

December 2013

SLOT TECH MAGAZINE

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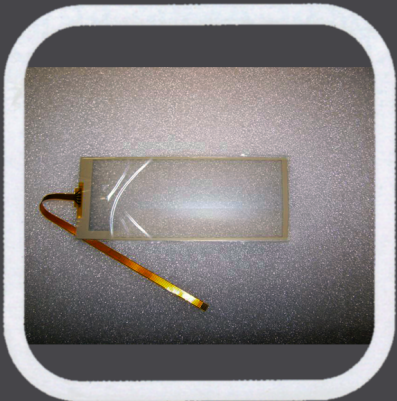
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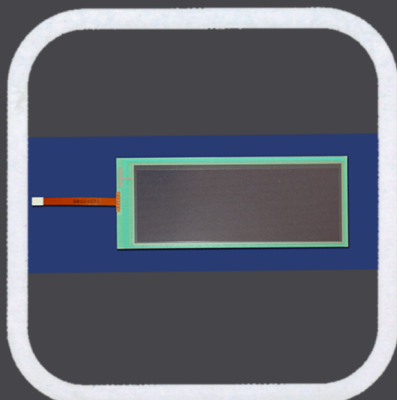
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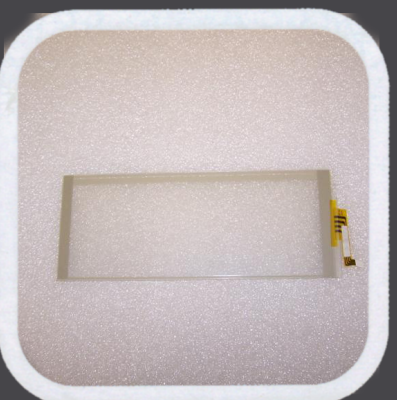
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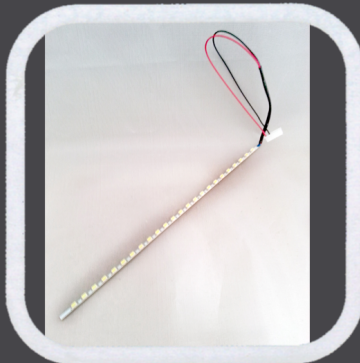
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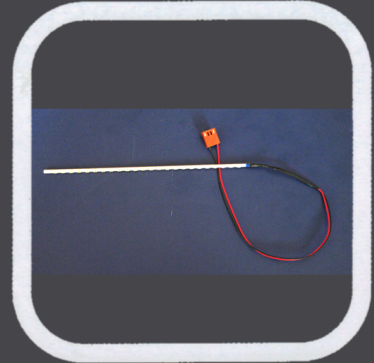
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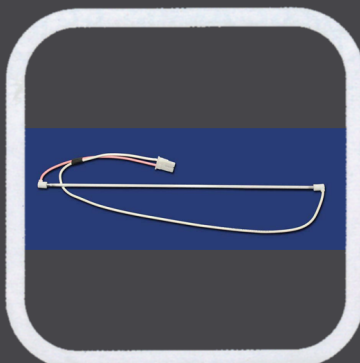
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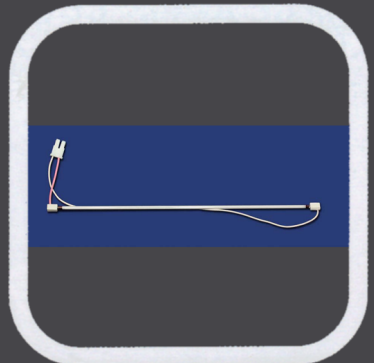
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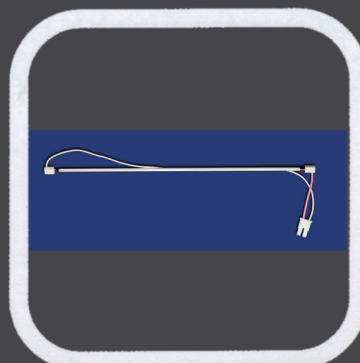
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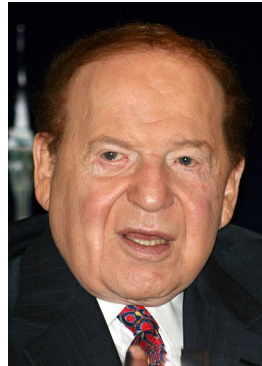
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I'm With Sheldon!

I don't pretend to know precisely WHY Sheldon Adelson (chairman and chief executive officer of the Las Vegas Sands Corporation) is against online gambling but he and I stand shoulder-to-shoulder in this regard. I watched as the coin-operated video game industry (my previous profession) was decimated by home gaming. When you mention "video games" today, nobody thinks of Pac-Man. It's all about X-box.



It's not too difficult to imagine a time, 20-30 years from now, when the thought of playing a "slot machine" will evoke a couch-potato visit to the "casino" (via Internet on your giant home display) and few people will opt to get in their aero-car and hover over to a brick-and-mortar establishment to gamble. I am a hardware guy so I become obsolete. So are the cocktail waitresses ("Honey, could you please grab a beer for me out of the fridge? I'm right in the middle of a hand.") and Security and Maintenance and so on. It's easy to see why online gambling will be really good for some people but for working stiffs like me, it spells disaster.

Randy Fromm

Publisher-Slot Tech Magazine



Randy Fromm

Randy Fromm's Slot Tech Magazine

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Hiring Advice for Technicians

by Micah Lahren

They have impressive certifications, and an outstanding list of previous experience. However, when you contact the references, it seems they lack a good work ethic, which led to their termination of employment in the past. How can you hire good technicians and be guaranteed they'll be a good employee in your team? There are no guarantees. But you can do much to ensure that the individuals you hire will be a good fit for your team by following some simple tips. Here are a few steps regarding hiring advice for technicians.

1. First Appearance

First impressions are important, and are very important when it comes to job interviews. Was the candidate punctual for the job interview? How is the prospective candidate attired? Are they fidgeting or slouching? Good posture

shows confidence, and is a good sign. Do they use offensive language or profanity in their casual conversation? Are they someone you would be glad doing business with if you were a client? How do they describe their previous employment? If they are negative about previous workmates or employers, they may be negative about you and your team as well, and it's a good thing to watch out for. Enthusiasm for the prospective job is another good sign, and if they ask for the job at the end of the interview, that is also a good sign, but it's not everything. There are a few other tips you can follow.

2. Test Their Knowledge

Testing their knowledge is a good initial step for hiring a technician. This effectively separates the 'Search Engine Techs' from those with actual experience. There's a difference between searching online resources for error codes and rare error messages given by software and applications, and searching for 'computer won't turn on' every time they need to work on a machine that won't boot

up. Throw a few scenarios at them, and ask them what their repair or troubleshooting procedure would be. Allow them a specific list of tools and supplies to work with, of course.

If you have a spare machine available, loosen some connectors, throw in a bad power supply, or swap out some hardware with some bad hardware you have sitting around. Give them some time to work with it, and see what they come up with. The idea is to give them a chance to show their experience and potentially their work ethic as they go. They might feel put on the spot, but clients often 'hover' over and around technicians while they work, so it's still just a basic experience test, as well as a test in customer relationships and patience on the job.

If you don't have a spare machine available, write up a simple scenario and request they work out a simple flowchart of the troubleshooting options they might take. It's a good test of their experience, and will give you insight



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into some of their techniques. It might also reflect a little on their work ethic as you see how detailed their solution is.

3. Check Their References

When contacting their references, inquire as to their work ethic, and how enthusiastic they were about their job. Many prospective employers ask for only two references, but I recommend requesting more. An individual with a good work ethic should not be in short supply of good references. These references could be places where they volunteer, people they've done business with before, teachers in school or professors at colleges. A good study ethic in school is often a precursor to having a good work ethic. If they can't supply any good references outside of relatives or close friends, that's a rather large risk to take, and depending on your situation, you may or may not be in a place to take that risk, so that's something you'll need to use your own discernment on.

4. Knowledge isn't Everything

A lot of techniques and tasks can be easily trained, whereas a work ethic cannot be easily trained. In fact, some organizations prefer training untrained enthusiastic workers with a good work ethic rather than using trained workers with little or no enthusiasm for the work. If the job candi-

date has an excellent work ethic, it may be worth training them quickly according to your service procedures and then giving them a chance at proving themselves. Of course, we're talking about the technician field here. Some candidates may just not be cut out for technician work, and lack of any computer experience whatsoever is a considerable drawback, so there is need for balance and discernment as far as this goes.

5. Honesty is Imperative

If the prospective employee shows any tendency to dishonesty or has past dishonest conduct reported by their references or previous employers, that's an instant red flag. You need a team you can trust when you're hiring employees, and a dishonest employee has ruined more than one company in business history. Often companies lose a lot of their profit margin due to employees taking hardware home, taking office supplies for personal use, or as in the case of a certain computer tech chain, smashing company devices in store rooms just to supply entertainment or see how difficult it was to do so.

Supply a small honesty test, requesting that they lie to cover for the company. Often, people who have no qualms about lying when it comes to personal profit via their job will have no qualms doing the same to the detriment of the company when they feel it

is in their better interest to do so. Someone who will lie for you will often lie to you when they feel they need to. That's not the type of employee you need. You need employees who will be honest as a matter of principle, not just because they see it as being in their best interests to be honest at a particular time or another.

Honest employees will be accurate in their paperwork, in their reports, and in their dealings with clients on the job. They have the integrity you need for your business, and you won't have to second guess them when doubts come up about a certain situation where the client claims one thing and the employee asserts another. The integrity of your workers will add to your business reputation as well, whereas dishonest employees will detract from your business reputation.

If you follow these basic tips when searching for prospective technicians, using discernment and balance, you can find excellent help that will boost your work team and add to your business and your business' reputation as well.

About the Author

Micah has been involved in the tech and repair sector since 2000, although he's been tinkering with computers since he was six, eventually turning it into a career. His experience covers a wide spectrum of the tech industry.



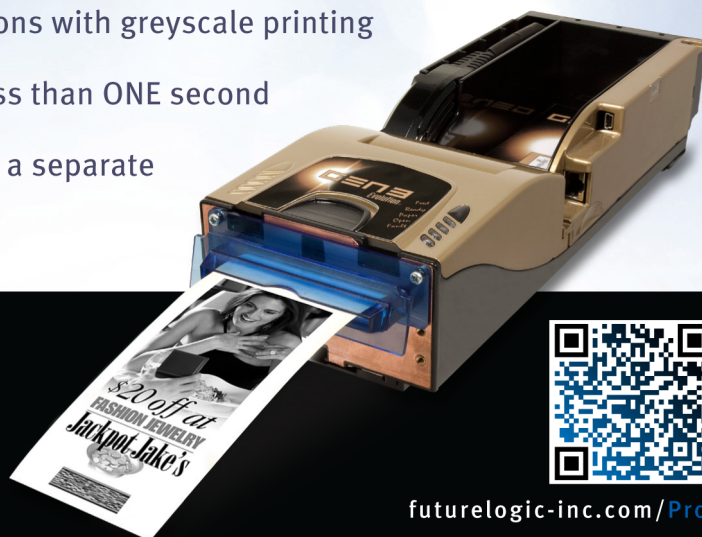
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Meet the LeakSeeker 89 AutoRanging Fault Locator

Editor's Note: We ran a press release about this new unit previously in Slot Tech Magazine. Here is how to use it to locate a shorted component on a PCB.

Locating shorted components on PCBs has not been a common issue in the past. However, as we have moved to SMD and, especially, the use of high-density, Tantalum capacitors (which have a tendency to short-circuit when they fail at a higher rate than aluminum, electrolytic capacitors, which dry out and open-circuit almost 100% of the time when they fail) it can be important to be able to quickly locate a “mystery short” on something like a power bus.

Engineers hang capacitors all over the power buss in a circuit. Sometimes, these are fairly high-value electrolytic capacitors (100-470 microfarads typically) that are used to present a nice,

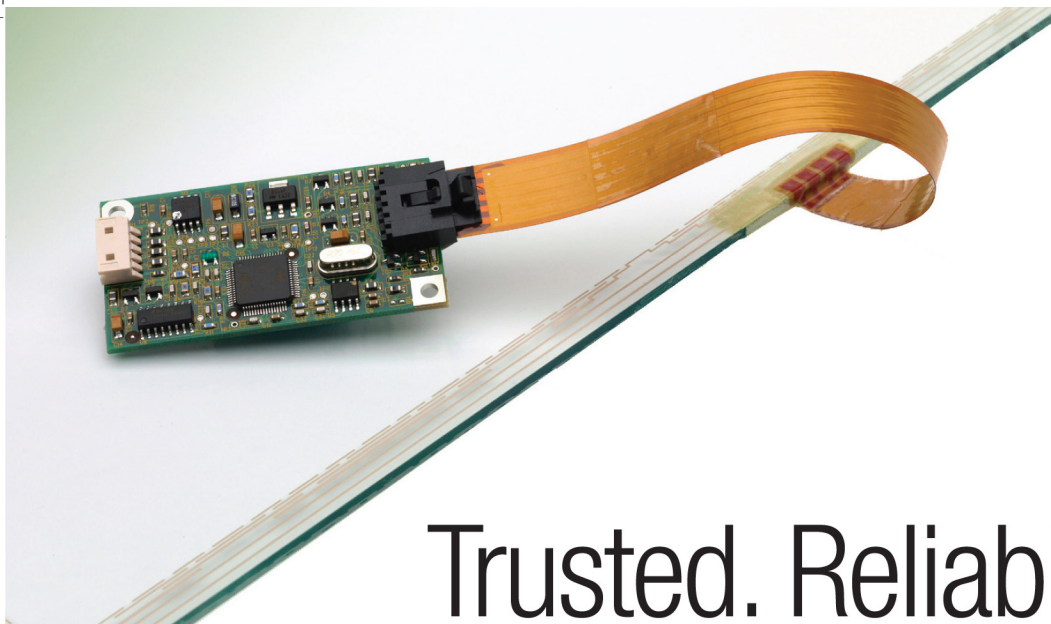
low-impedance source, physically close to the device that will be using it. A good example of this is the electrolytic capacitors that are placed across the DC input to the A-to-D PCB (the “video” or “scalar” PCB) in an LCD monitor. Because the small “brick” type of power supply may be located a meter away from the monitor at the end of a fairly thin wire (causing voltage fluctuations as the current draw is modulated), the charged electrolytic capacitor acts as a “source” that’s only a few millimeters away from the DC-DC Converter. In other words, it’s like having another power supply that is very close to the load and no longer subject to voltage drop due to resistance.

Other, smaller capacitors may be placed across the power buss as well. These can range from small, ceramic capacitors that are measured in picofarads (millionths of a millionth of

a farad) to .47 or even 1 microfarad. A rating of .1 microfarad is typical for these so-called “bypass” capacitors whose function is to shunt any high-frequency electrical “noise” (typically generated by the switching circuits in the electronics themselves, not from outside sources) to ground, thus eliminating it.

And this is often where our problem lies, especially if SMD, Tantalum capacitors are used as bypass capacitors. If just one of these capacitors fails and develops a short-circuit or low resistance, the entire power buss is taken down. It’s easy enough (in general) to determine that the buss is shorted. The power supply voltage will be taken down (often to zero if the power supply’s “over-current protection” or OCP has kicked in) with the faulty device connected but will pop back up when it’s disconnected OR a “power-off” measurement of the RESISTANCE across the power buss will be very low when compared to “normal.”

The challenge here is to locate the shorted compo-



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nent, which could be just about anywhere! The power buss goes out to all of the devices on the PCB and these little bypass capacitors are sprinkled like Fairy Dust across the board to keep the EMI in check. If any one of these capacitors short-circuits, the entire buss is dragged down but you can't locate the short with an ordinary ohmmeter because all of the components that take power from the buss or are across the buss will appear to be shorted to an ordinary ohmmeter (the resistance setting of your digital multimeter).

That is where the "LeakSeeker" comes into play. The LeakSeeker is a sophisticated "intelligent" ohmmeter that can read down to thousandths of a ohm ("milliohms"). As anyone who has attended one of my tech classes knows, I work as little as possible with the power on. I don't want to slip with my meter or oscilloscope probe and accidentally cause additional damage to the unit I'm trying to fix! The LeakSeeker is designed to be used, safely on a non-powered circuit. It supplies its own precise test voltages. Be sure power is disconnected from the unit under test, or your LeakSeeker may be damaged!

The LeakSeeker model EDS-89 will locate a shorted or leaky component or any other shorted condition (such as a pinched wire or solder bridge) with a

short resistance value from zero to 300 ohms, to the exact spot on a pc board. If the unit has multiple pc boards, LeakSeeker will first identify which board contains the defective component, then will guide the technician directly to the location of the defective component on that board. The EDS-89 version is an updated version of the original LeakSeeker EDS-82 series with three sensitivity modes, all fully automatic. Tests are done simply by touching the solder pads along a "shorted" foil trace and the pad with the highest pitch marks the defect.

How the Leakseeker Works

The EDS-89 LeakSeeker pinpoints the exact location of a shorted or leaky component by comparing the resistance at different component solder pads along a shorted pc foil trace, and subtracts the foil's milliohm resistance from the value of the defective component. Therefore, there is a different reading at each pad, although by a very small amount, with the lowest reading at the short. Leakseeker consists of a 16 bit self-calibrating digital comparator with a range of zero to 300 ohms, auto memory, and a variable gain comparison circuit with visual and audible indicators. Initial search for a shorted component automatically starts at the LeakSeeker's maximum range and counts down to the resistance of the defec-

tive component, within a "window" that is indicated by nine small distance LEDs. It also uses a variable pitch tone, which will be at its highest when the test probe is touching the pad where the resistance is lowest.

LeakSeeker can use one of two different test methods to locate the defect. The NORMAL test causes a precise voltage/current to appear at the test PROBE, and as the technician touches each pad, the small difference in the voltage/current readings is translated into the change of the beep pitch and distance LEDs. This test method is ideal for finding the location of typical "dead" shorts under a few ohms.

The 3-WIRE test is used when the readings are confusing, for example, if the "short" is actually many ohms, and a large electrolytic capacitor is somewhere along the trace. Instead of a steady tone, the pitch may constantly change as the capacitor tries to charge or the leaky defective component warms up, making stable readings impossible. The 3-WIRE test separates the precise voltage reference +REF from the PROBE port. It is more difficult to use, so the technician should have a thorough understanding of the normal testing methods first.

First, some important notes that you need to remember:

LeakSeeker recalibrates itself automatically to a new

range as you get closer to the defect, as ohms get lower. If you get further from the short and resistance goes higher, a lower pitch of the tone, and eventually no tone at all and the lowest red indicator will be the only indication. If you lose your way, or accidentally touch the wrong pad, you can push RESET and LeakSeeker will recalibrate itself again, as soon as the PROBE is touched to the correct pad. Remember that all tests must start by pushing the RESET button to clear the memory.

During the normal test, you would touch any pad along the "shorted" foil and allow LeakSeeker to recalibrate automatically as you get closer to the defect. However, if all of the solder pads seem to have the same tone because of the low resistance of the ground plane power source of a multi-layer board, using a higher GAIN allows you to increase the resolution many times.

Normal Testing

You should be sure that you are looking for a shorted or leaky part by verifying that the pc board trace you are about to test shows a suspiciously low ohms reading. A quick method for checking any type of unit for shorts is to simply measure the resistance across the largest main filters in the power supply with your ohmmeter. In a normal circuit, you will usually see the cap charging up to several thousand ohms. If you own a CapAnalyzer 88, set the LOW DCR warning slider to 50 ohms. Any cap that shows 50 ohms or less is probably the supply line that feeds the shorted component. Be advised that using an ordinary DVM ohmmeter will not find active shorts. Instead, use the CapAnalyzer or LeakSeeker as you would an ohmmeter. Normal circuit conditions would produce no warnings, while passive or active shorts 300 ohms or less will make LeakSeeker calibrate to the short and give you a steady reading.

For example, a normal power supply output usually shows several thousand ohms, after the filter caps finish charging. If you feel that you have a problem with the

supply because voltage readings are low while the unit is powered up, or CapAnalyzer warned you with DCR TOO LOW, remove power and use an ohmmeter across the cap to see if the reading is lower than 300 ohms (the maximum range of the LeakSeeker) to ground. Typically, most good supplies show resistances in the thousands of ohms while most with "shorts" will show just a few ohms, or even less than an ohm. The exception to this instance is when you suspect an active short, where a supply is pulled down by a component that does not show shorted with your ohmmeter. This can happen when, for example, a component shorts, but is powered through a diode. Although your ohmmeter cannot measure past the diode, the LeakSeeker (and CapAnalyzer) can. A steady tone after the LeakSeeker calibrates indicates that it found a suspicious reading under 300 ohms and your search can go on. If it simply chirps or gives no reading at all, then no short (active or normal) was found.

Getting Started

Look at the GAIN switch. Notice that the lower gain setting is best for thin pc foil traces, and should be your first choice. If you notice very little pitch changes as you hop from pad to pad, you can raise the GAIN, as the foil traces might be thicker.

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You would use the highest GAIN setting for very thick traces or multi-layer boards with ground planes.

In the NORMAL test, the BLACK ground wire alligator clip is connected to the best ground available, preferably at the power source. The connection must be of high quality or the results will be misleading. You can ignore the alligator clip and solder the bare wire (behind the alligator clip) to ground to eliminate this source of errors.

Push the RESET button to let LeakSeeker know to start a new search. The test probe is then touched on a solder pad anywhere along the pc board copper trace that you believe a shorted or leaky component is soldered to. If the board is dense, you might use a thin Sharpie marker to outline the trace, to prevent confusion so that you don't accidentally touch the wrong pad.

As you hold the test probe on the first pad, LeakSeeker will beep at its highest pitch and light the WAIT lamp brightly for a few seconds as it ramps quickly down to the short value. Be patient. As it gets closer, the search will slow, the WAIT LED will flash dimly and you will hear the pitch clicking step by step as it gets a few milliohms closer and closer. When it has calibrated, the pitch will be low and steady and one (or a group) of the nine distance LEDs will be lit. Touching the test probe to the next solder pad along

the pc trace should make the pitch higher or lower, depending on whether you are moving in the correct direction. The distance lamps will also give rough indications that you are getting closer or further from the defective component. As you touch the probe from pad to pad in the correct direction, the beeps will get higher in pitch and the distance LEDs will go CLOSER > to the green LEDs. As you get out of range of the window, the WAIT LED will come on as LeakSeeker recalibrates the window. If you get further from the short, the LEDs will reverse toward the red LEDs and the pitch will get lower. You should always make it a habit to go back one pad after each new pad test to make sure the pitch is higher on the new pad and lower on the old pad, as LeakSeeker will recalibrate very quickly and you might not notice.

If you accidentally touch the probe to a wrong pad not on the shorted circuit, like maybe ground, and LeakSeeker notices the huge change, it intentionally waits a second before accepting the huge change and recalibrating. The delay is intentional; if you accidentally touched the wrong pad (like a ground), this delay gives you the time to change your mind as long as you lift off of the pad before the WAIT LED comes on and recalibration is complete. You should always double-check your progress by touching the previous pad—the pitch

should be lower than the pad closest to the short. If you goof, just press RESET and start off the last valid solder pad.

On older boards with large traces, or on multi-layer boards with groundplanes, you may find that many pads close to each other may have the same pitch. Use the highest GAIN setting and now you will see and hear a slight change between the two pads. The pad with the highest pitch is your objective. When the tone no longer changes and the WAIT LED is off, the window is perfect.

As you touch each pad, remember to always go back one to double-check that the tone is lower (or gone completely as that window is now long gone). At some point, the beep will be highest in pitch at only one pad along the trace. This is the short, and may be the location of the defective component. If you continue past this pad, the pitch will start to go lower and the distance indicator will start to head towards the red indicators. If you backtrack, the pitch will always be highest at the pad with the lowest resistance, and of the possible defective component.

But what if the highest pitch can't be the bad part?

If the highest pitch comes from a pad that is a jumper or wire, or coil or transformer, for example, a component that is supposed to

conduct, this means that the defect is probably on the other side of the component, in another area of the board. For example, if you are tracing a short at the collector of the horizontal output transistor and find that the highest pitch is at the flyback transformer primary, this does not necessarily mean that the transformer is shorted; the short may be on the other side of the winding, at the B+ supply. Follow it like a detective, as you may find that you may be jumper-hopping, coil-hopping, possibly even board-hopping, for example from the HV board, to the supply board and so on, to where the bad part actually is. The obvious parts that could be bad are parts that should never show as a low resistance in the first place, such as a capacitor, cathode of a diode, B+ pin of an IC chip and so on.

Using the Hot/Cool Thermal Test Method

If the defect is several ohms, you can search for the defective component in another, much easier way. To keep your hand free to hold a can of freeze spray or a soldering iron or hot air blower, use the extra plug-in test cable supplied with LeakSeeker that has the solder wire tip, plug it into the REF+ port, and solder the tip to any pad along the shorted trace. The test mode switch remains in the NORMAL position, which joins the REF+ and PROBE ports together. Press the RESET

button and wait for a stable reading.

Higher resistance defective components are always thermally responsive. You can use a can of freeze spray to spray each component on the board while the solder tip test cable is soldered on the suspected trace. The spray will make the LeakSeeker change quickly in pitch when the defective component is sprayed.

3-Wire Testing

3-Wire testing is used for times when Normal testing becomes difficult. In these cases, a component may not be shorted, but just leaky; perhaps 50 or more ohms, and a capacitor along the trace tries to charge each time the test probe is touched to a pad. Instead of steady tones, the LeakSeeker will chirp from high to low, or the pitch will vary, making testing very

difficult in the NORMAL position as you wait forever for the pitch to get stable, but the 3-Wire test will separate the +REF from the PROBE port, and allow the circuit to stabilize under power. Only use the 3-wire test for higher-ohm shorts over about 10 or 15 ohms and when normal testing is too difficult.

Solder the +REF wire solder tip to the normal source of the power in the supply line you are troubleshooting, for example, at the output of the power supply at the big electrolytic that shows a short to ground. This is important, as the 3-Wire test does not allow testing to start anywhere on the board as the NORMAL testing allows. Make sure the mode switch is in the 3-WIRE test mode. You must start probing at the normal source of power, like at one end of the trace by the large power supply capacitors. Allow about 15

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seconds for all voltages, currents and temperatures to stabilize, push the RESET button, then touch and hold the test PROBE at the starting point where the +REF is soldered, and allow LeakSeeker to calibrate. Then touch each pad along the bus and proceed as you would in the NORMAL test. Each reading should now be quick and easy since the special signal from LeakSeeker +REF now is no longer changing.

As you proceed, just as in the NORMAL test, the pitch of the tone and distance indicators will guide you towards the defect. As you probe different branches, you will find that some branches do not have any changes from pad to pad. That is because there are no problems in that branch. Go back to the fork and try another branch.

At some point, you will reach the defect and pass it, and the distance indicators and tone pitch will again no longer change, just like the previous branches that had no problems. The first pad on the branch that is highest in pitch is the location of the defect. Going back towards any other branch will cause the tone to get lower, and going forward will no longer cause the highest pitch to change. Therefore, be sure to notice the exact location at which point the readings no longer change as you pass the defect. The exact location of the first pad that has the highest pitch will be the exact location of the

defect. All pads beyond this point will have the same pitch as the first pad of the highest pitch. You can verify the defect by using a blast of freeze spray or directed heat on the suspicious component. LeakSeeker will change pitch drastically only when the defective part is cooled or heated.

Self-Tutorial

To best be familiar with LeakSeeker, try this little experiment. It will give you the direction and understanding in real time of how to use LeakSeeker. You will intentionally create a defect by soldering in a low-value resistor across a capacitor in a power supply trace, and then use your LeakSeeker to find it.

On an old pc board or discarded electronic component, locate a power supply trace on the main board and check the resistance to ground. You will see how a normal circuit should show, probably a few thousand ohms. Now, solder in a low-value resistor across a large capacitor, or maybe somewhere further down the trace to ground, to simulate a leaky capacitor. For example, you could solder a 4.7 ohm resistor to ground at an integrated circuit B+ or small filter cap. (Of course, don't power up the unit, or you might damage its power supply). Use your DVM or ohmmeter to verify that you get the same 4.7 ohm reading to ground, everywhere along the trace.

With the LeakSeeker power switch in the NORMAL test, push RESET once. Start at some distance from the "short" resistor, along the same foil. Use a Sharpie marker if the trace is very thin so you don't get lost. You should follow the instructions for the NORMAL test and follow the LeakSeeker's advice, tracing a path along the PCB foil trace pads, wires, jumpers and connectors, and end up at the resistor that you soldered in. (Don't forget to remove the tutorial resistor from your experiment when done!)

As you progress, you will get the feel and the personality of your LeakSeeker. Try the 3-WIRE test method only after you have mastered the NORMAL test, as this test is more difficult. You'll usually only need this test with shorts higher than 10 ohms anyway, which are rare.

The unit includes a universal AC adapter with a 2.1mm plug. The internal regulator in LeakSeeker allows it to run from any AC or DC adapter from 9 to 25 volts AC or DC, as long as it has a 2.1mm plug.

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TechFest 28 Las Vegas



Above: Heisenberg stopped by for a cooking lesson. Actually, that's David Oldham of Suzo-Happ, representing MEI.
Below: Tony Bowe represented FutureLogic (printers). POPULAR!

A couple of dozen slot techs from as far away as New York, enjoyed the sunny weather in Las Vegas last month for TechFest 28. TechFest has sort of evolved into much more of a hands-on class, thanks primarily to Ceronix and their traveling LCD monitor lab. Everyone in the class had a chance to tear down and rebuild an entire LCD monitor, right down to the CCFL lamp assembly. Everyone attending received their own digital multimeter as well. We covered just about everything except soldering!





Above: Ken Lema (Ceronix) hands out door prizes! Thanks again, Ceronix.

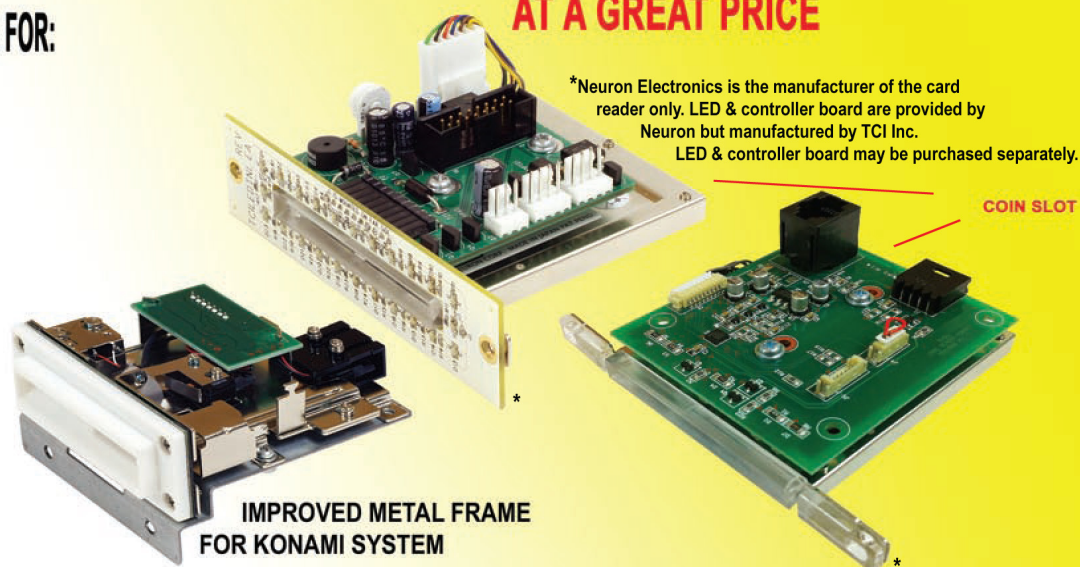
Top: My homeboys from Pala Casino in San Diego rocking the hands-on, LCD monitor lab. They have the best noodle house and best sushi bar of any casino in San Diego County.
Above: Slot Tech Magazine's #1 supporter, Harry Iverson of Pacific Illumination gave free CCFL testers to everyone at TechFest 28!

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Dust Sucks!

The gaming machines in your casino get dirty, inside and out. That's a fact that hasn't changed since the first spinning reel game graced the dime store counter top. The machines of today are much more sophisticated. Each year, they have more complicated electronics inside and with more technology usually comes more investment required when a new game is purchased. If you're like most casinos in this economy, you've likely had to cut staff and you rarely get approval for another FTE (Full Time Employee). This can be a recipe for lost revenue and decreased bottom line profits as staff limitations severely cut into normally scheduled "Preventative Maintenance." PMs are always the first thing to go and as such, Preventative Maintenance is sometimes non-existent and the games are rarely cleaned.

The games on your floor today are a mix of new and old but most of them have complicated electronics,

multiple (and expensive to replace) Power Supplies, LCD monitors, CPUs and graphics cards. These electronics require regular upkeep and can fail if not cleaned regularly. Electronics fail more often with heat and when they fail, they need to be replaced. The typical casino of today spends \$75 per game on parts per year. Many of these parts could be saved if the machine was kept cool and there is no way that can happen if the fans in the machine are clogged with dirt and dust or, as often happens, have failed completely due to the destruction of the bearings due to the incursion of dust (see Slot Tech Magazine November 2013 for our report on cooling fans and their destruction due to dust).

Whether you operate a casino with regular peak capacity OR you operate a casino that's just pretty steady every day with a pickup on weekends, you know that when a game goes down it isn't earn-

ing revenue and sometimes, this can mean customers don't play and your game revenue suffers.

Let's say you weren't constrained by staff hiring restrictions. If you had to hire a full time employee (or staff of employees) to do nothing but clean and PM your games, how much would that cost your casino? What's the cost to recruit, hire, train, provide benefits and supervision just to ensure that the machines you invested in are up and running and clean and ready for your guests to enjoy?

Many casinos today struggle to be able to afford these staff members and when hiring is frozen and headcount reduced, what's the alternative when you can't clean the games? Leave the games dirty? When the games are dirty, how efficiently do they operate? Do parts fail more often? Do games that are left unclean experience downtime and if so, how much does that downtime cost your casino?



Filter holder mounts in less than a minute with adhesive strips. Filter changes in seconds

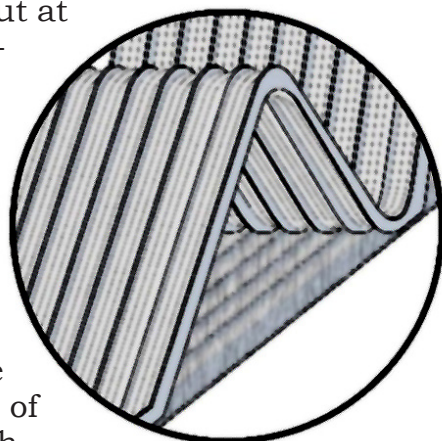
If you were able to solve these problems above for just pennies a day, would you do it? Why not find a piece of technology that can help keep the games clean with minimal installation and maintenance?

Casino Air Products

Casino Air Products markets, assembles and sells the HAF (High Air Flow) air filter from 3M. This filter has been successfully installed over 50,000 times globally since the product invention and inception in 2011.

More than just an air filter, the HAF filter is specially designed to work with electronics because it passes through the majority of the air that it filters. The filter doesn't restrict the airflow in any significant way because even when the filter is fully loaded with debris, it was tested and re-tested and found to raise the air temperature inside the game by a negligible amount. The HAF filter is great at keeping carpet fiber, dust, dirt and debris out of your games and away from critical parts.

The HAF filter has been extremely useful before, during and after carpet changes and construction projects. Sometimes, the games 'breathe in' this debris from carpet and construction and the machine's parts are put at risk unnecessarily. The use of this very inexpensive filter has been shown to pay for itself in the first month of use through protecting the game's components and sub-assemblies and ensuring that the game is up and available for play without downtime.







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ROI

The use of the air filter can significantly reduce the number of spare parts your casino has to purchase each year. Failures of expensive graphic cards due to fan failure is extremely common. Most casinos realize a savings of 50% on their parts budget once the filters are installed.

The filter can help you either reduce staff expenses or reposition your staff to serve your guests more effectively. Staff efficiency is an important part of the Return on Investment associated with the HAF filter and normally pencils-in as follows:

- 1.) Normal Preventative Maintenance Schedule = six times per year (Bi-Monthly)
- 2.) How Long it takes to clean the inside of a game = 30 minutes
- 3.) Average wages (fully loaded) of FTE to clean games = \$45
- 4.) Filter life = 6 months
- 5.) Amount of time saved on each PM = 50%
- 6.) Amount of PM time saved per filter = 45 minutes
- 7.) Amount of \$s saved per filter normally spent on staff = \$33.75 (minimum)
- 8.) Amount of \$s saved per year \$67.50 + \$37.50 (½ of parts) = \$105
- 9.) Filter cost (normally between \$8-10 depending upon volume) x2 = \$20 max
- 10.) \$105 savings - \$20 cost = \$85 total savings, per year, per slot. This doesn't take into account savings on lost down time.

A casino with 1,000 games could save \$105,000 per year. This is enough to buy a bank of new machines each year!

The HAF filter is electrostatically charged and in between the 'pleats' of the filter, the fine particles that enter your games are retained by this charge and kept there until the filter is replaced. The air filter needs to be replaced every 5-6 months. The average cost to own the air filter is just 4-5 cents per day!

This is a filter from a popular model video game after five months of use from a casino

on the LV strip. The majority of the debris is carpet fiber (79%) followed by dirt and dust (16%) with "other/organic" at 5%. We've seen these kinds of results all over the world. Our filters work and we know it. Contact us for our "No Risk" guarantee.



Here are a few photos of dirty filters that all were a result of four-to-seven months of use in casinos all over North America. These filters really work for others, we know they will for you too!



To see a video of the air filter and its easy-to-install application, please visit www.CasinoAirProducts.com or call Karla Wellman at 951-221-7397.

E-mail Karla for a free sample and/or more information at KWellman@CasinoAirProducts.com.

3M™ High Air Flow Electrostatic Filter

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3M™ High Air Flow Electrostatic Filters (HAF-E) have been specially designed to help reduce the amount of certain air-borne contaminants such as smoke, dust, dirt, debris and carpet fibers from entering air intakes on devices such as slot machines, vending machines, arcade games, ATMs, kiosks, and computers.

Peak Filter Performance

3M HAF-E filters utilize novel microstructured features shaped in a hollow triangle pattern to increase filter surface area to allow high air flow rates while minimizing pressure drop across the filter. Additionally, filter effectiveness is maximized by utilizing 3M's proprietary electrostatic manufacturing process which provides an electrostatic attraction from the filter surfaces to airborne particles to help attract and capture fine particulates and smoke while providing a low pressure drop.



Recommended Applications

- Slot Machines
- Arcade Games
- ATMs
- Critical Electronic Components
- Kiosks
- Computers
- Vending Machines

Equipment Uptime

With a 3M high efficiency filter protecting the air intake ducts from certain air-borne contaminants, the need to perform daily, weekly, and/or monthly cleaning of a device interior may be reduced. Filter change-out can be performed in less than 30 seconds with no special tools and typically does not require taking the equipment out-of-service resulting in maximum uptime of the OEM device.

Constructed to Perform

The hydrophobic (non-water absorbing) polypropylene filter media in an all High Impact Polystyrene (HIPS) filter housing construction provides superior durability for recommended applications. The filter housing material has a textured matte black finish that complements the industrial design of the device to maintain a finished professional look.

Feature	Benefit
Electrostatic Filter Media	<ul style="list-style-type: none">• Helps attract and capture fine particulates and smoke and provides a low pressure drop. The resulting clean, high air flow helps attract and capture fine particulates and smoke while providing a low pressure drop.
Novel Microstructured Features	<ul style="list-style-type: none">• High-air-flow design provides particulate protection of fine components while helping to minimize any component temperature increase (the filter protects components from debris building while contributing $\leq 5^{\circ}\text{F}$ increase under normal conditions)• High filtration surface area can help to extend the filter's useful lifetime• Rigid filter construction provides a clean, effective filtration solution, and minimizes particle dislodgment during filter changeout
Ease-of-Service	<ul style="list-style-type: none">• Specifically designed for rapid (less than 30 seconds) filter changeout with no tools required• Maximizes system uptime



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Slot Tech Magazine is strictly technical. As such, the magazine's contents are not time critical. The repair information and technical data contained in past issues is just as valid today as it was the day it was published.

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

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

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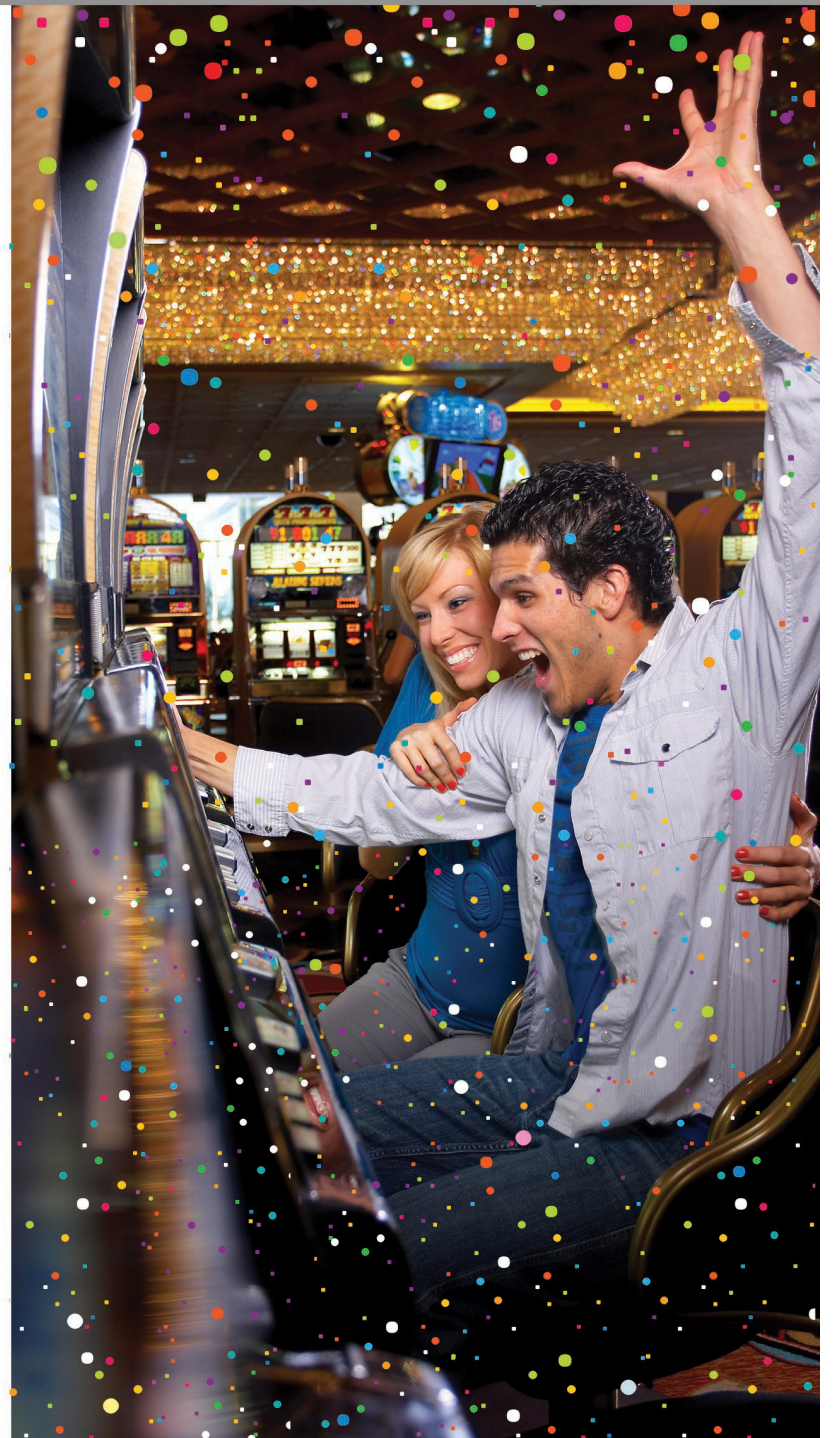


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