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Slot Tech Magazine

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Randy Fromm

Dear Friends of Slot Tech Magazine,

I have an updated tech class for 2013. Having phased-out CRT monitor repair and replaced it with LCD monitor repair (much easier), I had a full day that I thought I could use advantageously by modifying the five-day program to include an introduction to digital electronics, including a segment on using the oscilloscope and a quick look at surface-mount device (SMD) rework options and techniques.

I really enjoy working on digital electronics. You will too because it's easy to understand and really fun to play with. The flip side is that you must have extremely good soldering skills. While it is generally pretty easy to repair things like broken traces and lifted solder pads on a simple PCB like a power supply, self-inflicted board damage on something like a CPU can be a costly mistake.

This class is not a detailed look at microprocessor technology and it is not an "advanced" class that assumes any previous knowledge of electronics. It's just an additional peek into the next logical step in your career as a slot tech. Following your sucesses in repairing power supplies and LCD monitors, it is logical to move to on to digital repair (no pun intended).

The first class will be held March 18-22, 2013 in Slot Tech Magazine's home town of San Diego, California (actually, the eastern suburb of El Cajon) at Sycuan Casino. See the website at slot-techs.com for details and to download an enrollment form. There are only a dozen spots available. Enrollment is on a first-come, first-served basis.

Randy Fromm

Publisher
Slot Tech Magazine

Randy Fromm's
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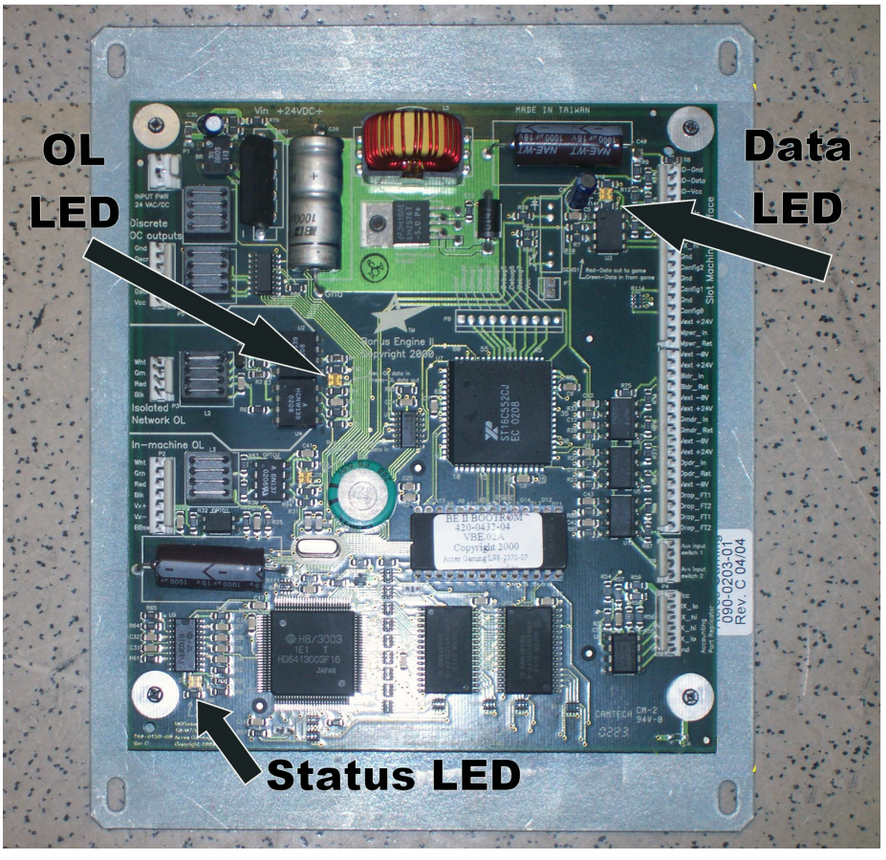
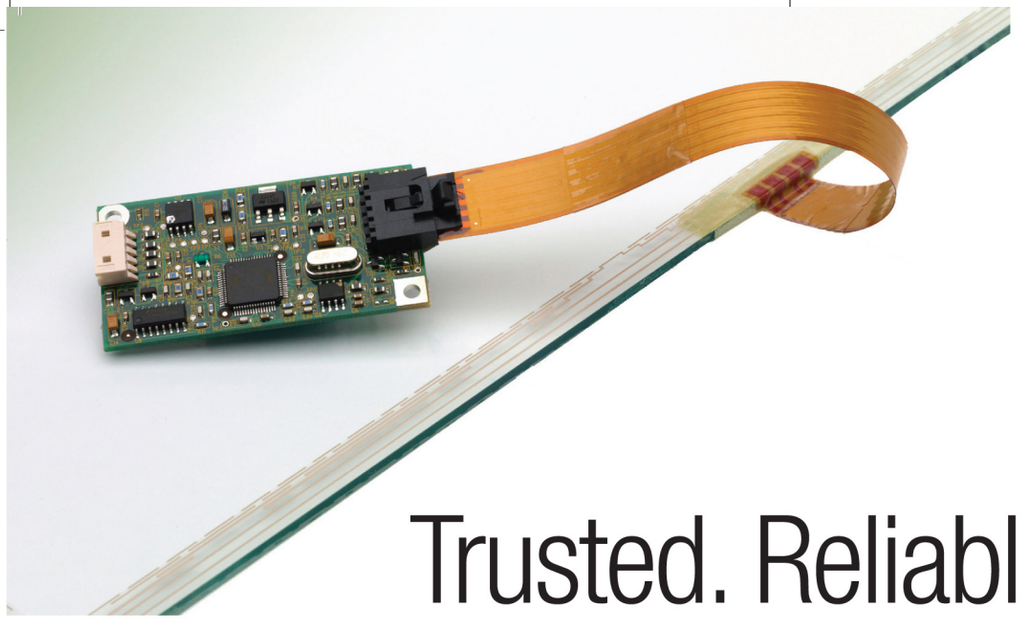
Acres (IGT Advantage) Revisited

By Vic Fortenbach

In a past issue of Slot Tech Magazine, I covered the hardware aspects of the Acres Player Tracking system. In this article, it's the software's turn or, more specifically, how the software on the BEII can help the slot technician diagnose and repair any Acres player tracking issues. IGT now owns the Acres player tracking system and has renamed it the IGT Advantage system. In this article I will cover the Advantage system that utilizes, the bank controllers, the Video Florescent Display (VFD) and the Bonus Engine II (BEII).

The two visual devices that can be used to troubleshoot the Advantage system are the LEDs on the BEII and the VFD itself. The condition of the LEDs on the BEII are limited to just red and green and on/off but knowing how to decipher these LED cues makes troubleshooting easier. The VFD is mounted above or between monitors on the slot machine cabinet and all massages that are displayed are readable. The most important LED on the BEII is the status LED. This LED is located on corner of the BEII, opposite the large white machine connector and near the BEII RAM clear two pin connector. This LED should be green all of the time, except when the BEII is powered up. On power up, this LED briefly turns red and then turns green. If this LED is alternately flashing red and green, the BEII is in reset mode. When the BEII is in this mode, the BEII is trying to reset itself to clear a problem. Unfortunately, most of the time, the BEII never recovers from this error. The status LED will keep flashing red and green over and over. If this LED is flashing, the keypad will be lit but will be unresponsive. The letters COMM will be displayed on the VFD and the card reader bezel will be yellow or blank. Most of the time the BEII status LED issues are caused by drink spills on the BEII itself. Taking the BEII for a bath and scrubbing it with a brush will clean the BEII of any corrosion; it's OK to get an unpowered BEII wet to clean it. I use a tub of water with a small amount of dawn dish washing soap to get any dried drink spills off the BEII. Just make sure it's completely dry before re-powering it. Cleaning the BEII with soapy water and a





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stiff brush will most of the time restore the status LED to green and the BEII to normal operating mode. There are some very rare situations where cleaning the BEII will not fix the flashing status LED problem. In this case, a component has failed and requires more in depth troubleshooting and repairs.

Once the BEII has been verified to be operating correctly, the OL LED indicator is the next LED to watch. The letters OL stand for On Line. Like the status LED, this LED is also two colors, red and green. Observing this LED while the BEII is connected to the OL line and the Advantage network will guide the technician to any network issues. This LED is two colors by design, red for data coming into the BEII and green for data going out of the BEII. Since this LED lights up for any data activity, it will be dark for only one of two reasons: The 12 volts on the OL cable is missing or the BEII has no utilities programmed (shot) into it. The 12 volts on the OL cable is required to properly power the "buffer chip" that isolates the BEII from the outside world. Without this buffer chip, an accidental short of higher voltage or a static pulse on the OL line might destroy the BEII. This chip provides a line of isolated defense so the odds of this happening are rare. The 12 volts drives the buffer chip with the OL LED connected to the output of this chip. The 12 volts as well as the data in and data out wires come from the OL cable. This cable connects to the BEII by way of a white, four-pin connector. Pin 1 has +12 volts on it and pin 4 is ground. Pins 2 and 3 are the data in and out pins of this OL connector. Don't get tripped up by visually looking at this connector, the pin 1 wire is colored black and is the +12 volts, the white wire is ground and connected to pin 4 (I was taught that the black wire should be ground).

Watching the OL LED is an excellent aid for troubleshooting OL issues. If this LED seems to be stuck and flashing fast a red pattern over and over again with no green LED ever lighting, the BEII is stuck or hung. The network is trying to communicate with the BEII but it just does not want to answer. A RAM clear on the BEII will usually solve this issue. Because the BEII is in a loop, sometimes the BEII will not RAM clear when you short out the RAM clear pins. Power resetting the BEII will knock the BEII out of its loop and allow a RAM clear to be performed. Keep in mind the status LED on the corner of the BEII will be green. The last status LED on the BEII is the data LED located nearest to the long multi-pin connector on the edge of the BEII. This LED is also red and green and visually displays the data to and from the slot machine. This LED will be flashing a dim green whenever the slot machine is off or still booting up. The BEII is trying to talk to the slot machine but because it's still booting up, no two way communication exists. Once the slot machine has booted up completely, this LED will flash fast both red and green alternately. Once this LED is flashing both colors, this is an indication that data is flowing in and out of the BEII correctly.

Once the BEII is functionally working and displaying messages to the playing guest on the VFD, there may be an occasion where some messages displayed do not make sense. One of the strangest messages I have seen is the UNK TOK (XX.XX) message. The UNK stands for UNKNOWN and the TOK means TOKEN. The XX.XX is two sets of numbers separated by a dot. These numbers will be identical if this same issue exists on a different slot machine. This massage is displayed when a player inserts their card in to the card reader or when the guest selects on of the bonusing features. Even though this message is displayed on the VFD and does not look normal, the player is still earning their points. This message is caused by some incorrect data or garbage in the RAM of the BEII. This message showed up on our system after a major software upgrade. You may also see the UNK TOK message randomly on a single slot machine VFD. A BEII RAM clear will remove this message from the VFD.

Another VFD message you may encounter is the BONUSING DISABLED message. At first glance, a slot technician may be inclined to think this problem is a "back of house" problem but in reality, it's a slot machine problem. The Bonus Disabled message is caused by very quick occurrences of a slot door opening and closing multiple times a minute. These door open and closings are called cues and are stored in the BEII until the

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system can fetch and act upon them. Sometimes these events occur too fast, causing the BEII cues to decrease to a very low number. Once the cues get too low, the BEII will "shut off" any bonusing functions. If the door open messages keep coming into the BEII at a fast rate, you may see the BEII CUE FULL message on the VFD. The BEII CUE FULL as well as the cue numbers will slowly increase once the door issue has been corrected. The BEII cues can be displayed on the VFD by inserting your "nines" card in to the card reader. The cue numbers will be the first item displayed on the VFD. Depending on your network software version, the highest cue numbers displayed will be 120.00 or 240.00.

The VFD message HOST DOWN is pretty self-explanatory. It means there is no valid communication between the network system (HOST) and the BEII. The OL LED will be flashing red and green as normal but the data on the OL line is not correct or valid. Most of the time, this issue is caused a bad BEII on the same bank controller OL line. You will have to use process of elimination to find the bad BEII to bring the host back online. The status LED on the corner of the bad BEII will be flashing red and green alternately. To get the system back online and talking, replacing the BEII is the only option.

EGM INIT and COMM are the most seen VFD messages. EGM INIT stands for Electronic Gaming Machine INITializing. When this message is displayed, the slot machine is not communicating with the BEII. There are several reasons this message will display. The data cable from the slot machine to the BEII somehow got disconnected. Another reason may be the slot machine is still booting up or has been reset. In the case of Aristocrat machines, the SPC board is not communicating with the BEII. A visual cue to this issue will be one or two flashes of the red LED on the SPC board itself. On the IGT AVP machines, the small RS232 interface board that connects to the back plane board is disconnected or not functioning. These little boards, like the BEII, also have red and green LED indicators to visually display the communication status but the colors will be reversed. BEII data communication colors are green for data out and red for data into the BEII, on the RS232 board a red LED indication is for data out from the slot machine and green for data in.

Last but not least is the VFD message COMM. This COMM message stands for COMMunication and is displayed on the VFD whenever there is data loading from the backend system or if the BEII is not functioning. This COMM message is actually stored in the VFD itself so it will display whenever something is not right with the BEII. If you encounter this COMM message, look at the OL LED. It should be pulsing mostly red. This is an indication that the BEII is loading data from the back of the house. The time frame for loading data varies between three and seven minutes. If the BEII is functional, this may be an indication of a bad VFD. Always RAM clear the VFD before replacing it, this will save you some time.

- Vic Fortenbach
vfortenbach@slot-techs.com

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Repairing LCD Monitors

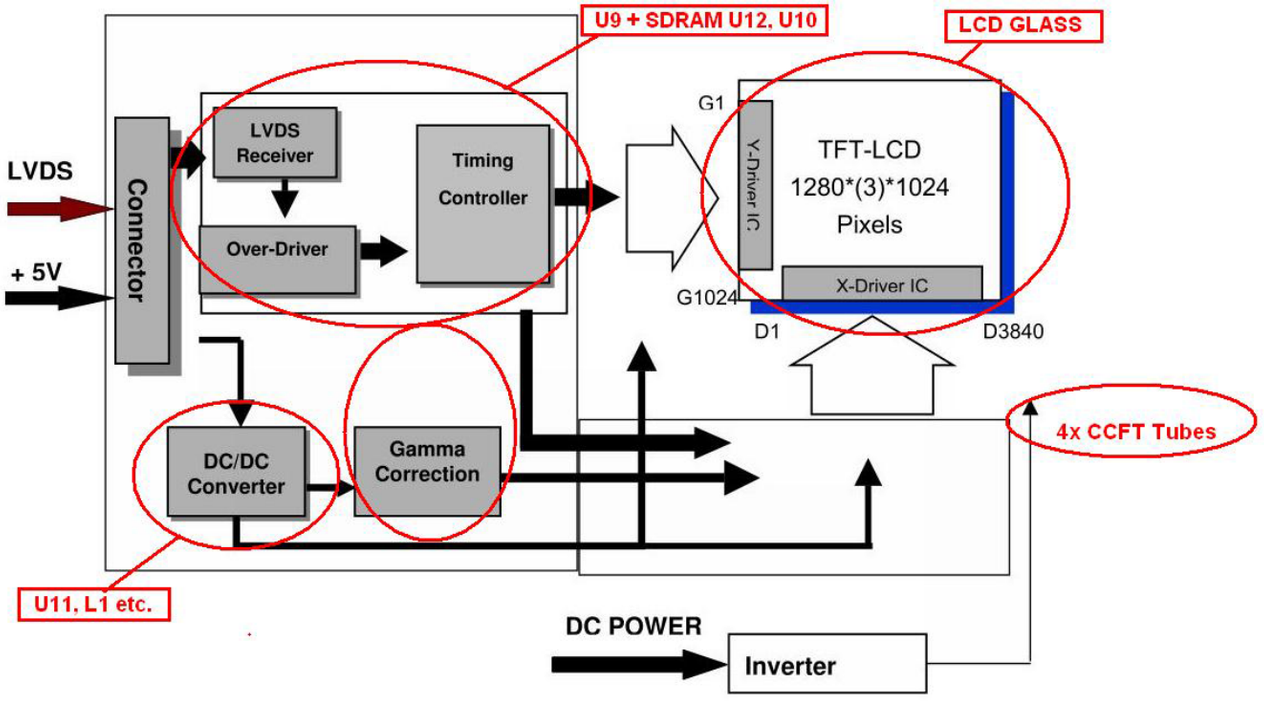
Description and Repairs of TFT LCD panels

By Henry "Heno "Kollar

Today, I want to bring closer the description of LCD panels, because this is most important and most expensive part of the LCD monitor. This article shall primarily address LCD panels with a screen ratio of 4:3 and 16:9 with screen sizes from 17 inches to 22 inches.

Regarding the backlight for the LCD panel, I will it mention only briefly. Mostly they use two to six pieces of CCFT (Cold Cathode Fluorescent Tube). Editor's Note: We call them Cold Cathode Fluorescent Lamps here in North America. Remember, Mr. Kollar is from Slovakia.

These luminous tubes are powered by AC voltage from 1000 to 2000V at frequencies from 40 to 80kHz. The voltage is high because, given the small diameter of the tubes, it is not practical to use a cathode



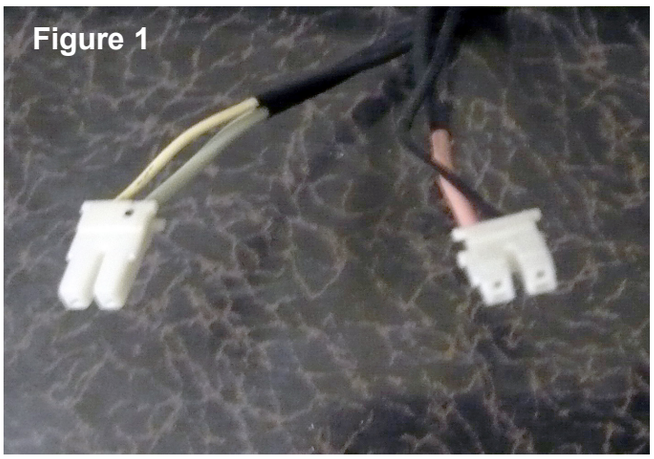
19 inch TFT LCD panel AU Optronic M190EG01

The block diagram in Figure 2 shows what is inside a 19 inch LCD panel from the manufacturer AU Optronic, type M190EG01.

heater as it is for conventional fluorescent tubes. Eliminating the hot cathode also has a nice side-effect in that it extends the life of of the lamps up to 40,000-50,000 hours. This high-voltage, high-frequency AC comes from the monitor's inverter. The inverter uses a DC input (typically +12 VDC) as a power source and creates the high-voltage, high-frequency output that directly powers the lamps. It is a DC-AC converter, essentially the opposite of the AC-to-DC conversion of a power supply.

The inverter simultaneously measures the current in each of the tubes. If the current flow in one or more of the tubes is too low then the tube is ruptured, disconnected or worn, or the CCFL inverter itself is damaged. If the current is too high then it is either damage to the isolation of the leads for some tube(s) (wires pinched or nicked, cutting through the insulation to the bare wire) or the CCFL inverter is bad. In either of these two cases, the inverter/CCFLs work and the good tubes shine for only one or two seconds before turning off automatically as the system switches to "safe mode."

Figure 1 shows the most common type of connector for connection CCFT tubes to CCFL inverter. It is known as a "JST" connector.



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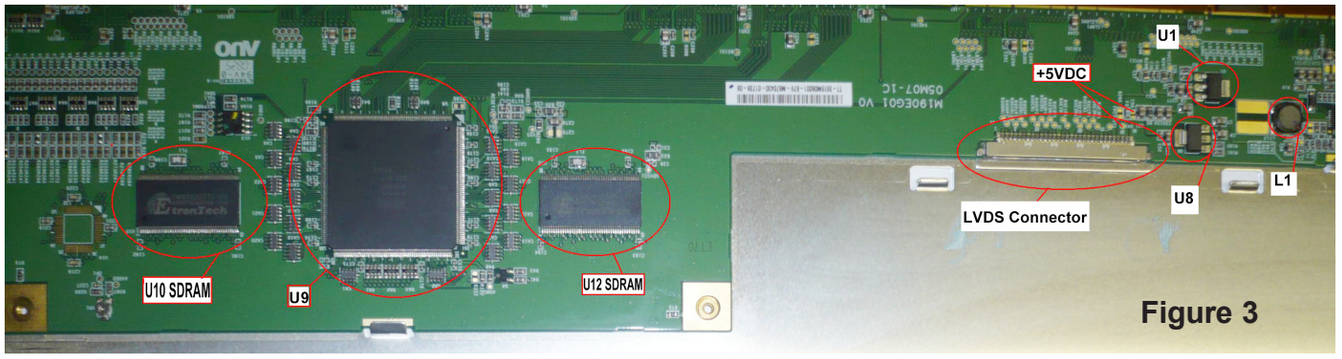


Figure 3

Now I will describe the actual LCD panel electronics that ensures that the picture is displayed correctly. Most of today's LCD panels use the LVDS (low voltage, differential signaling) interface to display an image. You can read more about LVDS in the Wikipedia but in a nutshell, LVDS is a way to move a lot of high-speed data around (in this case, between the monitor's PCB and the LCD panel itself) without excessive power dissipation and without radiating a lot of spurious signals into space.

The block diagram in Figure 2 shows what is inside a 19 inch LCD panel from the manufacturer AU Optronic, type M190EG01. Of course there are different manufacturers and versions so there are differences between the various types of panels but they are fundamentally very similar so in the point of view of the repair-ability of defects, it is only necessary to get your bearings on the electronic board of a specific LCD panel.

Figure 3 shows overall view of the PCB electronics LCD panel after removing the cover.

Figure 4 shows a description of the LVDS connector and location of the components of the power circuits and the DC-DC converter.

If you need to replace unrepairable LCD panels but an exact replacement is not available, then I recommend you contact an authorized LCD panel service, Suzo-Happ, CasinoTech or Patriot Gaming. My European friends can go to www.elsin.eu.

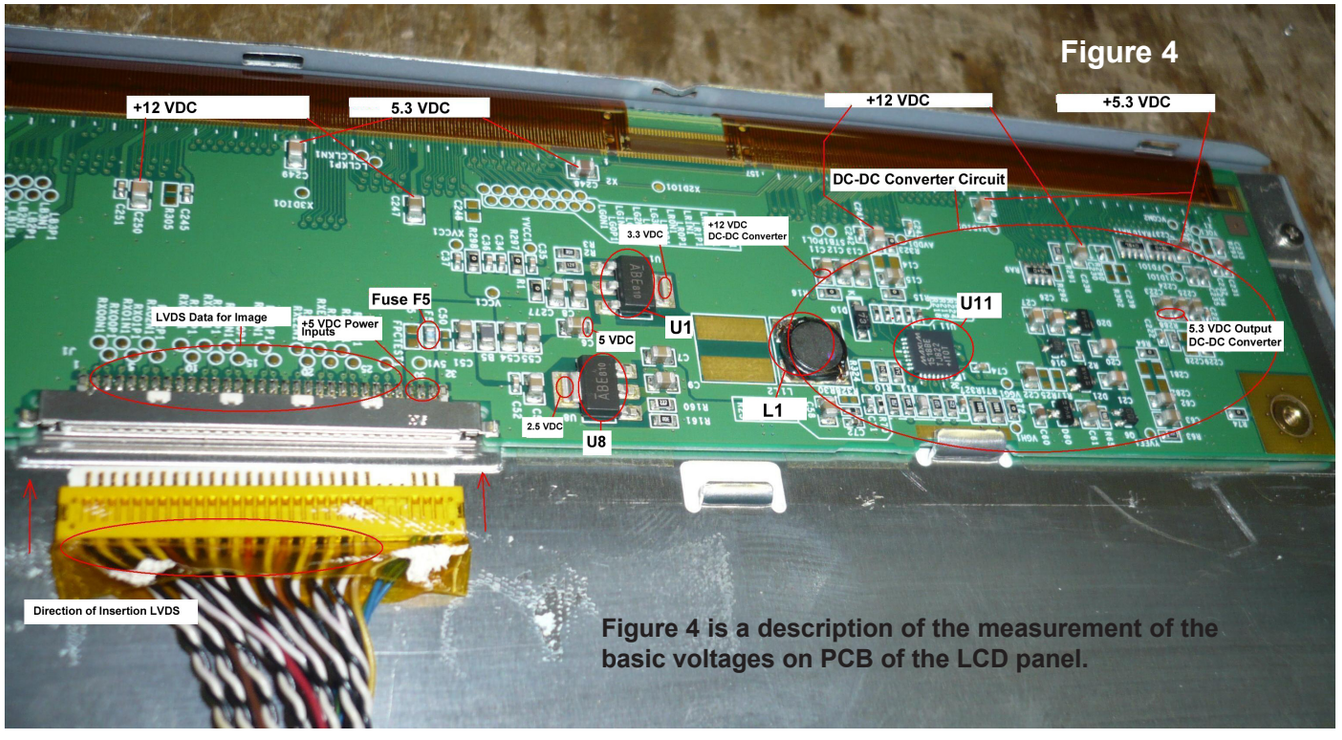


Figure 4

Figure 4 is a description of the measurement of the basic voltages on PCB of the LCD panel.

Experienced technicians can compare the data sheets of the spare LCD panel to the original. In this comparison, it is necessary look for particular attributes:

1)Supply voltage for LCD panel electronics must be observed. There are three versions: 3.3 V, 5V or 12V. The most commonly used is 5V.

2)Type LVDS connector, CCFL terminals and the number of CCFT tubes.

3)Some panels do not supported all display modes (LVDS interface compatibility).
The viewing angle of the image.

4)Mechanical dimensions. In addition to the basic dimensions, also check the places for the mounting bolts (can be re-drilled if necessary) and thickness (depth) of the LCD panel.

Some defects of the LCD panels are repairable if you have a well-equipped workbench. If you come to the conclusion that replacing the A/D boards and other tests cannot remedy the defect, by process of elimination, your problem probably is a failure in LCD panel itself. Then, it is necessary to consider whether the panel repairable on your terms.

Malfunctions related to mechanical damage to the panels can be repaired only by an authorized service center LCD panel. Some malfunctions (many) are not possible to repair, only swap:
Broken glass for liquid crystal - image 5.
Horizontal or vertical lines irregularly - image 6.
Defective pixels
scratched glass - picture 7

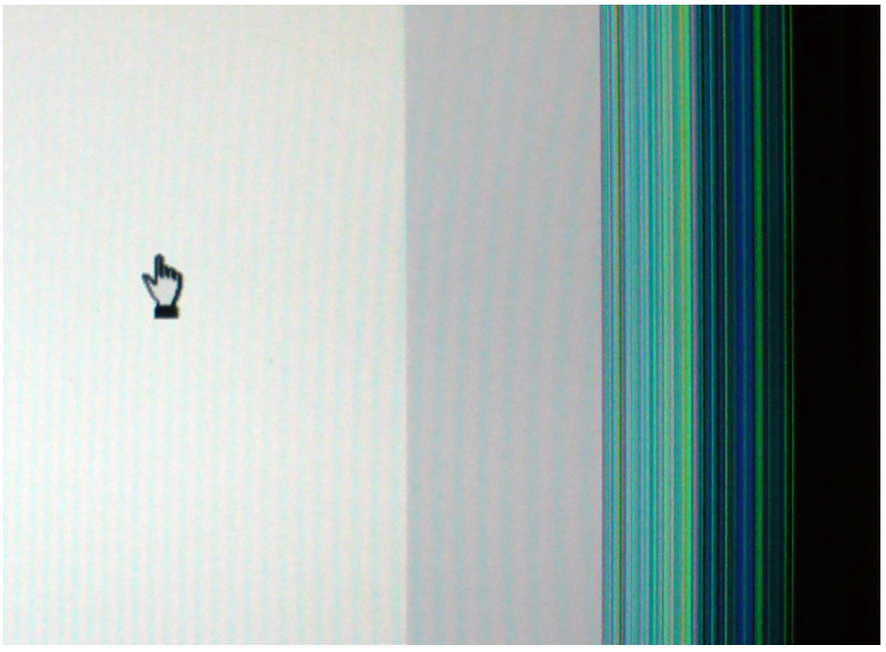
Repairable malfunctions:
1) No picture (black or white screen, backlight works).
2) Regular thin vertical strips with a thickness of one pixel.
3) Thick strips of different colors or images that gradually fade to black or white.

Symptoms of type 1) and 3) are often caused by a DC-DC converter malfunction on the PCB board LCD panel (likely bad capacitors, see Slot Tech Magazine December 2012 issue)or bad contacts in the LVDS connector/cable.

Defects of type 2) point to the LVDS connector, where there is a failure contact of some a data cable/lead. If this symptom is not caused directly by a failure on the A/D board or the LVDS cable between the A/D board and the LCD panel, then you might need to replace the LVDS connector that is soldered to the PCB in the LCD panel.

Description of Defect Type 1)

Figure 4 is a description of the measurement of the basic voltages on PCB of the LCD panel. The supply voltage (in this case 5V) via LVDS connector passes through the fuse F5(smd 0603 F3A) into voltage regulator U1-3.3V, U8-2,5V and choke L1 to the dual DC-DC converter that converts 5VDC to 12VDC and 5VDC to 3.3VDC for the power electrodes in the LCD glass. The most common error here is if a some SMD ceramic capacitor at the output of the DC-DC converter (12V or 5.3V) has become “leaky” or has completely short-circuited to GND. Short circuit or high leakage in the short time causes a decrease in the voltage of the DC-DC converter output and the reaction of the regulator is that it is trying at all costs to achieve the rated voltage of 12V/5.3V. This, however, increases the current consumption of LCD panel and gradually leads to a blown fuse, F5. After blowing fuse, the LCD panel is not powered and the image is lost.



Since the 12V and 5.3V branch is relatively a lot of capacitors connected in parallel, it is necessary use a very accurate Ohmmeter because it is difficult to find a defective (shorted) capacitor in a parallel connection. This special Ohmmeter can measure low resistances (< 0.01 Ohm) with greater precision than a conventional multimeter (with a low scale of 200 ohms and a

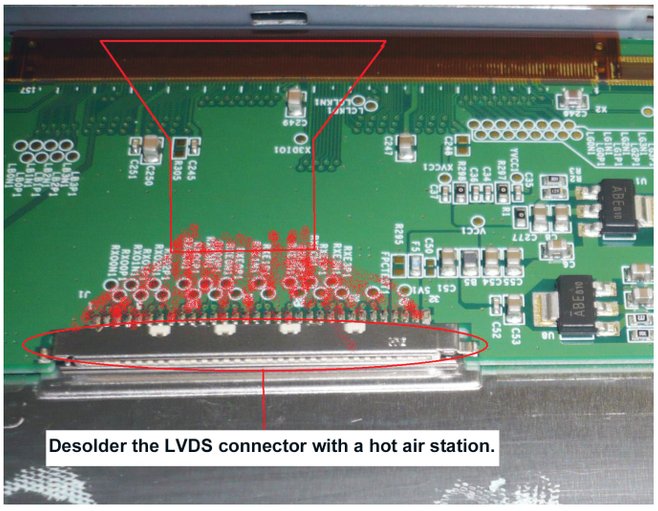


Figure 8. If the problem is in the panel connector, then desolder it and use an identical connector taken from "junk" for a replacement part.

resolution of only 0.1 Ohm.) The best unit to use for this type of troubleshooting is the "Leak Seeker" made by EDS. EDS is the same company that makes the popular "CapAnalyzer" electrolytic capacitor tester that you see advertised every month here in Slot Tech Magazine. Eds-inc.com or call 561-487-6103. Another suitable handheld meter is the LCR meter Escort ELC-131D or from Agilent Technologies U1730C. With this measuring device, you can locate the exact position of the shorted part without desoldering. Otherwise it would be necessary to desolder all of the parts for

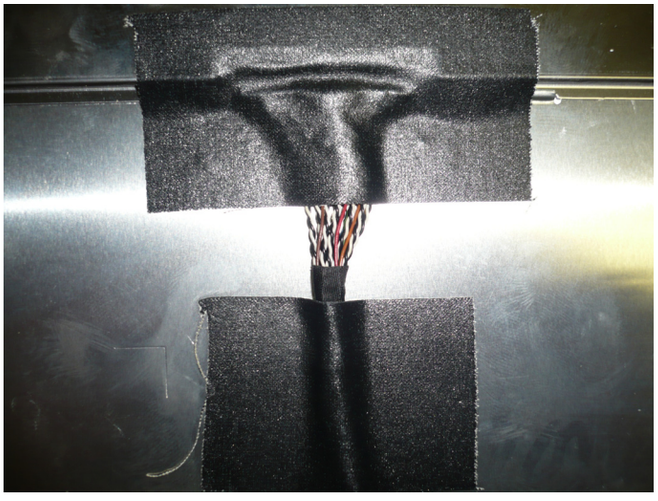


Figure 9. These connectors are quite prone to dirt and so it is helpful to cover and hold the LVDS cable and connector with quality duct tape.

12V or 5.3V line and it is unrealistic and/or time-consuming to do this.

I save all my "unrepairable" boards. When I need a replacement capacitor, I desolder it from a broken LCD panel of the same type. Therefore, it is advisable to save the broken panels for the spare parts.

To obtain the correct readings,voltages and resistances for a specific panel type, you should measure the values of a fully-functioning LCD panel of the same type. After replacing the faulty capacitor, be sure also to test and/or replace the fuse F5.

Description of Defect Type 2)

As I mentioned, this defect is related to disruption of some LVDS data line. Try to locate the malfunction by moving the LVDS cable and connector during normal monitor operation while it is disassembled. In some cases, you only need to clean the contacts in the LVDS connector. Use a contact cleaned such as Caig Laboratories "Pro Gold" or other, high-quality contact cleaner.

If this procedure does not help and we know that the problem is in the panel connector, then desolder it and use an identical connector taken from "junk" for a replacement part. See figure 8.

These connectors are quite prone to dirt and so it is helpful to hold the LVDS cable and connector without moving with quality duct tape, which does not release adhesive in long-term use with a high ambient temperature – figure 9.

Description of Defect Type 3)

It is the fault similar to the type 1) with the difference that the DC-DC converter and fuse is functional but the panel's DC-DC converter does not provide the correct voltage level or gives only a short while and then turns off.

I wish you many successful LCD panel repairs.

- **Henry "Heno" Kollar**
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Short Stories

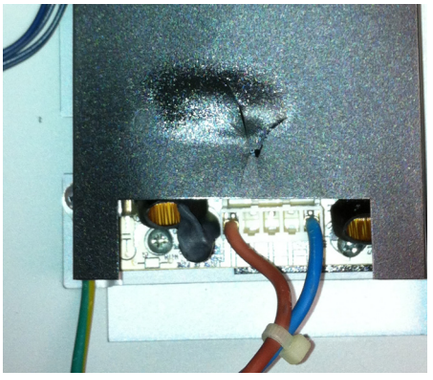
By Mystery Technician X

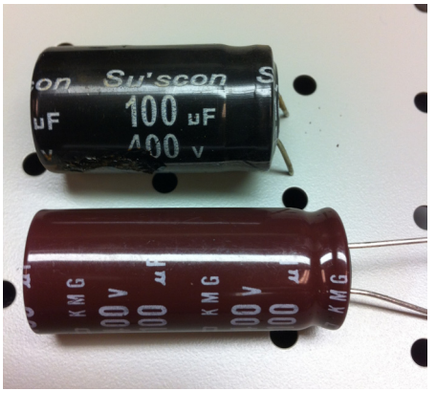
Editor's Note: Back in July, this article mysteriously appeared in the "upload" directory of the Slot Technical Server at slot-tech.com. I really do not know who uploaded it and nobody has ever asked me about it. So, if this is your contribution, please contact me so I can pay you and give you proper credit for this nice article.-rf

Tatung L19LA25M21LC03-R LCD Monitor-Symptom: No Power

This monitor is commonly found on Bally Alpha machines.

When it was brought back to the bench it still had the fresh smell of fried electronics. The back cover was

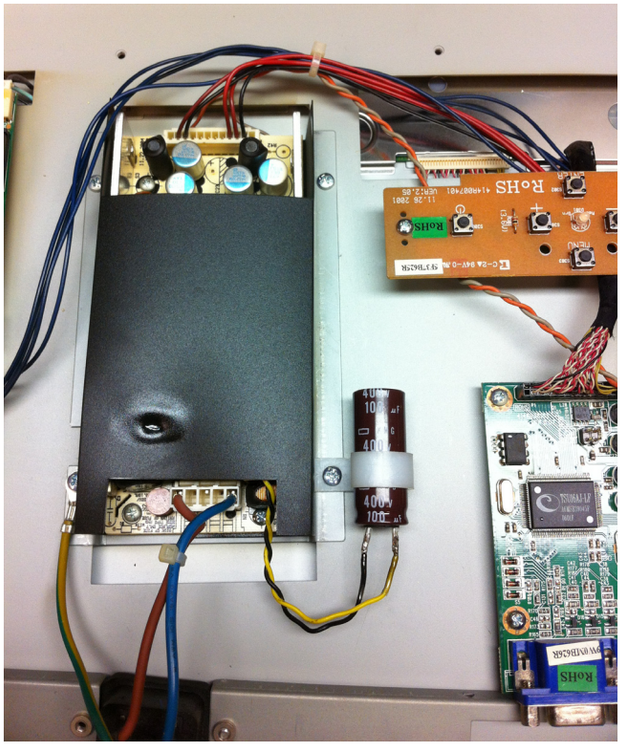




popped open and there was the obvious sign of what melted down. There was a melted blob on the plastic insulator cover that went over the power supply. Sure enough the main filter capacitor (C8 100uf@400V) let loose.

The problem I ran into was finding a replacement that would fit in the space. The ones we had in stock were a longer than I needed.

Bending the legs in every direction in a futile attempt to make it lay down on the board just wasn't happening. Time for me to stop being nice and relocate the thing off to the side. A few inches of wire and a nylon clamp did the trick. Monitor is now happy and back in the machine.



Bally Alpha Cinereels Jumping Monitor!

On this machine the monitor picture was jumping like no H SYNC and some real noisy lines. I swapped it with the game next to it and the problem stayed with the original machine. My first guess was a bad cap on the A/D board, but when it stayed with the game it blew that theory out the window.

The monitor in the game is a 20" Tatung L20LA41E2W53A04. It does not have an internal power supply, but uses +5, +12, and +24 directly from the game. A check on the voltages showed the 12 and 24 VDC power good and steady, but the +5VDC was bouncing from +1 to +3VDC. The problem is not in the monitor. Lets find out where this comes from.

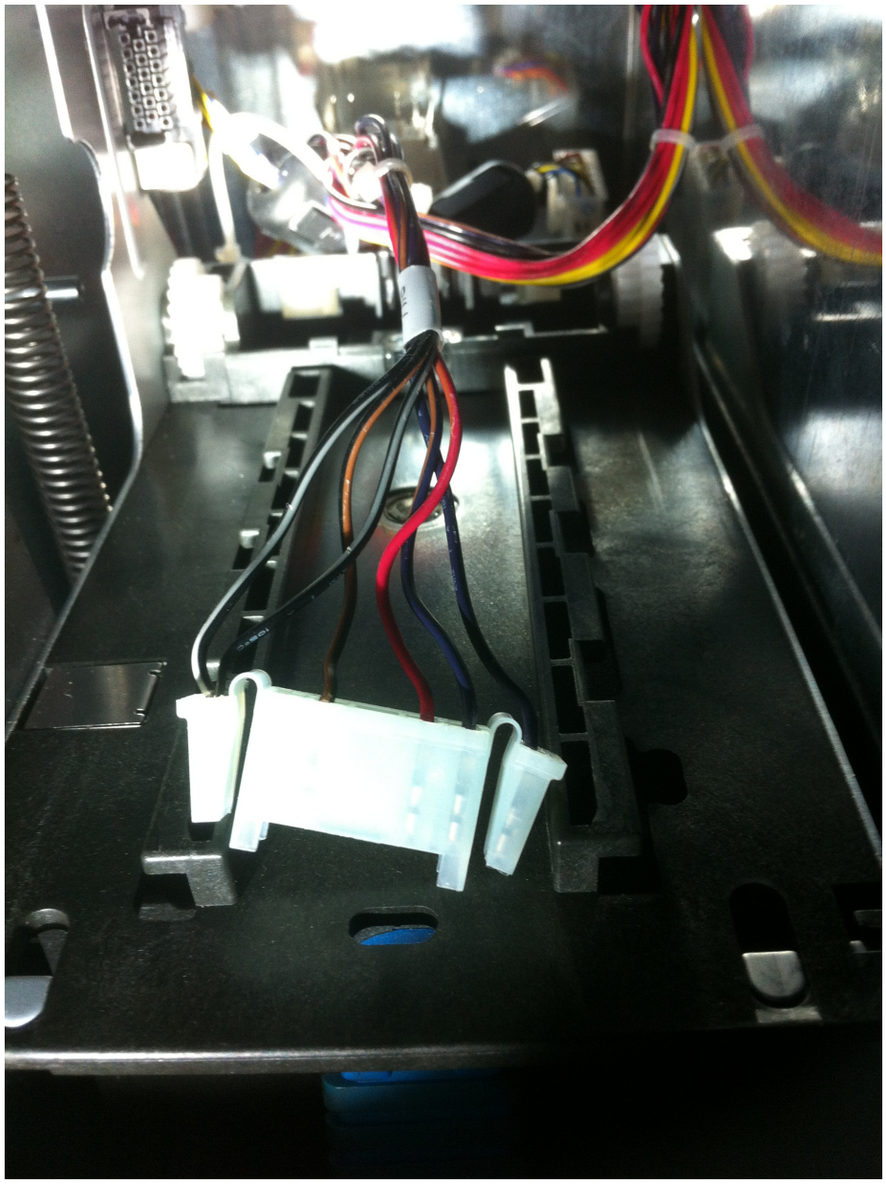
I turned the game off to inspect some connectors and turned it back on but it didn't like that too much. It just went on and off by itself. The power supply in the CPU was on and OK as was the printer and BV that run off the +24. That leaves the 5/12 power supply.

3Y Power YH-2351B +5 / +12 VDC Power Supply

I was correct about having a bad cap somewhere. There they were, with the tops bulging just asking for a root canal:

C49, C51 2200uf @ 16V C41, C42 1000uf@ 10V

I replaced them, installed the power supply back in the machine, the game powered up fine and the monitor never looked better.



WMS BB2 XD
Door Open V

This is a brand new game just installed on the casino floor. Game was RAM cleared and initial setup was completed. It could not be coin tested due to a constant V door open. Being a new game, I figured something had fallen out or become loose. Just to make sure what the V door was, I opened the same game next to it and found it to be a micro switch on the trap door deck and another on top of the cash box housing would cause this door open signal. Comparing the wire harnesses I noticed the rear micro switch connector was installed backwards on my game with the open door. The micro switch terminals are essentially the same on both sides so that shouldn't matter. I reversed the connector but the problem still remained. This problem could be anywhere. A continuity test of each switch showed them working properly. I used a jumper wire and shorted the switch terminals of each switch but that didn't work. I was testing this at the end of the circuit and I needed to start at the beginning.

The switch signal originates in the CPU, goes through the Backplane, and enters the wiring harness. Our BB2 XD schematic manual just indicates these switches go through connector J10 on the backplane. I had to go back to the shop and dig out our BB1 manual which breaks down the connectors further. It is labeled Bill Door on J10 pin 2. Grounding it from J10 pin12, showed the V door closed. So we now know its not the CPU or backplane, the problem must lie in the wire harnessing. Doing a quick continuity check between all the cables, I found no connection between the two V door switches. I jumped this wire out and it now showed closed. Inspecting the harness, I found a very bent pin on a black connector (sorry no documented number) mounted on a tunnel to the right of the monitor. Using my Brotherhoods bent screwdriver I was able to reform the pin and now the V doors work correctly.

TRANSACT EPIC 950
Works Then Doesn't

We have recently had a large amount of these printers come through the shop for cleaning and repairs. The main symptoms

are that it feeds paper fine one moment then it does nothing. Sometimes when printing it will stop halfway, or just keep spitting out blank tickets or will curl the ticket up inside and not eject it.

I have found that a few SMD diodes and other devices on the main CPU board have developed cold solder. These are ZD3, ZD 4, and ZD 5 (sometimes this one is not populated) near CN4 and CN5. Also it could be R15, R39, and few legs on U5. A gentle pick will usually slide one side off of the solder pad. Be very careful tacking these back on. They are close to connectors and other components and causing a solder bridge is easy to create. I found hot tweezers work best due to the close proximity of these items.

- STM

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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.

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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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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.*

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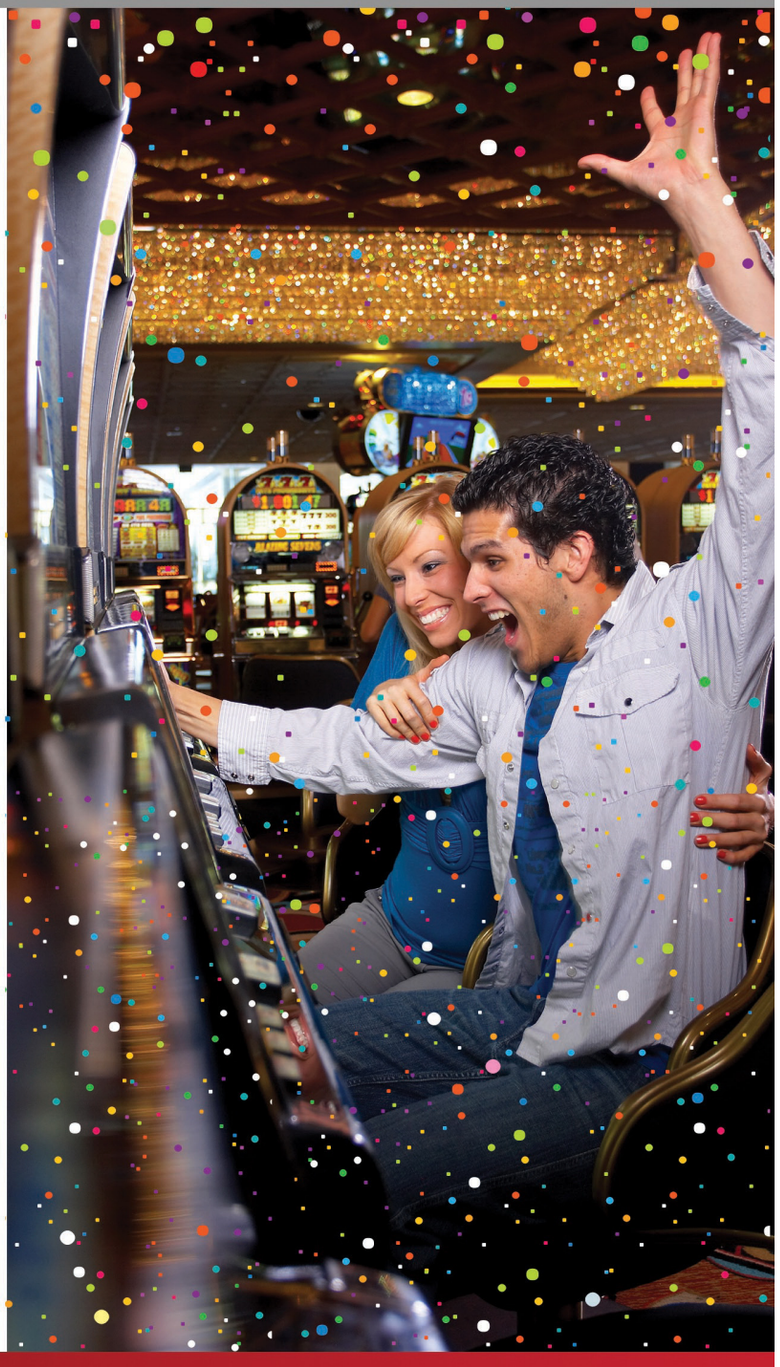

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