

February 2014

This month:  
The most important thing  
you can know-Component  
Identification and Testing

# Slot Tech Magazine

Slot Machine Technology for the International Casino & Gaming Industry



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Slot Tech Magazine





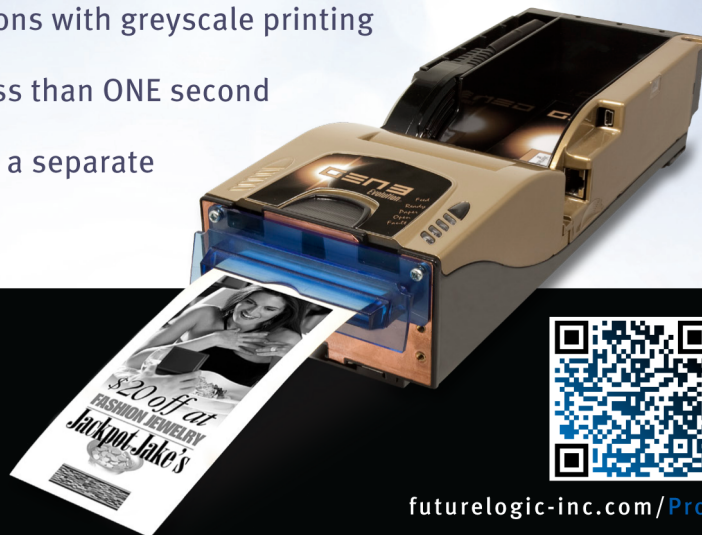
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# Slot Tech Magazine

**Page 3-Editorial**

**Page 4-Component Identification and Testing-Part 1**

**Page 14-Quick & Simple Repairs #103**

**Page 18-GTECH's Sphinx 3D – You'll Hardly Believe your Eyes!**

**Page 22-Subscriptions**

Dear Friends of Slot Tech Magazine,

I have one diagnostic skill that has helped me fix more broken ~~crap~~ equipment than anything else. I (mostly) know what all the parts are and I (mostly) know how to test them all using simple, inexpensive equipment (OK, maybe that's two skills). It's a technique I developed out of desperation in High School when all of my friends were working at gas stations, pumping gas and cleaning windshields (yes, we actually did that, once upon a time) I had managed to score a job as a busboy and dishwasher at a local restaurant. That lasted about a week before I realized that it was not a good career path for me. I had SKILLS! After all, I had actually built a set of "electronic bongos" once!

This was the era of the 8-track car stereo (Google it). There was a local storefront outlet that sold bootleg 8-track tapes. It was really common back then. He also offered a repair service (head cleaning and alignment, mostly) and was looking for a technician to handle the more difficult repairs. I convinced him I could do the job and do it for cheap. I could ride my 250CC, Italian motorcycle (a Benelli!) over to the store, drop off repaired units and pick up a new batch of bad ones. I had almost no idea what I was doing. I hadn't actually repaired anything, I had just built bongos and transmitters and stuff.

What saved my ass was two things: These were stereos so there were always two, identical channels. This enabled me to compare the good side to the bad side (component testing) when the symptom was loss of one channel (the most common failure by far). We do this in the casino business as well. We rarely have just one of anything. Often, we have dozens or even hundreds of identical units we can use for comparison purposes or even "swaptronics." The other thing that saved my butt from the sweatshop of the kitchen was my familiarity with the individual (discrete) components. I know what they are and I know how to test them to see if they're good or bad. The "understanding" part of electronics and electronic circuitry came much later in my career but I was able to fix a lot of stuff before that kicked in.

This month presents part one of "Component Identification and Testing." It's sort of a compilation of some of the material we've covered previously along with some new material. I admit to having an ulterior motive in putting this together as "Component Identification and Testing" is one of the presentations I'll be giving at TechFest 29, coming up May 13-15 at Mystic Lake Casino (registration is now open for this often sold-out event. See the website at slot-techs.com for registration form and schedule of events.) and I needed a nice handout for the session!

*Randy Fromm*  
Publisher-Slot Tech Magazine



**Randy Fromm**

## Randy Fromm's Slot Tech Magazine

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## Component Identification and Testing

Second only to soldering skills, the most important skill I have developed in my years as an electronic technician is the ability to test individual (discrete) components. This skill has allowed me to fix everything from 8-track cassette players (when I was still in high school) to advanced radar systems on US Navy vessels that may (or may not) have carried nuclear missiles.

### Passive Components/ Active Components

The discrete components fall into one of two categories: active and passive. As their names imply, one group might be thought of as having components with “Type A” personalities while the other is filled with couch potatoes. We see failures with both types of components but the failure mode often differs between them. The key to fast and accurate troubleshooting lies in knowing how the components are likely to fail. By this I am referring to the nature of the failed component itself. Is it shorted? Is the part open? Can you count on this component always to fail in the same manner or can the bad part assume a number of differ-

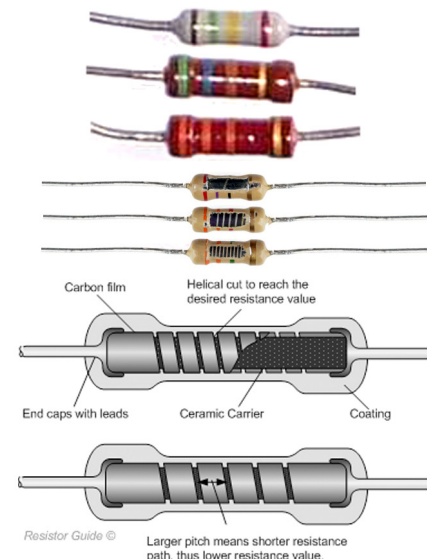
ent types of failures?

Knowing how components fail is also the key to reading schematic diagrams. Armed with just a few key measurements from a digital multimeter, it is possible to pinpoint problems like open or shorted components because we KNOW what to expect when the part fails. This type of logical troubleshooting can bring you quickly to the cause of your problem without agony or hair-pulling. With that in mind, let’s take a look at how parts fail (and how to test them).

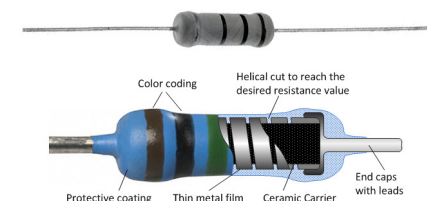
NOTE: All of the following tests are performed under static, “power-off” conditions. This makes the tests safe, with no possibility of electrical shock or damage to the equipment or component under test.

### Resistors

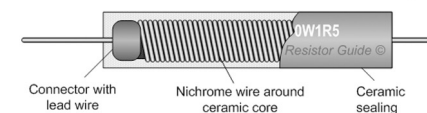
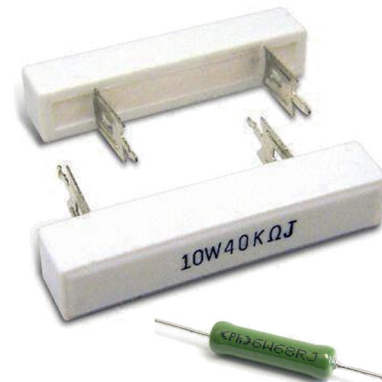
As far as troubleshooting is concerned, resistors are used in two different kinds of circuits: Power circuits and signal circuits. In a power circuit, resistors are used to drop a voltage or to limit current. In both of these cases, all of the current required to power a circuit will have to pass



### Carbon Film Resistors



### Metal Film Resistor/Metal Oxide Resistor



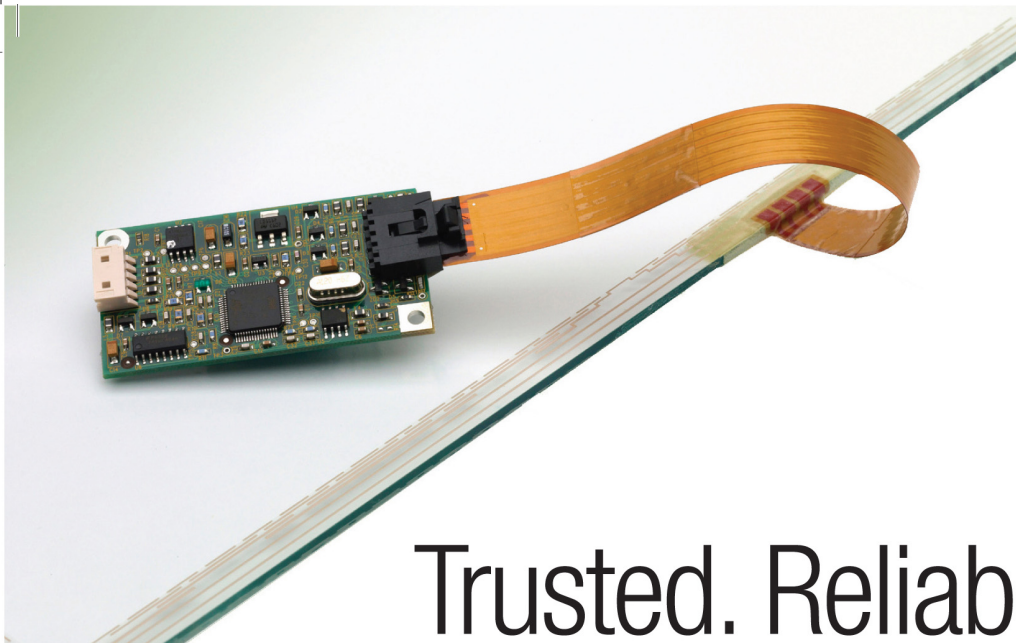
### Ceramic, Wirewound Resistor



### SMD Resistor

Drawings not in relative scale





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through the resistor first. This type of resistor often will be in the 1 watt to 10 watt range. It may be made from metal-oxide (such as tin oxide-SnO) or it may be a ceramic, wire-wound resistor, made from Nichrome (a nickel-chromium alloy) with a ceramic body that can withstand the heat given off by the resistance wire during operation.

In a signal circuit, the resistor will generally be one-quarter watt or one-half watt. These resistors are not handling any significant amounts of current and, as such, are unlikely to fail.

Regardless of the type of circuit it's in, when a resistor fails, it will ALWAYS OPEN or increase in value. Whether it's a carbon-film resistor, a metal-oxide (AKA metal film) resistor or a ceramic, wire-wound resistor, when it fails (either on its own or by virtue of some other component failure) a resistor will open-circuit. A resistor will never short-circuit or "partially" short-circuit.

In general, higher wattage resistors are much more likely to fail than  $\frac{1}{4}$  or  $\frac{1}{2}$  watt resistors as they must dissipate more heat.

When a resistor opens, always check any semiconductor connected to it. Look for a shorted semiconductor as resistors rarely fail on

their own. Typically, something else fails and takes the resistor out with it by creating excessive current draw across the resistor and "popping" it.

### Resistor Test

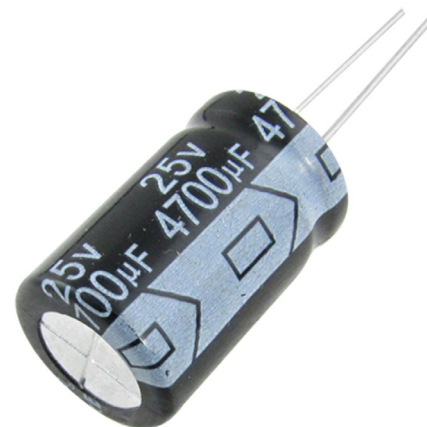
There is a dedicated resistance tester in the digital multimeter. It's marked with the omega symbol. We've covered the resistor "color code" previously so we won't repeat it here. Suffice it to say that if the resistor measures a higher resistance than it's supposed to be (or is open completely) it's bad.

### Capacitors

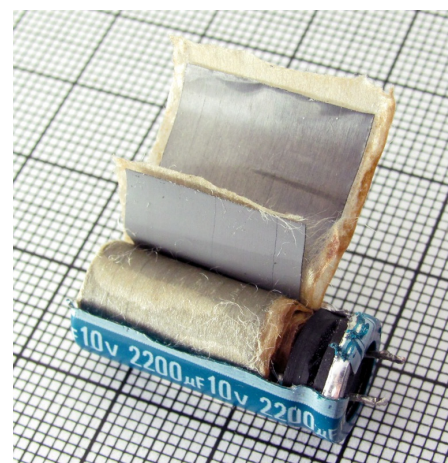
Capacitor failure is not quite so cut and dried as resistor failures. Capacitors cannot be adequately tested with the DMM for anything but a short circuit (they should not test "shorted"). Although many technicians claim that capacitors can be tested by using the resistance (ohms) setting of the meter and watching the resistance change as the capacitor charges, I have found this test to be extremely misleading. Capacitors that appear to pass the "charge"

test have often proven themselves to be defective.

You'll encounter a small handful of different types of capacitors with all sorts of weird shapes and colors. Fortunately, there is only



Typical aluminum electrolytic capacitor



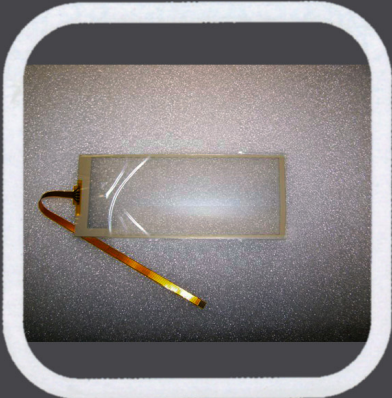
Above: This is what's inside! It's mostly aluminum foil and paper.

Below: Surface-Mount Electrolytic Capacitors

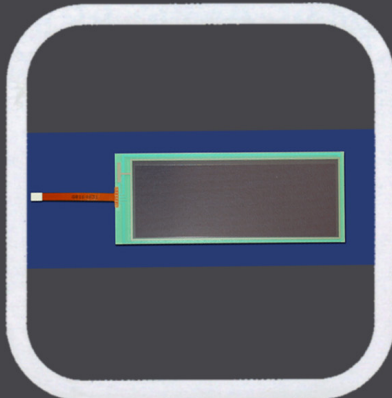




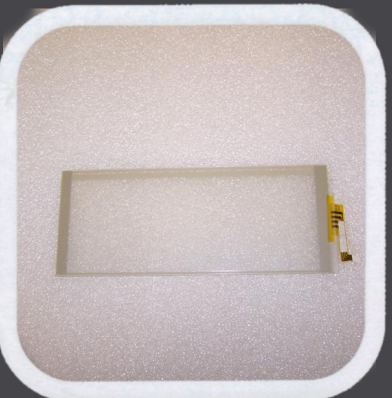
# Player Tracking System LCD Display Parts



5 wire touchscreen Bally Iview  
Hitachi LCD



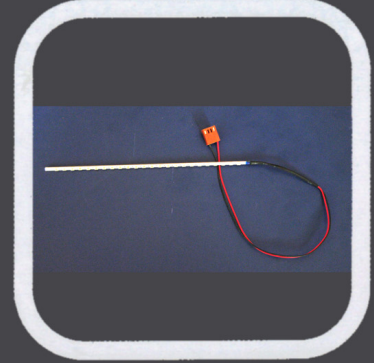
5 wire touchscreen Bally Iview IDW  
LCD



4 wire touchscreen IGT NexGen  
LCD



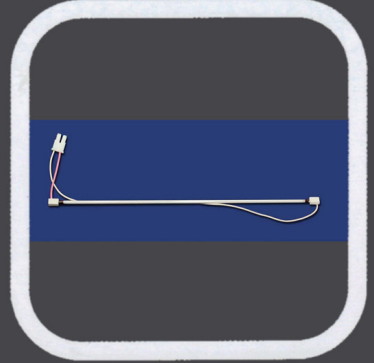
LED Strip for Bally Iview LCD



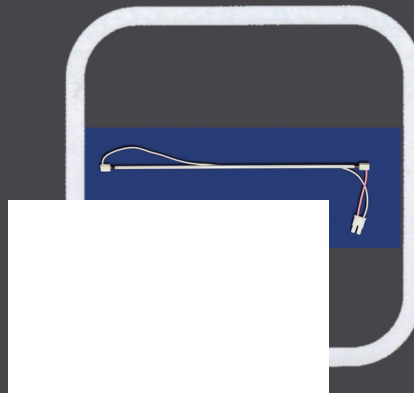
LED Strip for IGT NexGen LCD



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



one type that causes most of the problems, the electrolytic capacitor. It is also the most common failure in power supplies and monitors. In fact, it is the most common type of electronic failure in the world. Capacitor failure is so common, I generally travel with a suitcase full of them when I'm training or sitting on the bench at a remote location.

## Capacitor Failures

There are several ways a capacitor can fail. In slot machines, the high temperatures inside the cabinet often cause electrolytic capacitors to dry up. In high-frequency circuits such as switched-mode power supplies, the capacitors tend to bulge and leak. The technician must check all electrolytic capacitors for physically leaky or dried-up capacitors followed by measuring the capacitor's high-frequency, Equivalent Series Resistance (ESR).

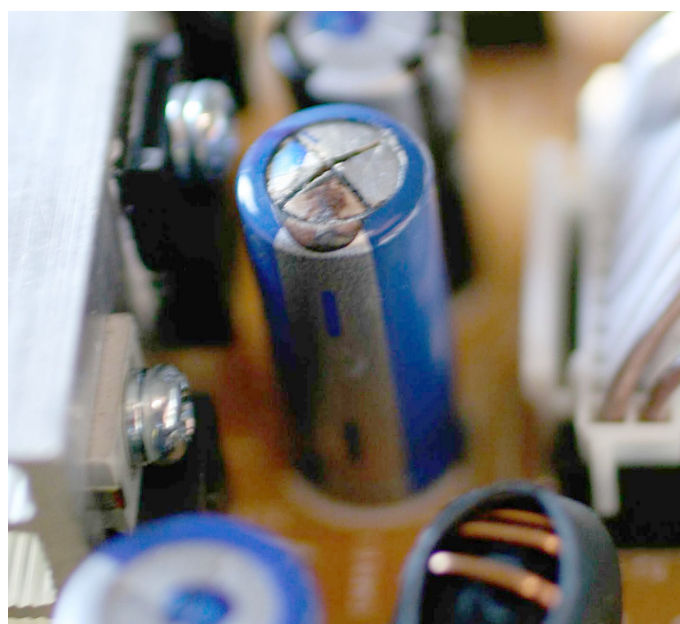
### Dried up and Physically Leaky Capacitors

As a capacitor dries up internally, it can become electrically leaky. As the capacitor dries up, it can cause strange problems in the particular circuit it is in. If the capacitor is in the power supply, jail bars or "hairy" interference may ride on the video. In the audio section it can cause distortion or low audio. In the system control supply, it can cause intermittent functions and microcontroller confusion, even a blank display. In the video circuits it can cause incorrect colors and/or a washed-out image. Often, the problem will be less noticeable if the unit is left on for some time. That's because a dried-up capacitor will usually decrease its ESR with higher temperature.

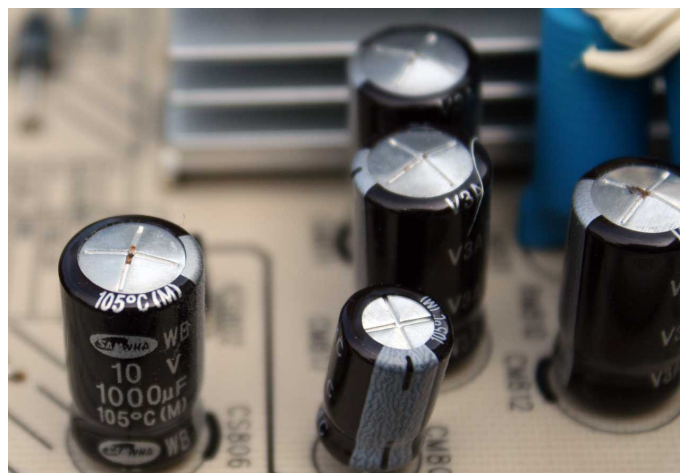
Most technicians already know these symptoms and have an idea where on the board to start. The first step is visual observation. Vacuum all debris off the board and look for dark areas under each cap, for bulging tops and for shrunken and/or

splitting covers. On surface mount capacitors, look for the solder connections under the capacitor to have a cloudy look. This can be easily confused with perfectly good, lead-free solder joints (which always look sort of grainy) so be sure to compare to other solder joints on the PCB. In some cases, you can still see a tell-tale bulge in the top of a surface-mount electrolytic capacitor but it's not common. Most bad surface-mount electrolytic capacitors show no external symptoms.

After visual observation and replacement of the obvious offenders, it's time to measure the rest of the electrolytic capacitors. The problem of measuring each capacitor is more difficult than measuring resistors,



Bad electrolytic capacitors often bulge on top or even crack open their "safety vent."







which can be measured in circuit quite easily with any cheap DMM. That is because any circuit that encompasses an electrolytic capacitor already has some DC resistance and some capacitance from other parts of the circuit.

The trick to locating bad capacitors in-circuit is not to measure capacitance at all! Years of testing by many technicians and engineers has shown that as a capacitor ages, its Equivalent Series Resistance increases.

### What is ESR?

Without going through the math, a perfect capacitance will measure as an open circuit at DC and will show less and less resistance as the frequency across it increases. Some inexpensive capacitor meters utilize this property by measuring a capacitor's impedance (Impedance is a type of resistance measurement. It is "AC resistance") at a fixed frequency such as 1 kHz and translating the reading to capacitance. In reality, checking a capacitor at 1 kHz only works if the capacitor is being used in a circuit that also operates at 1 kHz. It makes more sense to forget about capacitance altogether and use our knowledge that high frequency ESR increases with age and as a capacitor dries up.

### CapAnalyzer 88A

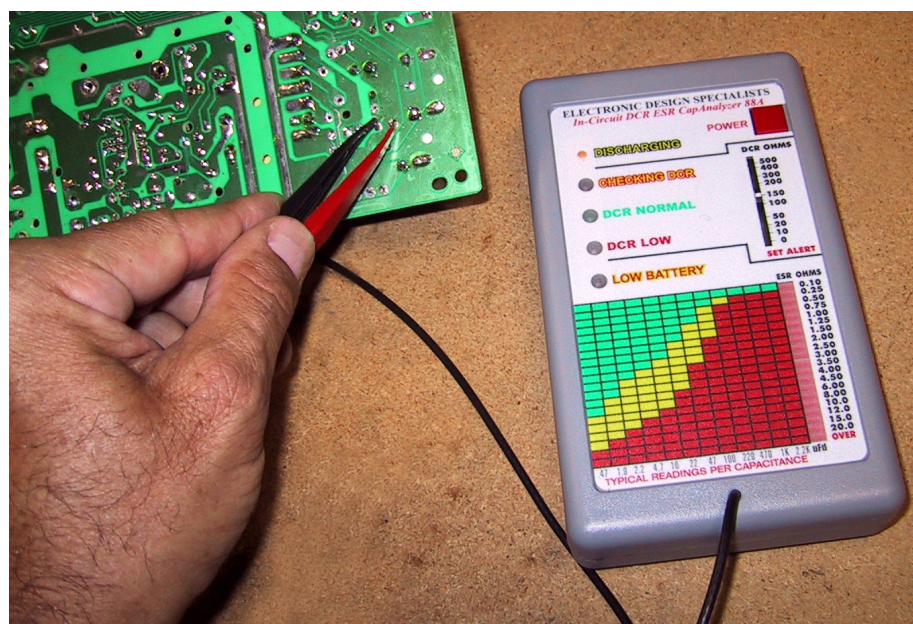
This meter automatically discharges the capacitor under test, checks for Low DCR, then checks and displays ESR on a 20 segment LED bar scale. It includes a low-capacitance, one-handed tweezer test probe, and beeps from one to five beeps depending on the ESR reading of the cap. Possibly its best attribute is a three-colored chart on the front panel that shows typical ESR readings of good, fair and bad caps depending on their capacitance.

The CapAnalyzer 88A claims 100% accuracy in circuit because of its testing parameters. The frequency is high enough to make the capacitor's actual capacitance insignificant, so it measures only the ESR. The high test frequency also helps isolate the capacitor under test from the rest of the circuit via the high inductance of the pc

board copper foil. This frequency is also high enough to ignore any coils over 5 uH. ESR testing is done with a calibrated low resistance at the test point which allows it to compensate for normal circuit resistance. Both DCR and ESR measurements are under 50 millivolts so that no active devices are turned on, therefore only the component at the test point will respond. However, because it checks DCR first, it will alert the technician immediately if the capacitor or anything else in that circuit is shorted or leaky, before it checks ESR. This test parameter (DCR OHMS SET ALERT) is user adjustable from zero to 500 ohms.

### Using the CapAnalyzer 88A to Check Electrolytic Capacitors

When the CapAnalyzer 88A is first turned on, after a second of internal calibration checks, it will briefly check all LEDs, multi-tone





beeper and the battery. Then, it will flash the OVER LED slowly to indicate ready. The DCR OHMS slider set alert is normally set to about 150 ohms. To test an electrolytic, simply hold the tweezer test probe across the capacitor leads. Polarity does not matter. The CapAnalyzer will chirp once to let you know that you have a good connection and the DISCHARGING LED will turn on for a fraction of a second.

The first test is the DCR test. The CapAnalyzer will show either a NORMAL or LOW LED, depending on the setting of the DCR OHMS SET ALERT slider. If the slider is set to 50 ohms, the CapAnalyzer will sound an alarm and light the DCR LOW LED if the DC resistance is lower than 50 ohms. Most circuits will never show this low normally. However, in some circuits, the circuit's resistance might be lower or higher. In these cases, you may set the slider for as low a DC resistance as you expect the circuit resistance to be normally. For example, where the supply must power a 15 ohm load, you could set the slider to 10 ohms. The CapAnalyzer would treat any DC resistance above 10 ohms as normal and warn you if measured DC resistance is lower than 10 ohms. In fact, you can set the DCR SET ALERT anywhere from a fraction of an ohm by setting the slider all the way down to 0, to as high as 500 ohms DCR.

Be advised that if you have the slider set higher than 100 ohms and try to measure a very large electrolytic, the charging time to test the electrolytic may exceed the DCR test period and you may get a false DCR LOW, or the CapAnalyzer may try testing the capacitor over and over because of conflicting test results. Therefore, use 50 ohms as a guideline when measuring most medium to large electrolytic capacitors and use the values higher than 100 ohms when measuring small tantalum and surface-mounted capacitors. Surface-mounted tantalums can become leaky by as high as 500 ohms.

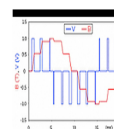
## Capacitor Testing

As you touch and hold the probe across the cap, the unit will chirp once to indicate testing has started, will pass the DCR test, then will chirp one or more times depending on the ESR of the cap. The CapAnalyzer 88A has been designed to chirp once if the ESR is less than one ohm, two chirps from one to two ohms, three chirps from two to three ohms, four chirps from four to eight ohms and five chirps from eight to 20 ohms. The handy three-color chart on the front panel shows typical ESR readings, so if a 2.2 uF capacitor chirps three times and shows 3.00 ohms ESR, the chart shows that this is in the green, good.

As a rule, some caps can show in the yellow area and may still work adequately. It is up to the technician to make the decision on whether to replace these questionable caps or not. However, any caps that show ESR in the red areas are out of spec and must be replaced.

Note that if an electrolytic capacitor is in such bad condition to be over 20 ohms ESR, the CapAnalyzer will treat it as an open circuit and will not even try to test it. The OVER indicator will continue to flash.

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Replace these caps, as they are bad, no matter what their capacitance is. If you wish to double-check the test probe at any time, simply short the probe contacts together and the CapAnalyzer will do a self-test. You can also check calibration at any time with a 10 ohm resistor: set the DCR OHMS alert to zero and measure across the resistor; the 10 ohm ESR LED should illuminate.

In some cases, you may find capacitors that are physically leaking, yet they check as perfect. Although the capacitor is leaking, it has not leaked enough electrolyte to render it defective and will still operate perfectly in the circuit . . . for a while. If you wish to avoid callbacks, replace them anyway.

### Quick ESR Test

Normally, the CapAnalyzer discharges the cap, then tests for DCR, then measures ESR. In many cases, you might know for sure that there are no shorted capacitors and might wish to save some time by eliminating the full test and just want to quickly check the ESR. To put the CapAnalyzer 88A in this special Quick ESR test, turn the unit on while shorting the probes ends together. Instead of the multi-tone song, the CapAnalyzer will only beep twice and be ready for testing. Keep in mind that

a shorted capacitor will show a low ESR, so we recommend using only the full test. This feature also uses less power and will result in longer battery life.

### Tantalum Capacitors

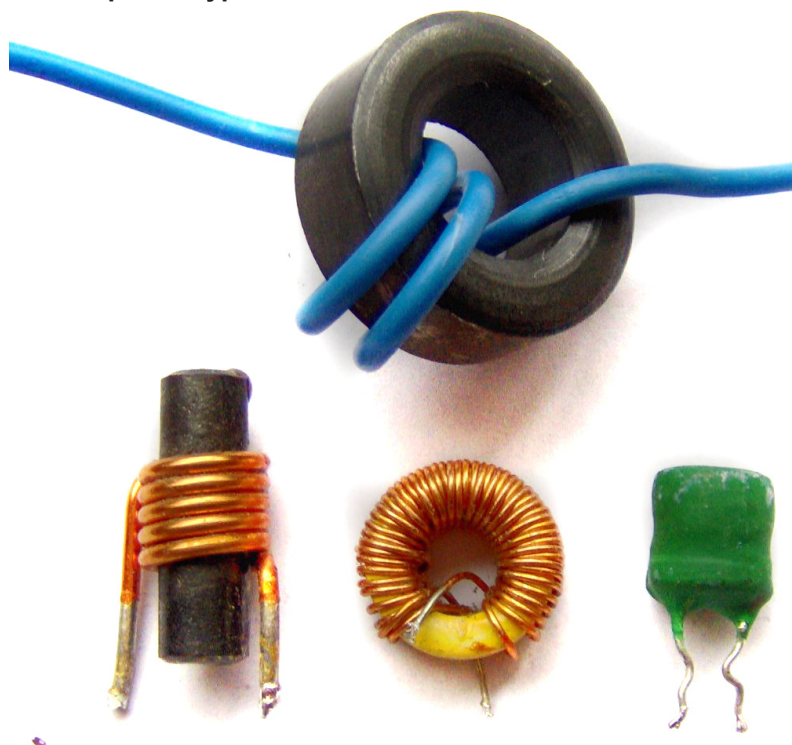
Surface-mount, tantalum capacitors are not wet inside and therefore exhibit completely different symptoms when they fail. Quite often, tantalum capacitors will short-circuit. If you have the component out of circuit, it's an easy test with your meter set to measure resistance. It should read "open." However, if the capacitor is across a "buss" to which more than one component is connected, they will ALL seem to be shorted when measured in-circuit. You'll need something tricky like the LeakSeeker from eds-

inc.com. We have covered the use of this device this device extensively in Slot Tech Magazine.

### Inductors

The final type of passive component is something called an "inductor" (get it? ResisTOR, capaciTOR, inducTOR). We use inductors (also known as "coils" or "chokes" depending on how they're used) all over the place in electronics. In radio circuits, they're a part of the circuit that allows you to "tune" into a specific frequency or station. A "tuned" circuit "resonates" at a specific frequency and a coil is half the circuit (a capacitor makes up the other half, if you care. You don't). Coils are used extensively in slot machines (everything, really) as part of a circuit to reduce elec-

Examples of typical inductors





trical “noise” called EMI or Electromagnetic Interference. Modern switching power supplies generate enormous amounts of EMI and the inductors help to remove it so it can’t interfere with the other circuitry in the system. The other part of the EMI noise reduction circuit is, you guessed it, capacitors.

In a nutshell, most good inductors will simply test as a dead short on a digital multimeter set to measure resistance. A bad inductor might simply be physically broken (broken wire) and so would test “open” with an infinite resistance. A burned coil might have shorted turns as the insulating varnish may have burned right off the wire itself. Naturally, this would test the same as a good coil (dead shorted on the meter) but hopefully, you would notice that the device was black and toasty before you bothered to test it.

HOWEVER, you are not at all likely to encounter a bad inductor that is not physically damaged in some way (broken or burned) and, in fact, you’re not likely to encounter a bad inductor at all other than fractured solder joints where they solder to the printed circuit board (PCB). It is extremely common for large, heavy coils (often in the form of donuts-shaped coils known as “torroids”) to break free from the solder of the PCB due to vibration and/or

temperature cycling.

## Active Components

They’re called “active” components because they switch on and off, controlling the flow of electric current. Sometimes they’re on, allowing current to flow through them. Sometimes they’re off, blocking the flow of current. Sometimes they’re switched slowly on and off and at other times, they might be switching on and off thousands or millions of times a second. Some semiconductors can be turned on part way, allowing us to maintain a precise voltage or current level. Because they are “active” and are often controlling high voltages and/or large amounts of current, these devices are prone to failure. Generally speaking, these active components are known as “semiconductors” and,

generally speaking, when they fail, they short circuit. Big time. Shorted semiconductors can cause additional damage to other, connected components.

**-Continued Next Month**

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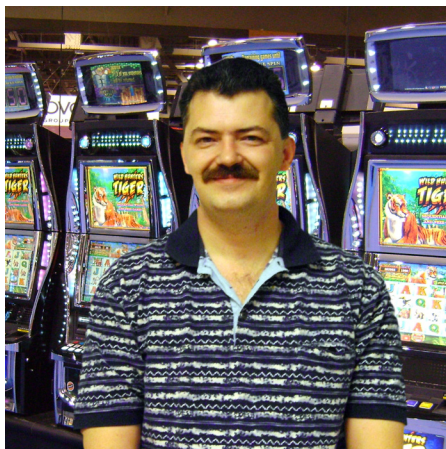
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### WMS UBA Assembly “Tweak”

For one reason or another, it seems once in a while on our WMS Bluebird games the UBA doesn't work properly because the stacker box has to be seated in the assembly just perfectly. On the exterior of the game, the bill acceptor bezel will be lit up but when a bill or ticket is inserted, the unit will only continuously run until an error appears on the screen and not accept money (as a note, we also have had a few minor issues with IGT and Aruze games and UBAs too.) A tech will reseal the stacker box until it sits perfectly in the assembly and a “normal bill acceptor” cycle is heard. It is then tested with a blank ticket to make sure it doesn't come up with an error again. I was working on a UBA in a WMS game when a co-worker came along (For privacy reasons, I'm not allowed to name my co-workers). I was telling

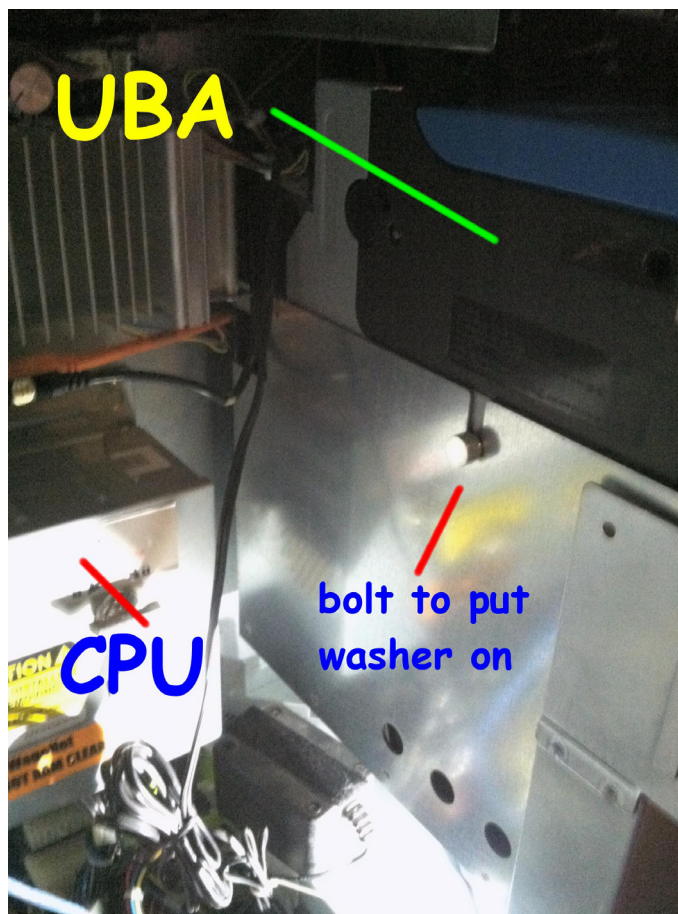
## Quick & Simple Repairs #103

By Pat Porath

the individual that I would like to do some “tweaks,” “enhancements” or “revisions” to try to cure this problem. Not like it was a major problem, only periodically. My co-worker already had a “tweak” and had done it to a bank of games, which worked well because I can't recall getting any bill acceptor errors to that section. Here's what was done: a washer was put in place, underneath the bolt that holds the bill acceptor assembly in (see picture). Once the washer is in place and the bolt tightened, the whole bill acceptor assembly stays in place and there are less bill acceptor errors. The steel washer needs to be the correct size so when the bolt is tight (not super tight or it will strip the threads) it will work as intended.

### WMS “Reel ‘em In” Progressive Error

I was asked to check out a bank of “Reel ‘em In” progressive games. All of the games displayed a “progressive unconfigured” error. Along with that, all of the progressive amounts on the games were blank. I could have called our WMS field tech (maybe should have) but why not check it out myself? Since there weren't any dollar amounts displayed, the problem may be a controller error. When locating and taking a look at the progressive controller





(small tan box mini computer) I noticed there weren't any lights flashing on the CAT-5 cable connector. Generally two lights should be flashing on the connector, a transmit LED and a receive LED. This was dead. Power was cycled, within a minute or so lights started flashing, then dollar amounts appeared on the games. A simple reboot of the controller cleared the progressive errors.

### IGT "Red Screen" Non-Recoverable Error

All I did was reboot the machine to see if it would reinitialize the touch screen and ended up with a "red screen non-recoverable error." The "green screen recoverable" errors usually reset with the jackpot reset key. Not the red screen errors. Upon pressing the

test button, "no games enabled" appeared, definitely not a good sign. Now I needed to get USB KEY 7 to set the game back up along with the so called "multi-game book" in our data room (I think it's pretty neat). We have a multi-game binder in our data room that has all of our slots that have multiple denominations and numerous games. In our bank of IGT Game Kings, we have around 34 different games. This binder comes in handy on a weekend or a holiday when office people have the day off. An example would be on a Saturday when a multi-game dies, needs a RAM clear, then needs to be set back up. Specific setup game information can be obtained from the binder. A poker game may only have Double Double Bonus Poker, Deuces Wild,

and 5 play Jacks or Better enabled. Not Bonus Poker, Keno, or Black Jack. Anyway, the game I was working on had around 10 different games that were supposed to be enabled. USB KEY 7 was inserted into the "brain box" and I started enabling the correct games. Then I forgot a crucial part of setup, selecting ENABLE GAME on the bottom left part of the screen. The game was highlighted and saved but it wasn't turned on...duh. After starting the procedure over and going down the list, luckily everything was at a quarter denomination so I didn't have to be concerned with that, everything looked fine. When KEY 7 was removed, I double checked to make sure all of the games that were supposed to be enabled, were. Other options

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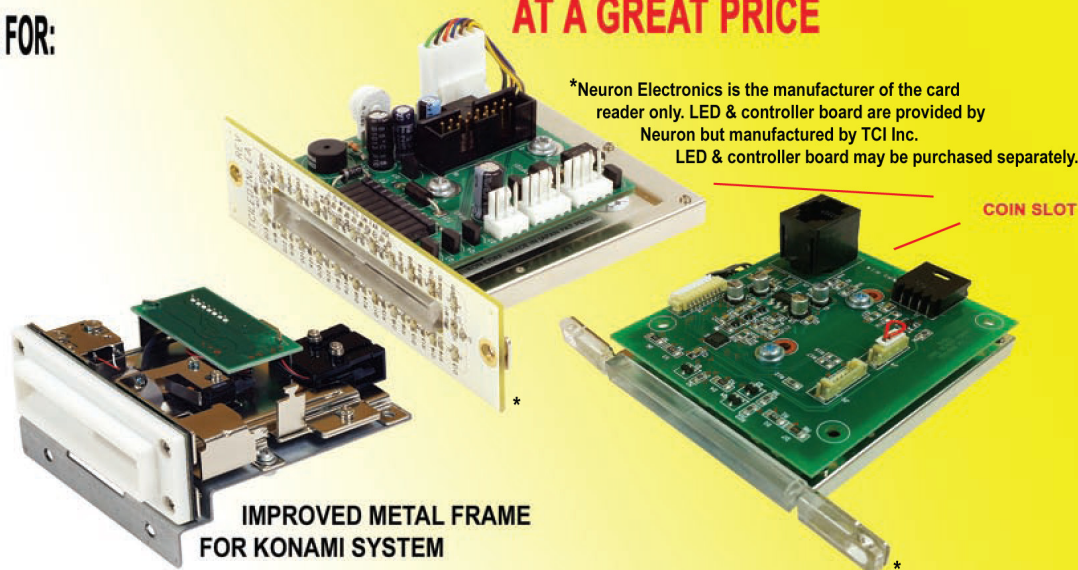
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such as “NO HOPPER,” “NO COIN ACCEPTOR,” SAS address 1, and such all looked OK. It looked like the game only lost all ENABLED games. Finally the game was back online. So much for a simple reboot to fix the touch screen, which did work by the way. LOL

### **Aristocrat Slant Top Veridian Power Supply Problem**

We had an Aristocrat slant Veridian that was acting like it had a power supply problem. During boot up, the upper and lower LCDs would flicker for a few seconds, then the game would load. It would only stay running for around six hours or so, then reboot itself. A co-worker swapped LCDs and the main power supply with a known good working game next door. Even the video card was replaced. Still, after time it would reboot itself. A new main power supply was put in and the CPU fan was checked to make sure it was working. No such luck there either. Just for the heck of it I was asked to grab the original video card to be put back in. Our replacement did not have the large cooling fan on it. All it had was tiny surface mount components. I know these boards work in other Aristocrats because I have successfully used them before. For some odd reason, after the original video card was put back in, the LCDs did not flicker during

boot up. Also the game did not reboot itself again that I’m aware of. No doubt kind of weird. The only possible theory may be that the new replacement video card was faulty. It wouldn’t be the first time new parts were no good, right?

### **Oasis Sentinel III “Flashing Display”**

I was called to a game in which an Oasis Sentinel III was installed and the whole display was flashing about two times per second. A reboot was done on the Sentinel and it still flashed. Video connections were checked at both the display and the Sentinel side; they were reseated just to make sure the connection was nice and snug. Still no go. A quick inspection of display itself didn’t show anything out of the ordinary either. The ribbon cable looked OK as well as the cold cathode connector. It was replaced with a new spare and it worked perfectly. For one reason or another, the original display was bad.

### **Aruze “Memory Error”**

I admit I don’t have a lot of experience working on the Aruze games. Basically they run pretty well in

my opinion. I put in a few “rod controllers” on the “Amazon Fishing” games and a power supply. When a call was received about a memory error on a “Sphinx” game I wasn’t sure what to do. A power cycle was done only to have the error appear once again. Only a simple turn of the jackpot reset key was needed to clear it. If I run across a memory error on an Aruze game again, a turn of the reset key will be tried first.

### **IGT Blank Upper LCD on a “Red Hot Jackpot” S2000**

The game was shut off sometime before my shift started and we were told (the IGT tech and I) that the upper LCD was bad on a “Red Hot Jackpot” S2000. When the game






was turned ON a flashing “NETPLEX error” was showing on the VFD located in the reel glass area. As most of us know, a flashing error isn’t normal on an S2000, almost as if something was interrupting power somewhere. My first thought was a bad power supply. They were swapped with a known working game next door without success. Next, we brought up a possible bad MPU board. But before changing it, the top VFD (which didn’t have anything appear on it when game power was ON) was replaced. As soon as game power was turned ON after the upper VFD (located in the award glass area) was replaced, it looked like the game was booting up normally. Sure enough the original monitor was knocking down the whole game. After it was replaced, the game was fine.


**Editor’s Note:** I have to comment here. In my opinion, this is an example of (can I turn a noun into an adverb?) ignoramus engineering. There is a plethora of failures that cause the “NETPLEX Error,” not the least common of which is a power supply failure! Having the self-test tell us that we have a “NETPLEX Error” is no better than saying “It’s Broke!” Thanks, bro. We sort of know that already. If you design a system such that a myriad of failures give an identical error message, you’re not performing at an acceptable level of engineering expertise. It’s sort of like your automobile indicating “Your door is ajar” but not telling us which door it is.

- Pat Porath  
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## GTECH's Sphinx 3D – You'll Hardly Believe your Eyes!

By Kevin Noble

**Y**ou have to see it to believe it. GTECH, with its gaming product brand, SPIELO, is wow-ing customers and players alike with the launch of the Sphinx 3D™ slot game, an Egyptian adventure featuring glasses-free True 3D™. This eye-popping slot immerses the player in ancient Egypt where pyramids, sphinxes, and scarabs seem to jump off the screen or stretch into infinity in high resolution 3D.

### The Technology

This 3D experience uses a True 3D™ display which was designed exclusively for GTECH for the gaming industry by SeeFront. The effect is achieved by a unique autostereoscopic technology with integrated eye-tracking. Images are processed and displayed so that the ideal 3D picture self-adjusts to match the player's precise line of sight.

Here's how it works: the integrated eye-tracking system detects the player's position and relays it to the

3D engine. This engine then combines the images for the left and right eyes in real time. An optical filter in front of the display provides a brilliant 3D image including accurate depth impression. As the 3D image is continuously adjusted according to the player's position, the player enjoys freedom of movement in all directions.

GTECH recognizes that 3D does not suit everyone. Therefore, the level of spatial depth is configurable with a touch-screen slider, which allows players to adjust to a level that suits them, from full 3D effects to flat 2D.

### The Game

When used as an input to game events, eye-tracking opens up a new world of possibilities: players can explore the on-screen vistas, change viewing angles without disrupting the 3D experience, and be amazed by wilds that stack atop one

another so they seem to jump out at them.

The 3D technology is incorporated into the very play mechanics, and the technology is leveraged in ways that enhance the gaming experience. For example, in the Ancient Wheel Bonus,





players can look behind the wheel to peek at values before making a selection. In the Bonus Selection segment, players travel up to the Sphinx pyramid in an immersive, real-time rendered 3D scene.

The 3D elements are also enjoyed during base game play on meters, win presentations, symbols, “Easter eggs” (hidden, “surprise” animations and functions), and more. This use of 3D technology makes Sphinx 3D an eye-catching addition to the casino floor.

### Some Components You’ve Seen Before . . .

If you’ve ever encountered a SPIELO Vu Slant or a MaXVusion, a lot of the components of the next-generation AXXIS™ cabinet will look familiar. The same basic components still exist but have been updated to become faster, better, stronger... When you open the main door you’ll still see a logic box, a power supply, and a peripheral board, but an updated version of each. It has a newer, more powerful logic box, the new peripheral board now includes a built-in USB hub and audio for the chair, and the power supply has been updated to 1000 watts.

### And Some You Haven’t

The AXXIS cabinet contains a 3D main LED assembly with matching eye-tracker (that’s what makes the special effects happen). A tall machine, standing at -88.5”

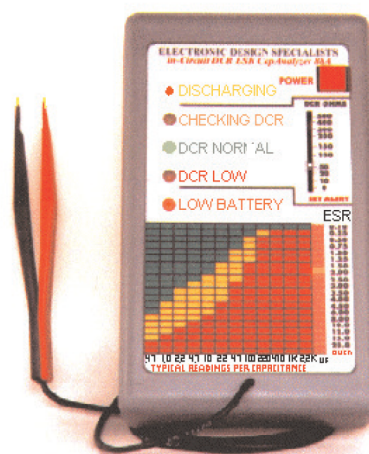
with a trim kit with software-controlled lighting via USB. The full installation (including the trim kit) stands at over 110” tall. There are Color OLED play buttons, additional side play buttons, a new touch-screen digital button deck, and a 39-inch upper monitor. The attached chair also has sound and rumble (add the unique slide feature).

### Tips

This is a brand-new cabinet and game on the slot floor, so you may not have even seen it yet, let alone serviced one. But



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when you do, here are some tips to keep in mind:

Both the main and upper doors open extremely wide for easy access to components (thank you, GTECH!)

The latch for the top box is tucked up to the left of the power supply in the main cabinet. Once the latch is pulled, the top door will open a couple of inches. Then you need to run your hand behind the upper monitor on the left where you'll come across a safety catch similar to what you'd find under the hood of a car; tip it up and out of the way, and the top door will fall slowly into a horizontal position.

If you are looking for what drives the trim kit lights, check under the back panel of the upper left pillar. You'll find a USB cable routed from the machine to a UBS to a serial converter plugged into the trim kit light controller.

The 3D monitor and the eye tracker are a matched set so you'll need to replace both if one fails, but if you're having problems with the eye-tracker, the first step is to check for dirt or debris blocking the tracker's view.

Both the lens cap and

OLED display on the button deck are designed to be easily serviced in case of damage. Simply use a designated tool to unlatch the bezel and the lens cap and OLED can then be pulled off and replaced without having to remove the button deck.

If you get the chance to see this machine, I recommend you play it. The 3D effects are so realistic, you might just find yourself grabbing at thin air in front of you!

- Kevin Noble  
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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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