect dust has on them, to a client who's foaming at the mouth, thinking the machine's struck a

jackpot. It is therefore highly recommended that cooler fans are kept clean and regularly serviced. In the eventuality of a suspicious or noisy fan, it's always best to just replace it. Cooler fans aren't exactly expensive and this exercise will, in

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the long run, save you a great deal of time and hassle.

I pulled both the FUBAR cooler fans out and installed a couple of working ones. Things were expected to look up but they didn't. Even though both fans were now rotating properly, there was still no image on either of the e-motion's screens. Could the CPU cooler fan's lack of fanning have damaged the CPU? Was the motherboard damaged? Was a memory module on the blink or could the video card have blown both its outputs? So many questions and so few answers.

Following a logical approach, the component which would have suffered the most during this disaster would have been the CPU. I can't imagine what temperature the device's core has had to endure and although these components should have some sort of thermal cutout, I still wasn't too convinced. What if the thermal cutout circuit failed? What if the CPU started melting before the thermal cutout came into operation? More questions, and no answers to offer back.

Still following the same logical approach, the next best thing which came to mind was to actually replace the CPU, despite remarks from my mate that they don't go wrong. Experience has thought me to doubt anything and everything. Nothing is etched out in rock and anything is possible in this wonderful and mysterious world of electronics, where expecting the unexpected has to be adopted as a way of life.

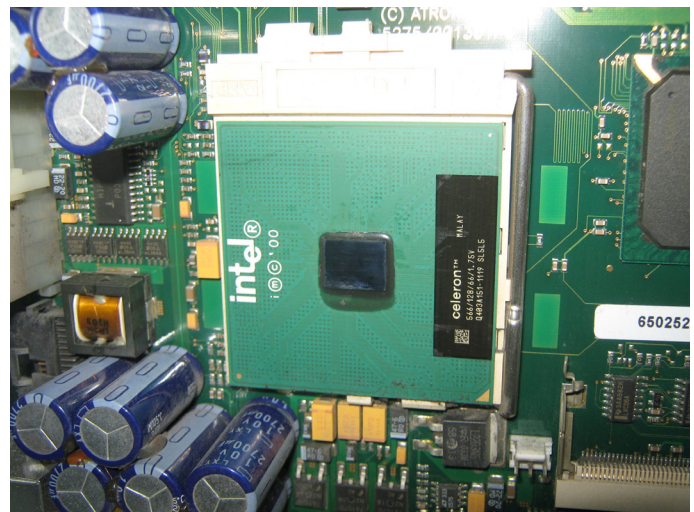
Luckily enough, I had a working Celeron 566/128 available. After gently lifting the metal lever on the side, the CPU can be released safely out of its socket. I inserted a replacement CPU, and applied some thermal paste on it. This is also recommended, as it greatly helps to transfer the heat from the device, onto the heatsink, which in turn will be blown away by the cooler fan anchored on the top.

With all the technicalities said and done, flicking the power switch produced the desired results, this time without my growing a beard. It's always nice to step back, and look at your work with a certain amount of pride, and satisfaction, at having given life back to a machine which had been certified clinically dead, and would have remained clinically dead, had it not been for your intervention.

It's always best, when possible, to try and trace the steps which led to a machine either dying or not doing as its told. In this case, the culprit was, without a shadow of a doubt (I mean doubt) the debris that had settled in on the fans, which caused their destruction, which in turn caused the destruction of the CPU.

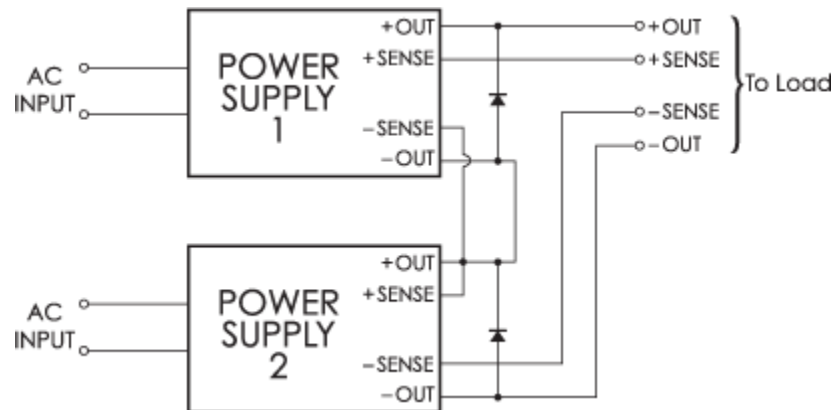
The moral of the story is that slot machines DO NOT like being in a dusty environment, no matter how much you cover them up, no matter if you think they are safe and no matter the many times you clean them (or think you have). The fine dust that settles in makes its way to places you've never even dreamed of and if your luck runs out, this dust might even start corroding your printed circuit boards. So beware . . . You have been warned!

- James Borg  
[jborg@slot-techs.com](mailto:jborg@slot-techs.com)





# Adding a Second +12 VDC Power Supply to Recover Your +24 VDC in Atronic e-motion



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Since the supplies are in series, the current rating of each power supply must equal or exceed the maximum current rating required by the load.

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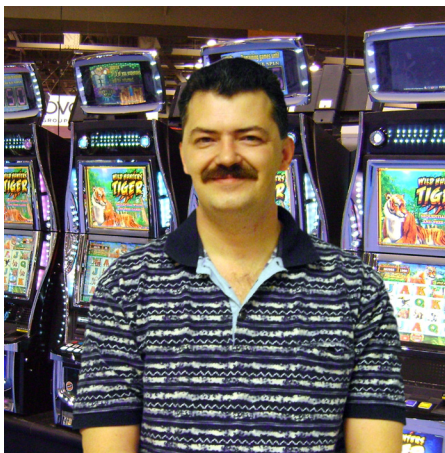


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### WMS Bluebird Upright Reel Tilt Wouldn't Clear

An upright WMS Bluebird was shut off because a Reel 3 tilt wouldn't clear. A co-worker and I were discussing that maybe the reel basket film that passes through the reel optic encoder could be dusty or it was possible the reel may be rubbing on something such as a cable located behind the reel or something on the main slot door. I brought some Q-tips with me on my way to check the game out so I could clean the reel film. Sure enough they had some dust on them. If one reel film was dusty it would only make sense to clean all five of them. Afterward, when turning the game back on, the small LCD in the door died. Sometimes they will come back to life when rebooting the game a few times or reseating the power connector on it. No such luck this time. Why not try reseating the CPU? When I opened the cover to the CPU, there was a ton of dust caked on the board. The board was reseated but I still didn't have any life on the LCD.

## Quick & Simple Repairs #105

By Pat Porath

Since I had to go to the shop anyway to grab a replacement LCD, I brought the CPU along in order to blow the piles of dust out of it. In the past I've seen machines act weird because of piles of dust in the CPU area. Processor boards overheat, causing games to reboot themselves, games "freeze" when a game won't work at all even though there are credits on it. Anyway...after blowing out the CPU with compressed air and grabbing a replacement LCD, it was time to fire up the game. Bingo! The LCD worked and after boot up, there weren't any reel tilts. Just to make sure the game was ready for play and we wouldn't receive a call to it, promo cash was downloaded to test the reels. I played the game as a customer would for a few minutes and everything looked good. No tilts at all. An easy cleaning of the reel basket film, cleaning the CPU, and replacing the bad LCD got the game running again.

### IGT S2000 Lost COM Between Game and Sentinel

While working on replacing top boxes on IGT upright G20s from a plain type to a top box that has "halo lighting," a co-worker asked me if I could look at a game that would only show a "door open" status on the Sentinel display. When the slot door is physically opened and closed and the display only reads open (or a steady closed) game to Sentinel communication has been lost on a Sentinel II. On Sentinel

III or N-Compass a red or yellow ring will be in a outer edge of the display, to show a communication loss. At the game on the Sentinel, there is a three-pin connector, and also a three-pin connector with one wire on the SMI board. This is the game interface cable that goes FROM the Sentinel TO the game. As I looked closer, a white wire was partially out of the connector. Could this cause the failure? It was pushed tightly into its connector and just for the heck of it, I opened and closed the main door of the game. Now the display corresponded with the door. OPEN and CLOSED which means game TO Sentinel communication had been re-established without even rebooting the game or Sentinel.

### IGT AVP "Sumatran Storm" Win Meter Issue

If you've had a "Sumatran Storm" game in which the mini progressive was won during a free spin bonus, the win meter could show an inaccurate amount for bonus game wins. There is a program upgrade to fix the problem. The old program numbers are (depending on jurisdiction) Game014-001PF2-J04, GI014-001PF2-J004V02, or Game014-001PF2-J05. Refer to IGT CN 5016 Rev A for more information.



While checking out toppers on a bank of Aristocrat Verve “Buffalo” games, I rebooted one of the games and the button panel didn’t come back to life; it was totally black. Usually when the game is booting up, the panel will display the Aristocrat logo. Not this time. Instead of turning the game off or putting it in “out of service” mode, it was left ON. I grabbed a cup of coffee and grabbed a spare panel from our shop. Once back at the game, somehow, the button panel came back to life. If I run into another one that isn’t working I’m going to wait around 10 minutes before replacing it just to see what happens. Unfortunately I didn’t have any luck getting the toppers working. They only stayed in a “blue screen” (basically a Windows XP start screen). All of the toppers in the bank are connected to a controller (similar to a desk top com-

puter box) where a simple reboot might fix the problem. The controller was rebooted a couple of times and a game was rebooted without success. Our Aristocrat field tech stated there was a very good chance the controller needed to be reconfigured. It reminds me of when an older progressive sign (now used for advertising) froze up. In other words the graphics on the display board froze in place and didn't scroll. I rebooted it, unfortunately it died. Don't blame it much though, it has been in the top part of the sign for years. An attempt was made to repair the controller, replacement of caps and such, but it was unsuccessful.

I was told that an IGT AVP G20 may have a bad power supply. First it had a ticket printer error, the game was rebooted, then it wouldn't boot back up. When I arrived only a few lights lit up on the

motherboard and no power at all was at either the upper or lower LCD. Re-seating the DC power supply didn't help at all, neither did reseating the motherboard.

I love swaptronics, therefore the power supplies were swapped with a working game next door. When the working game was turned on with unknown power supply it booted up properly. So did the game that had the failure! Both games booted up so I left both power supplies where they were. This was done in the morning and didn't have any problems for the remainder of my shift, I will have to keep an eye on it though. On the game side, where the power supply plugs in, one of the pins was black, probably causing a poor connection. Maybe the other power supply pin was in better condition which would make a better connection causing the game to work. Replacements have been ordered, just in case.



## WMS OLED Button Panel Quick Repair

One of our advanced slot attendants (who has been in the department for about six years) periodically goes through a bank of machines and tests all of the buttons while the game is in diagnostic test mode. I received a note that a Bluebird XD game had a repeat bet button that didn't work. Instead of grabbing a replacement panel, I thought I would check it out. When pressing it, the button didn't quite feel like it should so with my small pocket screwdriver, I carefully and gently pried upward on the side of the clear button cover, on all four sides. Once in diagnostic mode to test the button, it worked perfectly. Possibly something to try if one tests bad.

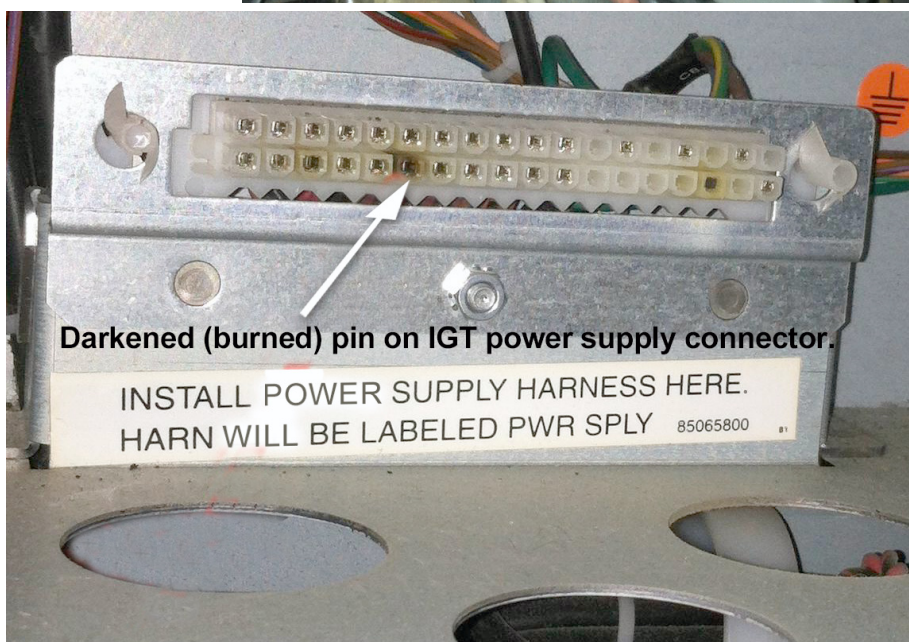
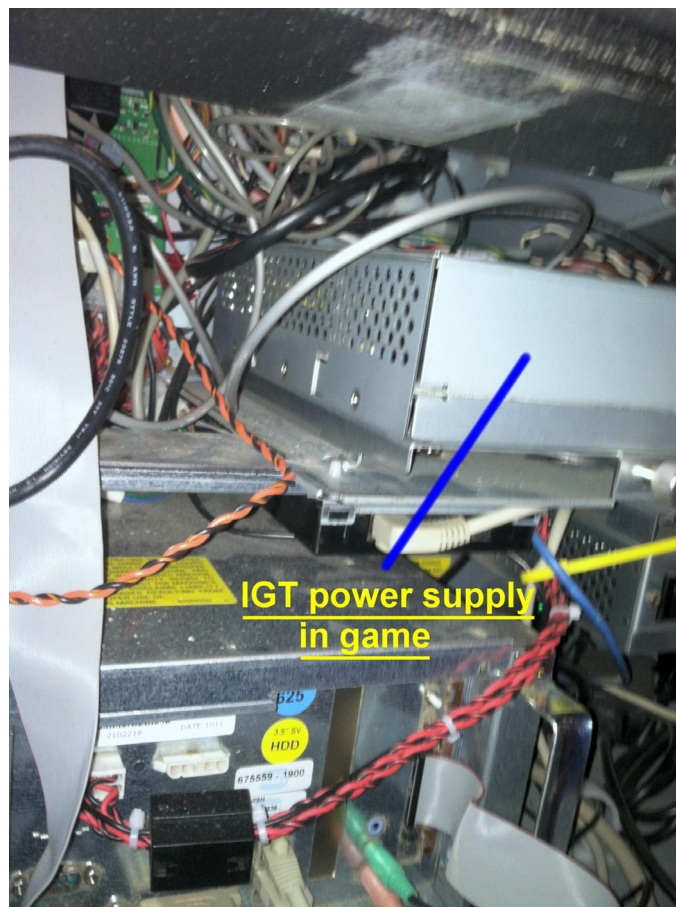
## WMS "Cheers" Power Cycle

If a "Cheers" theme game top box LCD displays the wheel bonus animation at a very slow speed, a power cycle may be needed. This is due to a memory issue (Some of us techs may call it "lagging." I've seen it on a few Bally Cinevisions before). According to WMS, a solution to the memory issue has been identified and game software engineers are preparing corrective software replacements to be submitted to GLI. Power cycling the game addresses the issue and must be done every two weeks for installed games until new software is available (I personally haven't seen the lagging on our "Cheers" games yet). More information available from WMS document number 1426740.

## WMS Blade Stand Alone Progressive Info

The WMS Blade has games that may be configured as stand alone progressives. These operate with a "must hit by" feature which limits the top of the progressive jackpot. Each time a progressive is reset (by a customer winning it or a RAM clear) the strike price cannot be guaranteed to be higher than the combined amount (reset amount plus the increment). Affected themes are as follows: "Great Zeus Fortune Palace, Lady Godiva, Lantern Festival Spirit of Dragon and Horse, Raging Rhino and Sea

of Tranquility." WMS reports that it has modified the operation of newer stand alone progressive themes to address the difficulty of recovering from a RAM clear and transferring progressive increment to the games. An example would be, if the progressive meter is at \$75.00 prior to the fault and the strike price is at \$95.00, after the RAM clear the tech applies the \$75 back to the progressive meter. The strike price resets to a minimum of \$75.01 to limit the chances of winning the progressive during a test spin. Progressive





increment added to the game during configuration before the game theme is fully loaded is not included in the strike price calculation. This allows the progressive increment to be added to a stand alone progressive game without the “must hit by” feature causing the next spin to generate a win. The funds transfer must be completed immediately after configuring the game before closing the main door (when the game loads). If the funds transfer is done after the game loads , after closing the main game door and before the first game play, the transferred funds will be included in the strike price. More information can be found on WMS document number 1437402.

### IGT “Lobster Mania 2” Display Issues

On an IGT AVP “Lobster Mania 2” or “Lucky Larry’s Lobster Mania 2 Multiway,” the game may falsely display a banner that a customer was eligible for the progressive. A power hit of the take-or-risk section of the “Pelican Bonus” caused the screen to stop displaying Pelican’s fish along with the fish value, which forced the player to make a take or risk decision without knowing the other potential win amounts. When 1024 ways with a multiplier was wagered but the progressive bonus bet was not wagered, the game falsely displayed a banner that showed the player was in fact eligible for the progressive. Possible affected software are Game014-005QH5-E01 media GI014-005QH5-E001 and GI014-005QH5-E001V02. For SBX Tier One properties, when approvals are received, new programs are included in the next scheduled library release. Please refer to IGT CN number 5027 for more information.

### IGT “All For One Free Spin Bonus Win error”

On an IGT SAVP “All For One Free Spin Bonus” after a large number of games were played, the program may have paid an amount based on the number of lines played RATHER than paying the amount won in the base game. The possible affected software is: GAME014-002MN2-D03, GI014-002MN2-D003V02, or GAME014-002MN2-D04. Refer to IGT CN 5005 for more info. (IGT CN = International Game Technology Customer Notification number.)

- Pat Porath  
pporath@slot-techs.com



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# The Fast Monkey

There is a solution to all of the casino world's weird AC power issues. We put a monkey inside each slot machine, trained to watch for power fluctuations. When the voltage fluctuates, they quickly adjust it to compensate or, in really bad cases, pull the plug to prevent damage to the machine.

That's the idea (sort of) behind Innovolt's PM15/PM20 "Power Protector" and "Power Manager" units. I'm always on the lookout for things like this, that might help casinos run more efficiently from a technical standpoint. However, when I first came across the unit, I wasn't really sure what the thing actually does or how it works. The promotional material is pretty vague, speaking only of protection from sags and surges and other transient AC power "issues" without getting into too much detail.

I had big questions when I ripped open my sample unit, about five minutes after I received it. It was small. It was lightweight. What the heck is it?

Nope, it's not a UPS so there's no heavy battery (and none to replace). There's no Super Capacitor either. There are no power semiconductors either, other than a pair of ultra-reliable, 7805 voltage regulators running so cool, the attached heatsink is no larger than the TO-220 package itself. They're just in there as part of a pair of little linear power supplies for the microcontroller (a PIC) and a few other circuits.

Innovolt points to the PIC and the firmware that is programmed into the device as what sets their solution apart from all others, with, according to the company "remediation algorithms and protection protocols

specifically designed for sophisticated electronics, the technology avoids nuisance trips while ensuring the long-term performance of equipment."

So, if there are no power semiconductors to somehow modify the current, what the heck is this thing doing and how does it function? How could this thing have any "muscle" if it is so small and lightweight?

It's like the difference between wrestling and judo (or u-jitsu or tae kwan do-whatever). You can use brute force or you can use a gentle flick in just the correct direction and with perfect (read "quick") timing to effect the result you're looking for. Innovolt's patented technologies use extremely fast algorithms to watch the AC power in real time and, if things get a little weird (or a lot weird) it can (and will) react in a variety of ways in order to protect the load (meaning,





# Powering the Performance of Gaming Equipment

*Innovolt provides next-generation power protection to vulnerable slots and other electronic casino devices*

By Ben Grimes, CTO, Innovolt

We are fortunate to live in a country where reliable power is the norm. However “always-on” power doesn’t always equate to clean power and our electrical system, which was built on technology primarily from the 1960s and 1970s, remains severely antiquated while our daily technology advances every year.

For example, take a look at slot machine technology which has gotten highly sophisticated since its inception back in the late 1800s. Slots have evolved from simple mechanical devices to complex computers that are plagued by seemingly unexplained performance issues—all of which negatively impact business through lost revenue, increased gaming operation costs and decreased customer satisfaction. What most operators don’t consider is the root of the problem in most cases is bad power and it is costing them. In fact, a recent 2013 gaming industry survey found that, on average, a casino with 1,000 slot machines:

- Experiences over 1,500 on-site fixes each year;
- Loses potentially \$456,000-\$576,000 each year from equipment issues;
- Spends an average of \$650,000 on support; and
- Has 120 slot machines to accommodate for peak-hour breakdowns.

## OUR VULNERABLE STATE

The truth is that today’s sensitive electronics have a low tolerance to voltage level fluctuations and traditional surge protectors and uninterruptable power supplies (UPS) do not guard against the vast majority of power events attacking slot games. Of power-related events that damage electronics, less than one-half of 1 percent are caused by voltage surges and spikes, and a small percentage of failures actually result from power outages themselves. These daily disturbances include a complex array of voltage sags, brownouts, overvoltages, power outages and voltage surges and spikes. No two disturbances are the same, and a single event or events overtime can be catastrophic to the lifespan and reliability of electronics. Even a minor voltage fluctuation can cause resets, component failures, NFF issues and loss of network connectivity. Innovolt recently began partnering with casino operators to study the power disturbances impacting the performance of slot games. After several months

of monitoring and remediating against these voltage fluctuations, the data collected indicated that sags and brownouts are the most common disturbance at the slot bank level. Most importantly, it was found that the Innovolt technology was successful in significantly decreasing service issues and greatly improved the uptime of slot games.

## RE-EVALUATING PROTECTION NEEDS

Backed by more than 25 years of scientific research, Innovolt’s offering provides quantifiable results that are proven to increase the reliability of gaming equipment and reduce the total cost of ownership by proactively preventing equipment performance issues at the outlet before they negatively impact business.

The technology is accessible to, and effective for all gaming electronic equipment, regardless of size. For the first time, there is a holistic and intelligent approach to managing electronics, resulting in equipment that performs better, lasts longer and requires fewer service calls.

Do you have a holistic and intelligent approach to managing your electronics? Are you prepared for daily power disturbances that have damaging effects to your equipment? By utilizing technology that manages and reports on power disturbances, slot game manufacturers and casino operators can extend the life of their equipment, resulting in improved product reliability and service-cost reductions.



*Ben Grimes serves as Innovolt’s chief technology officer. Innovolt intelligently protects and manages the productivity and usable life of the technology that powers today’s digital world. For more information, visit [www.innovolt.com](http://www.innovolt.com).*



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in this case, your slot machine).

This is an entirely new concept in “active” control of and/or protection from things like inrush current, voltage and current surges and spikes, voltage sag and other power-related “issues” that plague the slot floor, particularly during electrical storms or following a generator test.

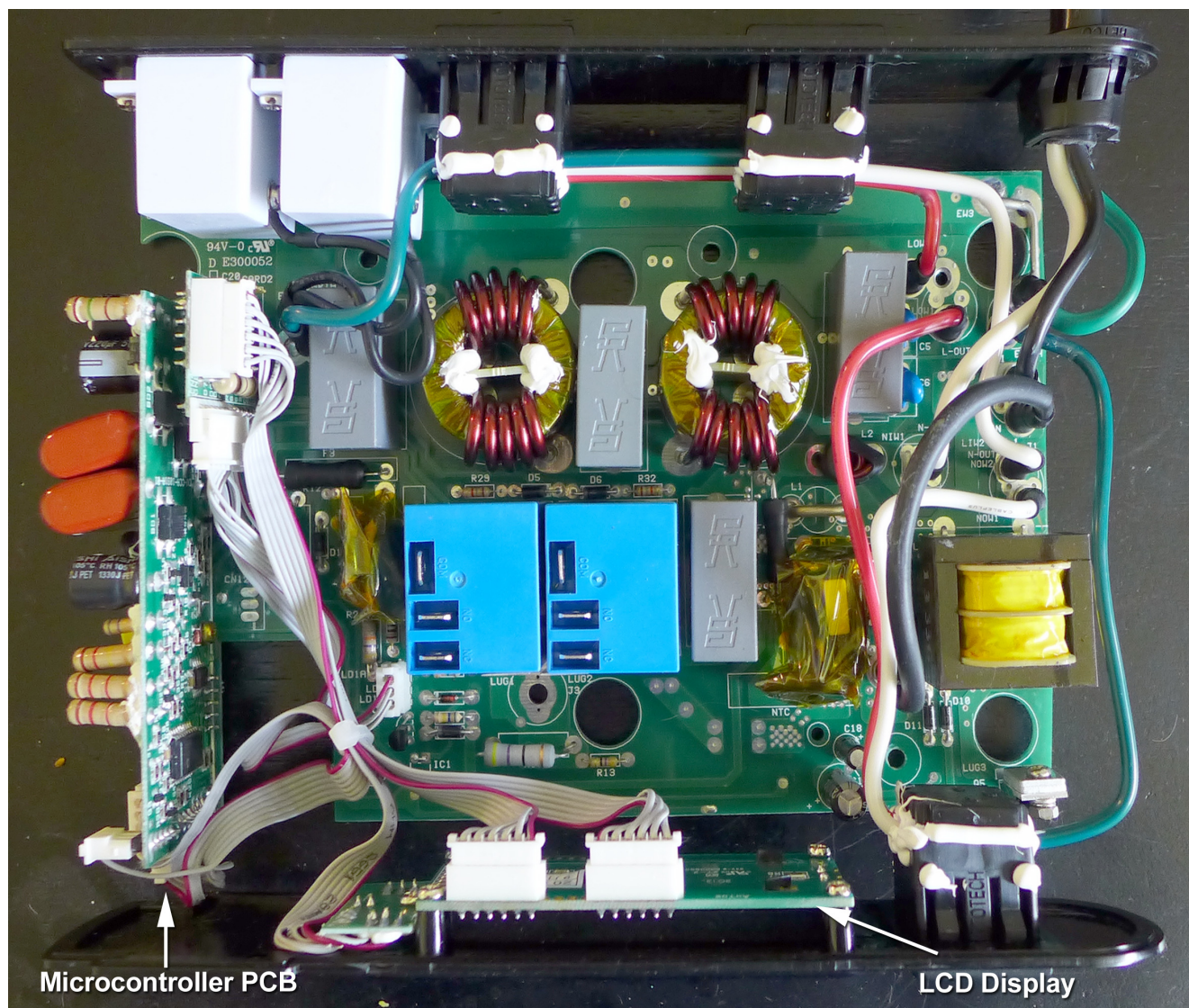
### What it is-How it Works

The unit does quite a few different things. It’s almost better to think of it as a “toolbox” of circuits and systems each reacting differently, according to

need. Some are fairly normal, “passive” circuits for doing things like suppressing EMI-Electromagnetic Interference (with some truly impressive, HUGE torroids wrapped in #12 wire) and limiting inrush current through the use of NTC thermistors. The Negative Temperature Coefficient thermistor has a higher resistance when it’s cold (typically around six Ohms or so) and drops to zero Ohms when it is warmed, typically by the current flowing through it to the load. This provides a “soft start” so the load isn’t slammed with “inrush current” which is the major killer of “things that fail

when you first apply power them.” Inrush current is often the culprit when the complaint reads something like “Funny, it was working yesterday when I turned it off. When I turned it on today, nothing!”

However, although NTC thermistors work perfectly well to limit inrush current when you first turn something on, they are useless one second later after they have heated during normal operation. In the 24/7 working environment of a casino, that thermistor might not come into play for years! Subsequent voltage surges and spikes cannot be mitigated by the





NTC thermistor once it's heated. It only works from a "cold start."

One of the features of this unit is that, when it senses a transient or over-voltage condition, it quickly will drop out a relay. The contacts on this relay are normally open and are connected directly across an NTC thermistor which is in series with the load. As long as the AC power is within normal operating limits, this relay is energized, effectively shorting across the NTC and applying AC power directly to the load. If an over-voltage transient is detected (and this happens blazingly fast, in 5 milliseconds-just ONE cycle of 60Hz AC power takes 16.66 milliseconds) the relay drops out and the NTC is magically connected in series with the load. Since the NTC is cold at this point (it had been shorted, remember?) it works perfectly, throwing its resistance, gently, in series with the load to act as a current limiter. The effect is instantaneous, protecting the load from a potentially destructive surge in less than a half-cycle.

If that isn't enough protection (if the duration or voltage of the surge exceeds the parameters deduced by the algorithm) the unit drops out another relay that removes the power from the load instantly and completely.

This same relay can be de-energized by other, "potentially catastrophic" power

conditions as well such as voltage sag. Notice I said "de-energized" and not "energized." This was not a misprint and it speaks to the cleverness of this design.

This device sort of takes a page from George Westinghouse. Mr. Westinghouse's "big idea" was to make the brakes on a train "fail safe." The system is always monitoring the pressure in the brake lines. As long as everything is normal, the brakes can be engaged or disengaged at will. However, if a hose breaks (a brake hose, that is) the brakes on that car will engage automatically, rather than being useless due to a loss of pressure. In other words, failure of the system will cause the protection to be automatically engaged, rather than disabled. In much the same way, this system uses a retriggerable monostable multivibrator circuit that must be retriggered periodically or it will "time-out" and the power to the load will be interrupted.

What re-triggers the circuit is NORMALCY. As long as things are within the load profile determined by the unit's microcontroller, the control circuit says "it's all good" and retriggers the multivibrator so it won't time-out. Anything outside of "normal" (over-voltage, under-voltage, current surge, etc.) is detected by the system, the microprocessor withholds from re-triggering the multivibrator and it times-out. This drops out the relay (its heavy-

duty, high-current contacts are in series with the AC power), cutting off power to the load.

The unit also protects the load during normal startup. There is a small "load simulator" circuit in the unit that samples the incoming AC power. AC power is first applied to the load through an NTC thermistor in a normal "soft start" mode. After a short delay and only after all nominal power requirements are met, the relay that shorts across the NTC is energized and power is applied directly to the load. Simultaneously, the NTC begins to cool. Cool!

## Reporting

In addition to performing the actual protection, the unit can also store and report on any events that have occurred. These are usually highly transient events so having dozens or hundreds of "eyes on" can really help you to identify and isolate power problems across the floor. The "Power Manager" units have a small LCD display indicating any faults. The unit can also be interrogated with a handheld unit or a smart phone with an IR reader.

Innovolt has offered a "No-risk" trial to casinos that want to give it a test. I hope to have a detailed report from a test installation at a particularly plagued operation in a future issue of Slot Tech Magazine.

For further information, visit [innovolt.com](http://innovolt.com) -STM

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

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**"I can help you bring down the  
cost of casino electronics repairs"**

Randy Fromm



# Buying Replacement Units!

Is your casino totally self-sufficient in repairing monitors, power supplies, bill validators and ticket printers or are you throwing away hundreds or thousands of dollars purchasing replacement units? While it is not exactly a "hidden" cost to your department, some slot managers simply accept the price of replacements as the "cost of doing business" while it progressively nibbles away at the casino's bottom line. **IT DOESN'T HAVE TO BE THIS WAY.**



**"OK.** You asked and I listened. My new tech class eliminates obsolete CRT monitor repair and the associated monitor repair lab. In just four or five days, your slot techs can learn to repair Power Supplies, LCD Monitors, Ticket Printers, Bill Validators and more. It's easy and it's fun."- Randy Fromm



In truth, most electronic repairs are pretty easy. Often, it's just a matter of testing and replacing a small handful of inexpensive, off-the-shelf electronic components. Sometimes, it's just one. For example, it costs less than 25 cents in parts to repair the most common failure in Bally power supplies. The entire process takes about five minutes.

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You will see an immediate savings to the casino, starting with the in-house repairs that will be performed during the class!



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](http://slot-techs.com)*

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