October 2006

Slot Tech Magazine

Slot Machine Technology for the International Gaming Industry

Quick & Simple Repairs #17
Acres NexGen LCD Repair
CCFL Replacement
Why Do CCFLs Burn Out?
Introduction to Host Systems
LCD Monitor Repair
Ithaca 850 Repairs
Three Tales From
Behind the Cabinet Door

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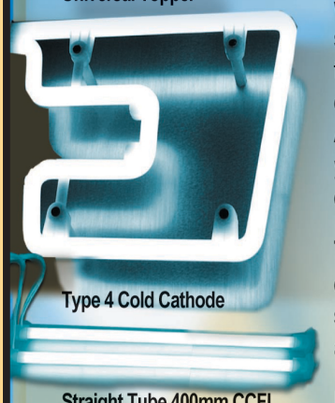

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Innovation through Technology

Slot Tech Editorial

This issue of Slot Tech Magazine is so good, it makes me want to cry. I am serious. This month, our contributors have brought together some really top-notch technical data that will save your casino thousands of dollars in repair costs and make you look like a genius when it comes to fixing LCD displays both large and small.

This month, Slot Tech Magazine (finally!) takes a detailed look at CCFL replacement. It's been something that I have wanted to present for quite some time as we have, more-or-less, covered just about every aspect of CRT-based monitor operation and repair over the past five and a half years (archived back issues available online at slot-techs.com/magazine). The holdup, until now, was that most monitors have been under manufacturer's warranty for the past couple of years as LCD monitors have been making their way onto the slot floor in both new machines (e-motion, Bluebird, etc.) and as retrofits for existing machines with CRT monitors.

Randy Fromm's
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Slot Tech Magazine is published monthly by
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slot-techs.com

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Now that the initial warranty period has ended for what is likely tens of thousands of LCD monitors in casinos worldwide, casinos are looking for ways to repair them.

One method is to continue to send them back to the manufacturer for repair. They built the thing so they certainly should be skilled at making the repairs. One of the nation's most skilled LCD repair guys is Ray Holdren of Kristel, Nevada. Many of you already know Ray through his presentations at TechFest. You can send your monitor to Kristel and it will be repaired for you at a nominal cost.

Another option is to use a specialist repair depot. As LCD monitor failure crosses many industries (point of sale terminals, automotive, medical, etc.) there are now repair depots that specialize in LCD monitor repair. HVT is one such specialist. Equipped with state-of-the-art cleanroom facilities, HVT can repair and completely rebuild almost any type of LCD monitor, in some cases making the monitor better than new by using proprietary films that improve brightness and provide other enhancements. I keep bugging them to provide Slot Tech Magazine with a behind the scenes look at the plant. I may have to go up there myself and see how they do it.

A third option is to perform LCD monitor repairs in-house. For most moderate to large properties, it is imperative that their slot technicians posses the skills and tools they need to perform LCD monitor repair. This is much easier than it sounds as it is a largely modular system (like the slot machine itself) that easily lends itself to troubleshooting down to the module level. Even if you are not prepared for component-level repair, you can throw in a new power supply, inverter or video processor PCB and be off and running in fifteen minutes.

But what if the CCFL lamps are burned out and need to be replaced? I asked Kristel's Ray Holdren if he could provide Slot Tech Magazine with a comprehensive article on CCFL replacement, since this has revealed itself to be the majority contributor to LCD monitor failure. He came through in spades, let me tell you. They say a picture is worth a thousand words. In this case, a picture is worth a thousand bucks as Ray, with the photographic assistance of Aladdin Casino's Jerry Alvey, has put together a photo essay on CCFL replacement for Kristel LCD monitors. This is how they do it at their repair facility, straight from the horse's mouth. If you find this article helpful, I suggest you call or e-mail Ray at Kristel, Nevada and tell him. He'll even sell you the replacement lamps! Thanks, Ray and Jerry. Awesome work.

Randy Fromm

LCD monitors come in many sizes in today's casino. CCFL failure is the common thread between them all. When the little NexGen touchscreen came out, I thought it was a really exciting technological addition to what was already a very interesting electronic system, the modern slot machine. I hadn't considered what 24/7 operation would do to the life expectancy of the display. It was all too new. Cutting edge stuff, this!

But David Spence Jr. of nearby Valley View Casino in San Diego knows all too well what happens when the end-of-life occurs all but simultaneously on hundreds of units. You steepen the learning curve and learn how to fix 'em, fast! Funny how real repair talent can show up in even the smallest of casinos. Mr. Spence takes us through CCFL replacement for the NexGen screens. You kind of have to dig down into the unit but the rewards are worth it. Thanks, David. Great job, buddy.

Also new in this issue is part one of Jason Czito's multi-part article on the OASIS host system. This series is really a keeper for any casino that uses the system. When the series is completed, it will be a complete training manual on the OASIS system.

See you at the casino.

Randy Fromm

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Quick & Simple Repairs #17

By Pat Porath

Bally 6000 Reel Game

On the Bally 6000 games there are mini circuit breakers. When they trip, you simply push the button back in once the problem has been found. We had a game where "something" had a direct short; there was no doubt about it. So, troubleshooting began. The major components (hopper, Coin Comparator, reels, power supplies) were all unplugged and one by one they were plugged back in until the breaker tripped. The problem was the CDS power supply. This was unusual for the casino were I work. It was plugged in and the breaker tripped right away. I suppose out of 952 games, one is bound to short out once in a while. The unit was replaced and the game was back in operation.

One other time a Bally 6000 happened to be tripping a mini breaker and once again, the major components were disconnected and one by one each was plugged back in. We worked from the bottom of the game to the top and when almost everything was reconnected, it turned out that the tower light shorted. It was replaced and the game was fine.

IGT I-Game
Coin In Jam and Meter Disconnected Error Wouldn't Clear

While reading our tech logbook in the morning to get the game plan for the day, an I-Game had a "coin in jam" and "meter disconnected" error that wouldn't clear. The game was shut down. Of course techs don't like down games. I thought to myself it would no problem at all, more than likely a loose I/O (input output) card. From the games being opened and closed by the count team and by slot attendants performing either paper or coin fills, every so often a card gets loose. Not this time. All of them were nice and snug.

Maybe the processor board needed to be reseated? That was tried and it didn't work either. It couldn't actually be a coin in problem because the game was coinless, and it is very rare for a hard meter to short out. It was possible for a small screw to be on the processor board shorting something out, I have seen that a few times. The processor board was pulled, and when I tipped it a little, I heard a funny sound. Some type of small object was on the board rolling around. It was a small piece of plastic and it had three traces on it. Not good. Could it be a tiny part of a chip? Sure enough it was. I scanned over the board and on the upper right

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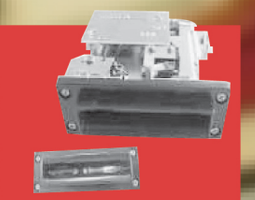
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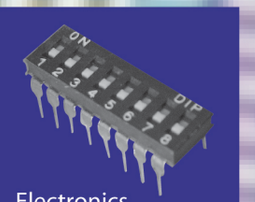

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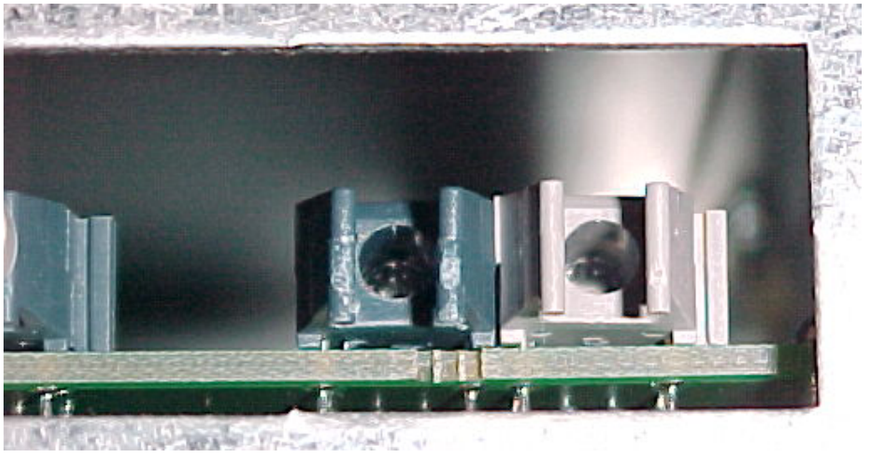
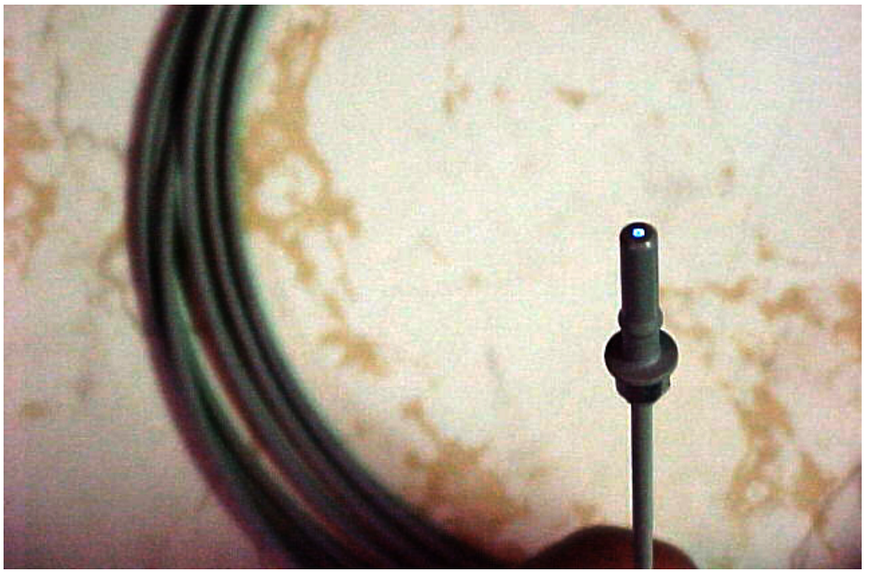
side; the top part of one of the chips blew right off. Something went haywire. At least we knew the problem now, an electronic mini explosion happened. The board was replaced, game options were checked and it was fine. This was the first time that I had ever seen this happen with an I-game.

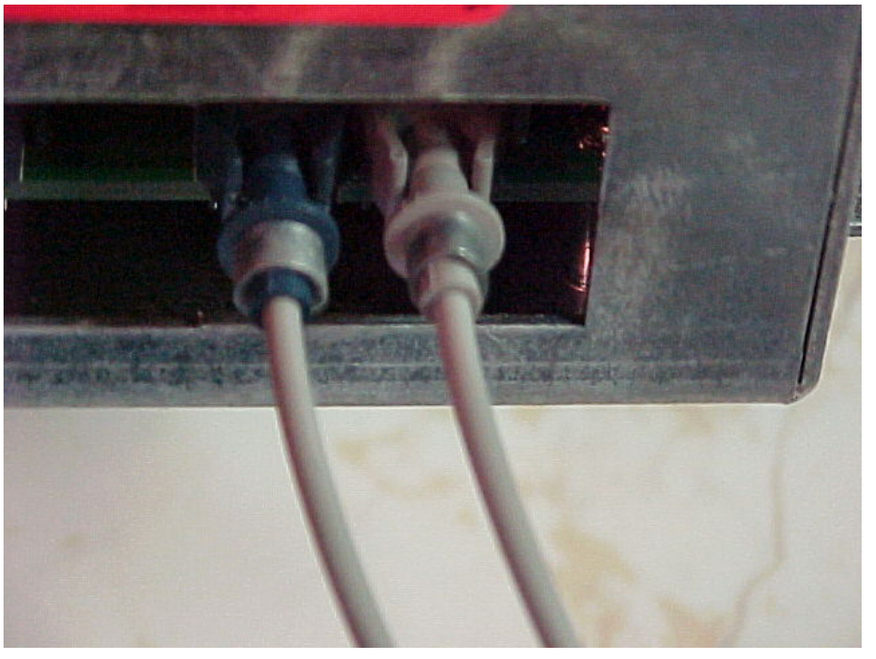


One thing to remember when working on fiber and CDS, the "light" goes to the left. Yes the light to the left.

CDS Fiber Optics

One thing to remember when working on fiber and CDS, the "light" goes to the left. Yes the light to the left. When looking at the fiber board, there is a COMM in, COMM out, and drop door connections. Each has two ports. The drop door switch operation is very simple. It closes off the light path. But to get the sentinal and game communication working properly is a bit more complex. The light (from the Data Port Unit) goes into the left connector of the fiberboard and the rest are connected on down the line. When the next game needs to be connected, same thing. The fiber line that shows visible light, goes into the far left connection. On a standard hardwire setup of CDS and games, the last game in the bank needs a 100-ohm resistor on the COMM out connection. With the fiber setup, there is a two-pin jumper that needs to be enabled. If not, more than likely there will be problems. The jumper is on all of the





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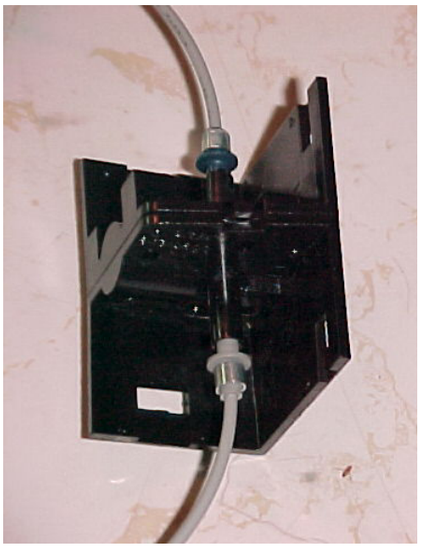

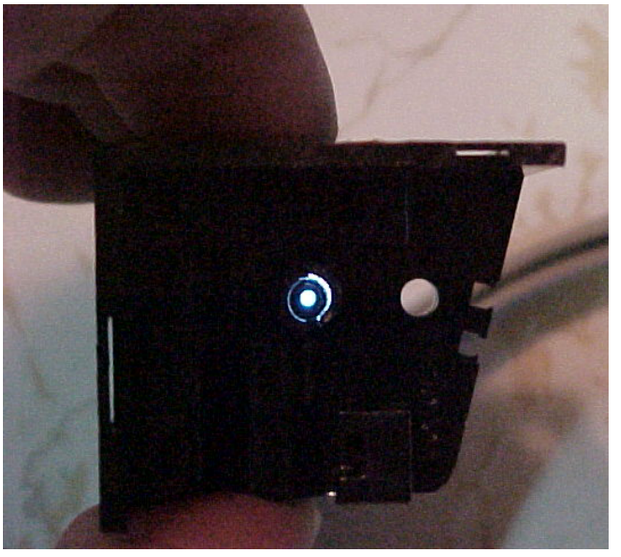

The drop door switch operation is very simple. It closes off the light path.

fiber boards (on one end or the other) and is disabled on the other games in the bank. It is commonly called "terminated."

Someone new to slots may ask what in the world are these people talking about, "Is there a terminator on that game?" They can cause problems if not in the proper area too. When moving some machines around the floor, adding a few new but leaving some, if there is a "terminator" in the middle of the newly set up bank, there will not be any communication past that point. This includes hardwire and fiber.

Think of it as how water flows. If there is a shut off valve in the middle of the operation, nothing past that point will have any water. Same thing here. If a "terminator" is in the middle, none of the games will "talk" after that point. In a few cases, it has caused headaches. What could be wrong? The North side of the bank of machines is working great, no errors at all, the connections underneath are fine, no broken or pinched wires. But the other half won't communicate. There is a chance that a "terminator" may be to blame. Remove it from where it isn't suppose to be and install it where is should be. Data Port Units (to the best of my knowledge) can handle 24 games, and not over 28 per unit.

Back to fiber . . . no, not dietary fiber . . . fiber optics. A couple of notes when hooking up games together: One is to make sure not to bend the fiber too much. I wouldn't go tighter than a five inch diameter circle. Make gradual loops up and through games. Also be sure that the cable won't get pinched in the path of the ticket printer or hopper. In the event of a hopper jam or a paper fill, the cables need to be clearly out of harm's way. It only takes a cable to get pinched once and it may be no good. Worse yet, it could cause intermittent problems. We all love them like a toothache.

UBA Frames Breaking?

Over the past couple of months we have had a few of our UBAs break and we were not able to repair them. Then we had a couple more break . . . Ok, what is going on here? Now there is a problem.

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fied game, IGT using their own, and Aristocrat using their own and so on, the UBA broke where the two connect. It may be the main slot door got slammed shut one time too many or there was an alignment problem with the door and bill accepter. It wasn't long and the antidote was found for the patient. The answer: steel. Aristocrat and IGT games that have the U.B.A installed in them now have a piece of steel that reinforces the bezels. I haven't heard about the Bally and WMS games yet. When I do I will no doubt pass the information along.

The steel plate mounts between the bezel and the unit perfectly and works great. Not a problem since. To save my soul, I cannot find a part number. Contact JCM at www.jcm-american.com and they will be able to help you out.

UBAs Not Accepting Bills?

The problem could be the cashbox. Even if EVERYTHING is brand new, it may be the cashbox. Not all that long ago we had some games come in and the following day there were bill accepter problems. What is the deal this time? Everything is new, the whole works. They tested fine yesterday. The problem we ran into was a small hole in the box was obstructed. Once the cashbox is inserted into the game, an optic must "look" through the hole to know that it is there and ready to stack bills. Our count team, not knowing, put labels on the boxes covering the hole. Doh! Obviously an optic can't see through a label very well. I took my handy-dandy small flat blade screwdriver and cut around the hole and removed the edge of the label and the bill accepter worked fine.

Bally Video Voucher and CDS Problem

This is interesting. Not long ago we had a situation where a voucher or ticket (same thing) was "already redeemed" in the system although it wasn't ACTUALLY redeemed. A few times on a Bally EVO Video slot, the ticket would go into the WBA 13 IDO 003, pause for a moment and return to the customer. There would be a bill accepter tilt right after the ticket is kicked out but the problem is that the system redeems it during this time. Obviously the game software was checked right away. The mystery was that the game did not show any information of the ticket AT ALL. On the CDS side, items can be checked in the section of "transactions" in "diagnostic monitor." On the specific game in question, once in "transactions" the game side showed that the ticket was accepted and redeemed in the game even though it was not in the stacker box and no information was in the game. The customer had the ticket. Pretty wild. When it is brought to attention that the ticket is "already redeemed" you may want to check your tracking system and the game to make sure. To fix the problem, which is the bill accepter, simply replace the bezel board, which is located on the side of the WBA. The game needs to be tested and the problem shall be gone.

Two-cent Ticket That is Supposed to be a $50.00 Ticket?

This problem seems to be happening more and more. A customer will state that they put in a ticket for a dollar amount higher than a few cents and say they didn't receive their correct amount of credit. At the casino I work at, this situation happens daily. As an example, a customer will say "I know that I put in a ticket for $10.00 and only got two cents. Where is my money?" The actual answer is that the money is (or was) in the game that they had previously played. When this situation comes up, the best thing to do (in my opinion) is ask what game they were playing BEFORE this one. If this is done, there is a chance that their credits will be there. If another customer saw the credits sitting there, and nobody around,

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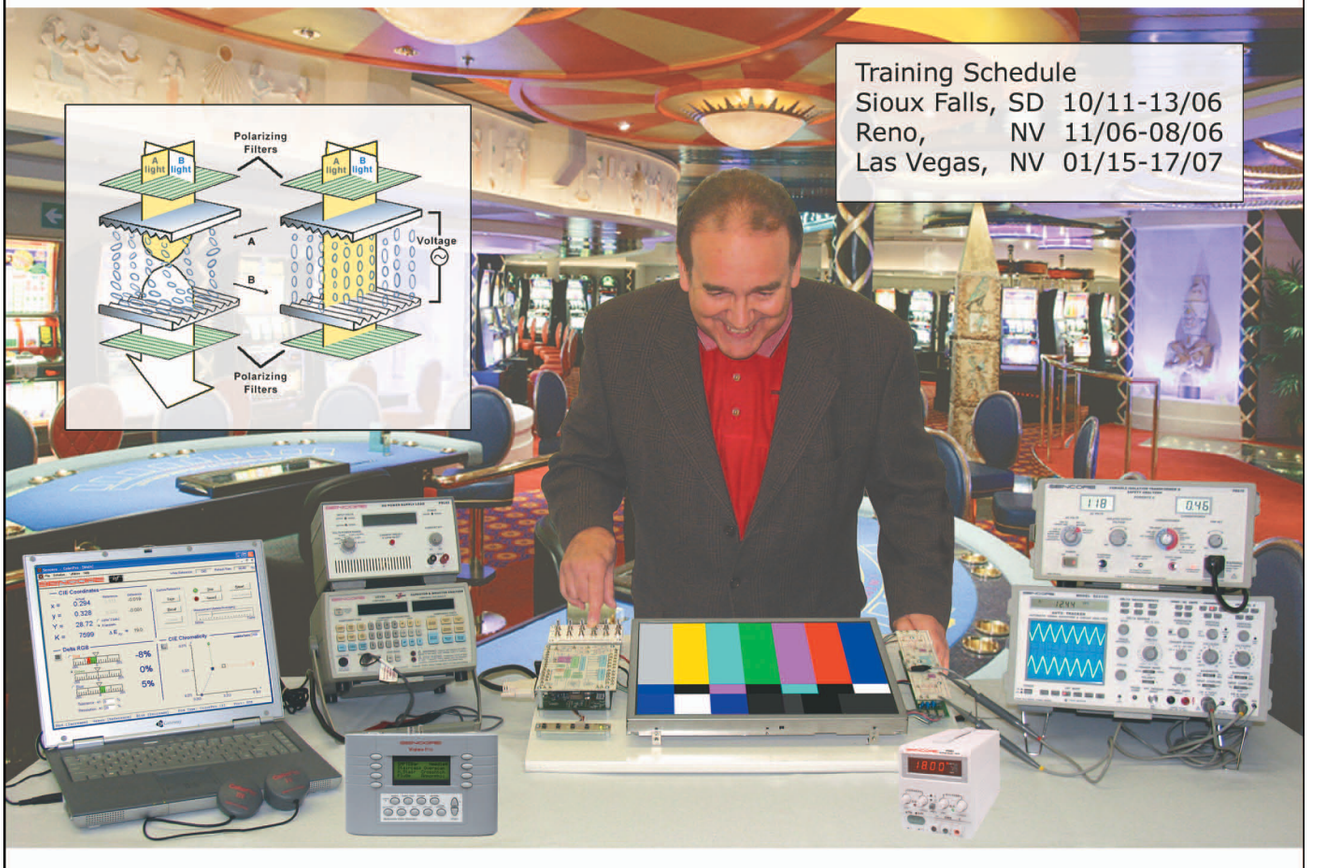

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guess what…they are long gone. Even though on the back of tickets, it states "we are not responsible for lost or stolen tickets" and "this is a bearer instrument" we try to find out where the credits are or where they went. If this is brought up to security, it is classified as abandonment (the customer walked away from their money).

So…what ACTUALLY happens, the vast majority of the time, I can't say ALL the time because we know how slots are, but what happens is a customer walks up to a nickel game with a $10.02 ticket, puts it in the game and because of the odd 2 cents, it kicks out a two cent ticket. The customer presses the cash out button and NOT looking at the ticket, grabs it, thinking it is the $10 one, and proceeds to the next game. In actuality it is only two cents. They insert it into the game and wonder where their money is. Meanwhile, it is at the other game. If caught in time, it can be recovered. If they were playing the game next to them it may be their lucky day, if not, there isn't much we can do. I tell customers, "I'm sorry, I cannot reimburse what isn't here." It is shown to them the bill and ticket path from the bill accepter head, through the transport, and down to the stacker box. We also show them the top of the contents of the box, CLEARLY showing that the ticket in question is not at this machine.

The best thing to help out the situation is to ask the customer right away which machine they were playing before this one. Even radio a slot attendant working in that area to check out the game. Unfortunately, if there are not any credits on the previous game, check last game recall. If the exact amount is not far back in game recall, more than likely someone else got the credits. If the previous game that was played is found quickly enough, the credits will be there. It is also possible to check the history in "transactions" of "diagnostic monitor" to see if the ticket in question has been redeemed. I've heard of it before. We check into the situation and a different customer cashes in the ticket right away and is long gone.

If the credits are, OR are not recovered, we tell our customers to BE SURE to look at the dollar amount when they cash out. We also explain to them what happens with the odd credit amount. Most importantly, verify the dollar amount when you cash out.

"This is What I Got Out of The Machine, a Blank Ticket."

If the ticket is TOTALLY blank and the verification numbers are not on the end, it will take a bit if investigating to be sure what the exact amount is. At the machine level, with last game recall, it can be seen what the dollar amount was, but it won't have the system verification number on it (All tickets must have a verification number at the casino I work at). Once the amount is verified on the game (lets say the amount is $25) a verification number must match it. The game was supposed to print out the ticket, and for whatever reason, it didn't. In the tracking system, the game indeed gave it a number. This needs to be matched with the game and a payout needs to be done for the amount, with the verification number attached. This way the paperwork matches us with accounting. If the paperwork doesn't, then there is variance. Most of us know that slot machine variance means more paperwork. Game testing needs to be done, more paperwork, and soon "Greenpeace" will be after us for using so much paper. Naw, just kidding. Anyway, you get the picture. If the game ONLY prints numbers on one end of the ticket and the rest is blank, things are a lot easier. The customer may be a bit shaken up especially if the amount is a couple of hundred dollars, but no need to worry. Bring

them up to the cashier cage and ask the cashier to punch in these sweet, neat little numbers and "we have a winner." The verification number that has just been manually punched in (instead of the bar code scan) matched up to the game and it is ready to be paid out. The tech is happy because the customer is happy, the cashier is happy too because she didn't have to call anyone.

Don't Get Me Started On The Whole "Ticket Doesn't Exist" Ordeal

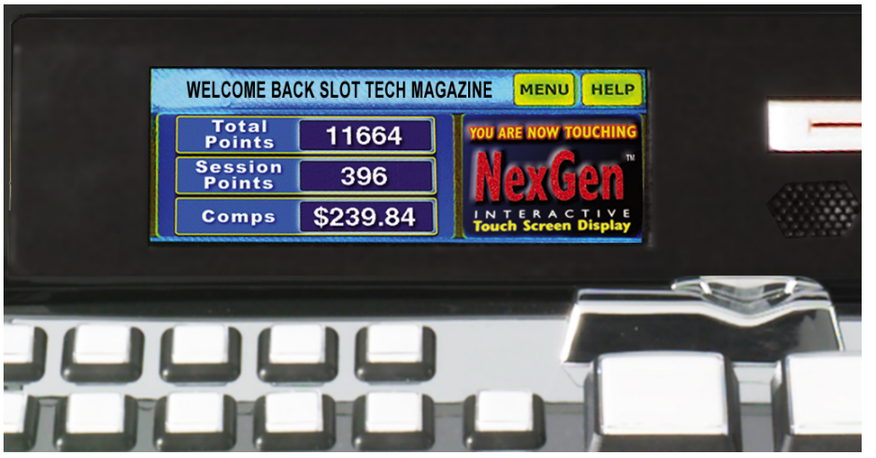
Wow. How is this even possible? What are you talking about? It doesn't exist? What do you have in your hand? It don't look like a Post-It note to me… it looks like a ticket. Doesn't it have a watermark on it? Well, sorry to say, the ticket does exist. It has the watermark, it has a verification number on it, it has a slot machine number on it, and there is even a good chance it has a bar code.

The PROBLEM is the tracking system says it doesn't exist. There isn't a record of it printing, therefore how can it exist for redemption. Make sense? Why doesn't the system think that there is something weird going on? Well, the game may have lost communication with the system. If the game isn't communicating with the system during the time of the print, there will be problem. We get a call to the cashier cage and look at the machine number and yes it is familiar. We are, in fact, having problems with that specific section. The communication problem needs to be taken care of and cured as soon as possible. Otherwise every ticket that is cashed out from that section of machines will "not exist" in the system. This IS NOT A FUN situation during power outages and severe thunderstorms. For example, if there is a power spike in a certain section of machines, it may affect the communication chip on the sentinal board or the communication chips in the DPU (Casino Data System Data Port Unit). Once the communication problems are looked into at the game level, and nothing helps, it very well could be the DPU.

- Pat Porath
pporath@slot-techs.com

Acres NexGen LCD Repair- CCFL Replacement

By David A. Spence Jr.



Introduction

LCDs have quite a few advantages over the CRT monitors. They consume less power, they are lightweight and they don't have a vertical retrace interval that puts stress on the user's eyes! The main power consumption begins in the LCD's Inverter board which is used to power the Cold Cathode Fluorescent Lights with a 12 Volt source.

One of the most common failures in LCDs is the Cold Cathode Fluorescent Lamp. CCFLs provide the backlight for the LCDs, which is obviously a crucial part of the overall structure. Like all fluorescent lights in the world, they burn out!

Acres Problem

This is an especially large problem for casinos with a mass amount of LCDs on their floor and has become a major issue for those with the Acres NexGen player tracking system. Each NexGen screen is a Thin Film Transistor – Liquid Crystal Display screen, built with backlight CCFLs that have a life span of 20,000 hrs. (2.5 years). Right about that time, after two and a half years, every NexGen screen you have installed will all go out at about the same time, causing major havoc with all your NexGen LCD screens on the casino floor if you're not prepared. This article will prepare you.

Diagnosis

How can you be sure it is the CCFL that has blown out?

Well, the first question that needs to be asked is "how do you troubleshooting an LCD?" Some solutions are more obvious then others.

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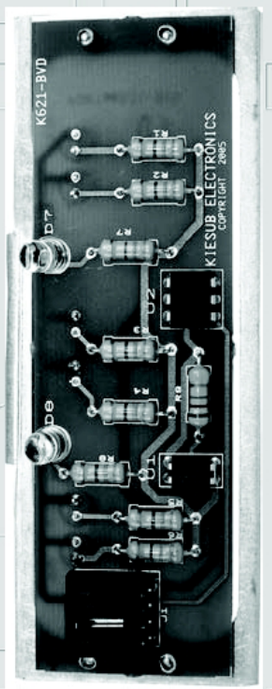

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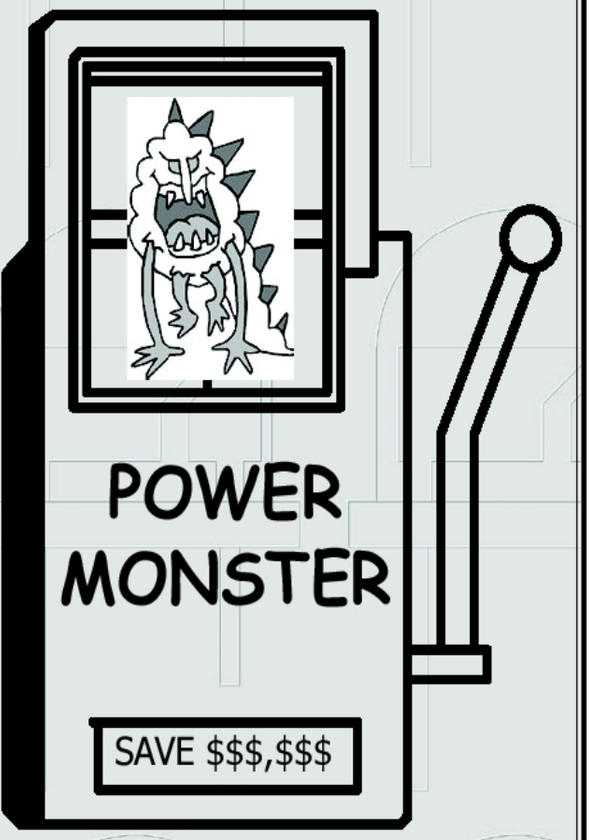

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Also, depending on the manufacturer, the problems may become more difficult to diagnose.

In the WMS Kristel model LCD-0018, the LED on the user button board gives some major clues where to begin troubleshooting: Amber = No video signal, Green LED/ Blackout screen = good video signal = bad Inverter board; Green LED, screen comes up for 4 sec. then blackout means you have a bad CCFL (especially if your current jumps to over 5 Amps, then drops back down to 0.5).

As it is with the NexGen CCFLs, the typical blacked-out NexGen screen means you have a bad CCFL. To confirm that you do have bad CCFLs, make sure the BE2 board is fully booted up (after it completes its P.O.S.T.) and see that it has remained blacked-out. If the touch screen is working but there still is no back-light, that's a pretty good sign that the CCFLs are out.

Solution

Replacing the CCFL in a NexGen LCD

Replacing the CCFLs is not as difficult as it may sound, but it is a difficult journey to get to where you need to go. You must disassemble the entire housing and LCD panel to get to the CCFL in the backlight panel.

As you can see here in figure A, the entire assembly is taken apart.

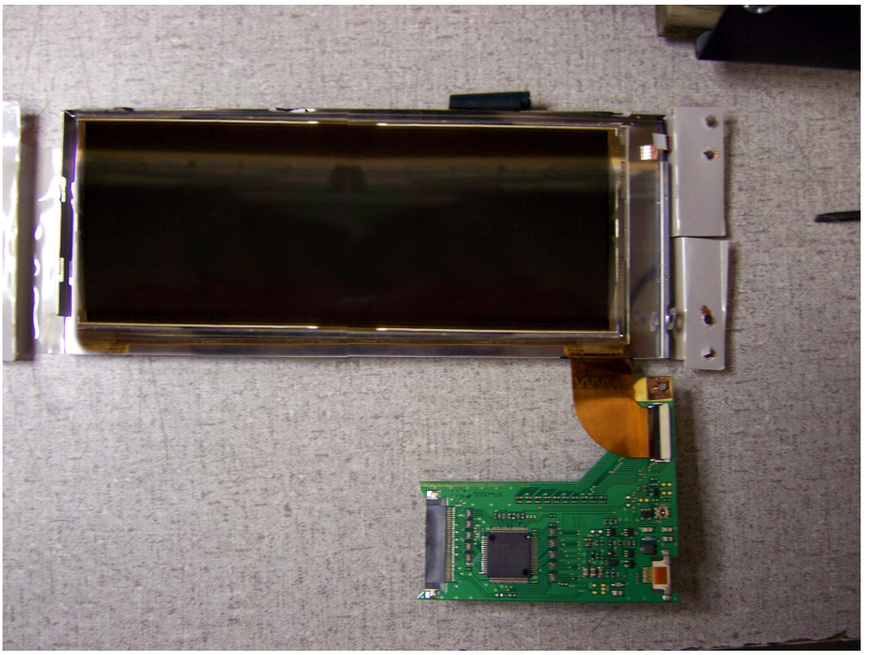

Figure A. Here is an LCD Panel for the Acres Nexgen

You must disassemble the outer housing, which consists of three screws. Disconnect the ribbon cable and set aside. Now you are ready to remove the plastic cover that connects the backlight panel, and the LCD panel. You will see six tabs, three on the top and three on the bottom. Use a flat head screwdriver and simply pop them out of place. You will need to disconnect the touchscreen sensor ribbon connector on the right

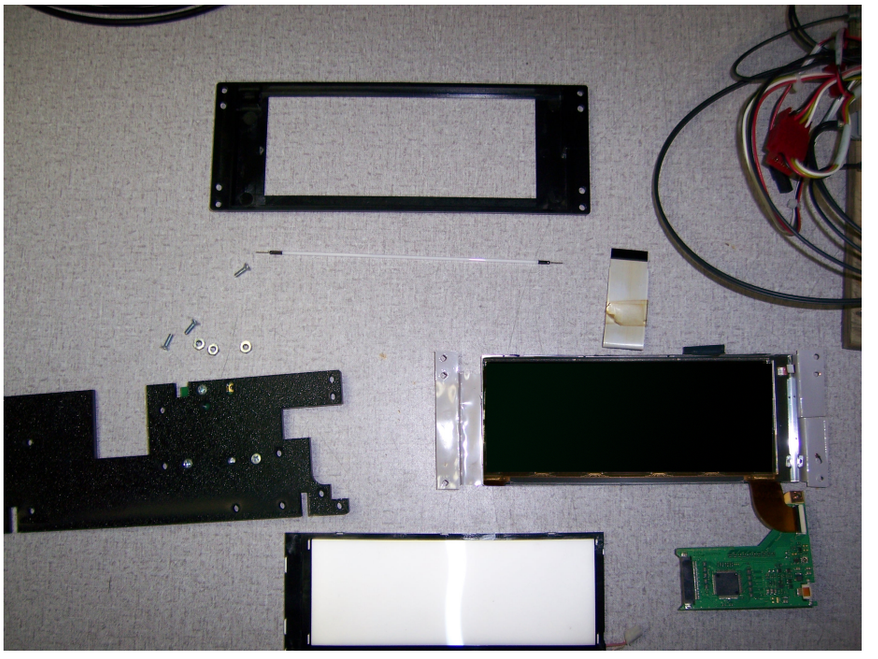

Figure B. The entire assembly for a NexGen LCD Display

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hand side and remove the Mylar tape that covers the LCD control board. Now you will be able to pull apart the LCD and separate it from the backlight panel. Now you are able to replace the CCFL.

If you attempt to remove the "paper" sheath that covers the CCFL, you will probably rip and damage it. So, you need to simply take your soldering iron, remove the harness from one side and slip the CCFL out the other side! Then you will be able to install the new CCFL. We use CCFLs from CI Innovations, in my opinion, the highest quality CCFL in the casino market for LCD repair.

I'm not going to say that I am not biased. I am. I like these replacement lamps. Here are some reasons why CI Innovation CCFLs are superior (supplied by CI Innovations, of course!):

CI Innovations CCFL Lamps use a proprietary blend and formulation of the highest quality 3-band, Tri-Phosphors available. Formulated to fit the highest purity and emits a full spectrum of light with high color rendering.

CI Innovations uses hard glass, also known as Pyrex, which has a much higher melting temperature. Therefore degradation of the glass-electrode bond does not occur and gases remain in containment, thereby extending lamp life.

All of their lamps pose a dead center internal electrode maximizing the full potential of the lamp.

Incorrect pressures and mixtures will cripple a lamp. The gas pressure of CI Innovations CCFL Lamps are stringently monitored and regulated to assure proper compatibility with the power output of the complementing power inverter.

David Spence
Electronic Tech Supervisor
Valley View Casino
dspence@vviewcasino.com

Editor's note: David, that was a really great look at CCFL replacement. I'm sure it will be very helpful to other techs in the field.

Along with this article, Mr. Spence enclosed the following sidebar material from CI Innovations. Call it a press release, call it what you will. Slot Tech Magazine has not verified any of this material but I have no reason to doubt any of it. In my discussions with CI Innovations over the past few years, they have always stressed the quality of the tubes themselves and expressed to me a bit of frustration on their part in their inability to get out the word about lamp quality versus cheap price. So, here you go, Jake. The floor is yours:

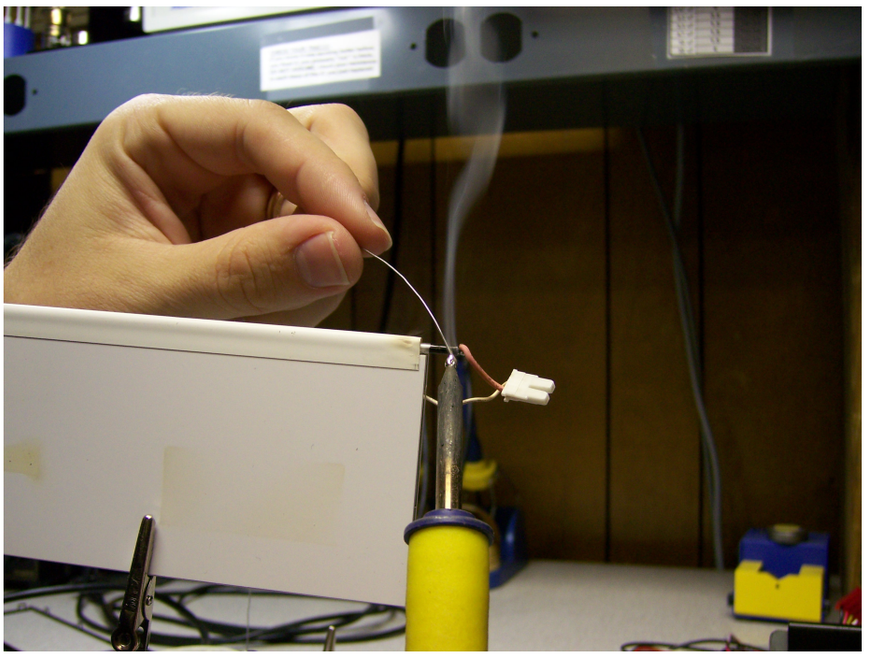

Figure C. Here you can see the CCFL being replaced. The CCFL supplies light for the back panel.

Why Do CCFLs Burn Out?

By Jake Cole
CI Innovations

Phosphor Quality

Low-end lamps are not concerned with the life of the lamp so low quality phosphors are used, which is a major contributor to color consistency, luminosity, and lamp life. As the main goal of the low-end lamp manufacturer is to make lamps as cheaply as possible, with no regard to lamp life or light quality, these phosphors have low purity and contain high contaminate levels. In many cases, they use Halo phosphates which are low quality phosphors that do not possess a high color rendering and degrade very rapidly but are very cheap and are quite suitable for toys and other short term use products.

Glass Tubing

Different types of glass tubing can be used in the construction of the CCFL Lamps. The two most common are “soft”, or leaded glass and “hard”, or Pyrex glass. Commonly, low end lamp manufacturers use leaded glass as it is much cheaper. Leaded glass has a low melting temperature, and this is a major detriment to lamp life. As the electrodes of the lamp warm, the bond between the glass and the electrode will begin to degrade thereby compromising the glass and metal seal. Gases will begin to escape, dramatically reducing the life of the lamp or resulting in catastrophic lamp failure.

Internal Coating

Before phosphor, mercury or any gases are introduced in the raw lamp tubing, lamps are coated on the inside surface of the lamp with a proprietary sealing material. This coating prevents the migration of the phosphor or

mercury into the glass of the lamp. Low end lamp manufacturers commonly skip this step to save time. The result will be mercury migration into the glass which greatly affects the life of the lamp and light output due to expedited and excessive mercury loss and phosphor layer contamination.

Internal Electrode

Lamps contain a proprietary internal electrode which reduces carbon buildup and mercury migration. The internal electrode allows power to flow evenly through the lamp, which adds significant life to the lamp. These electrodes are high-tech and on the cutting edge. Low-end lamps use a "flapper," a thin piece of metal in a configuration which resembles a "V." This configuration can increase carbon buildup and mercury migration thereby shortening lamp life.

The internal electrode on each side of the lamp must be in dead center position for proper flow of electrons from one end of the lamp to the other. If the electrodes are not in proper alignment a lowering of lamp efficiency will be noted and also light flickering on the ends of the lamp can occur. Low end lamps have been noted where the internal electrode has been positioned at an angle and in some cases even touching the glass tube.

Gas Pressure

One of the most critical aspects in the construction of the CCFL is gas purity and gas pressure. Purity of gas and a stringently controlled gas pressure are essential in the manufacture of high quality CCFLs. If the purity of the gas is low, the lamp life and energy efficiency will be reduced. This occurs due to contaminants interfering with electron flow within the lamp. Low end manufacturers will use a low quality argon gas that has a low purity level.

Proper pressurization is essential in the overall performance of the lamp. The pressure of the gas inside the lamp is dependent on the amount of power the lamp will be receiving. Gas pressure must be set to perfectly match that power input. If the gas pressure does not match the input power, you can get overheating of the lamp, reduced brightness, color shifting and of course, reduced life. This is a critical aspect of the manufacturing process. Low end manufacturers are not concerned with this aspect as the consistency and amount of lamp life is not a major factor in their production. Their lamps can have wide variance in gas pressure even within lamps of the same batch.

Mercury Content

All of CI Innovations lamps have consistent mercury content. This is very important in maintaining the longest lamp life possible. Too much mercury content is bad for the environment and severely shortens lamp life. Too little mercury content will shorten the lamp life and reduce the brightness level. Low-end lamps can vary greatly in mercury content from lamp to lamp.

One of the remarkable accomplishments that we have made is that we are able to achieve maximum lamp life with minimal mercury content. In fact, due to the ultra high purity and quality levels of our gases and phosphors we are able to use only between 1 and 1.5 mg of mercury vapor, far below the required amounts for proposed hazardous material disposal levels that are being implemented by legislature. Current legislation proposes that any lamp containing above 2.5 mg of mercury will be required to utilize hazardous material disposal programs which are very expensive. It is very common to have mercury levels in the range of 4-10 mg on the majority of the lamps found in the Far East.

For further information, contact:
CI Innovations
22445 E. La Palma Ave. "C"
Yorba Linda, CA 92887

Sales: (714) 692-5548
Tech Support: (714) 692-5548
E-Mail:
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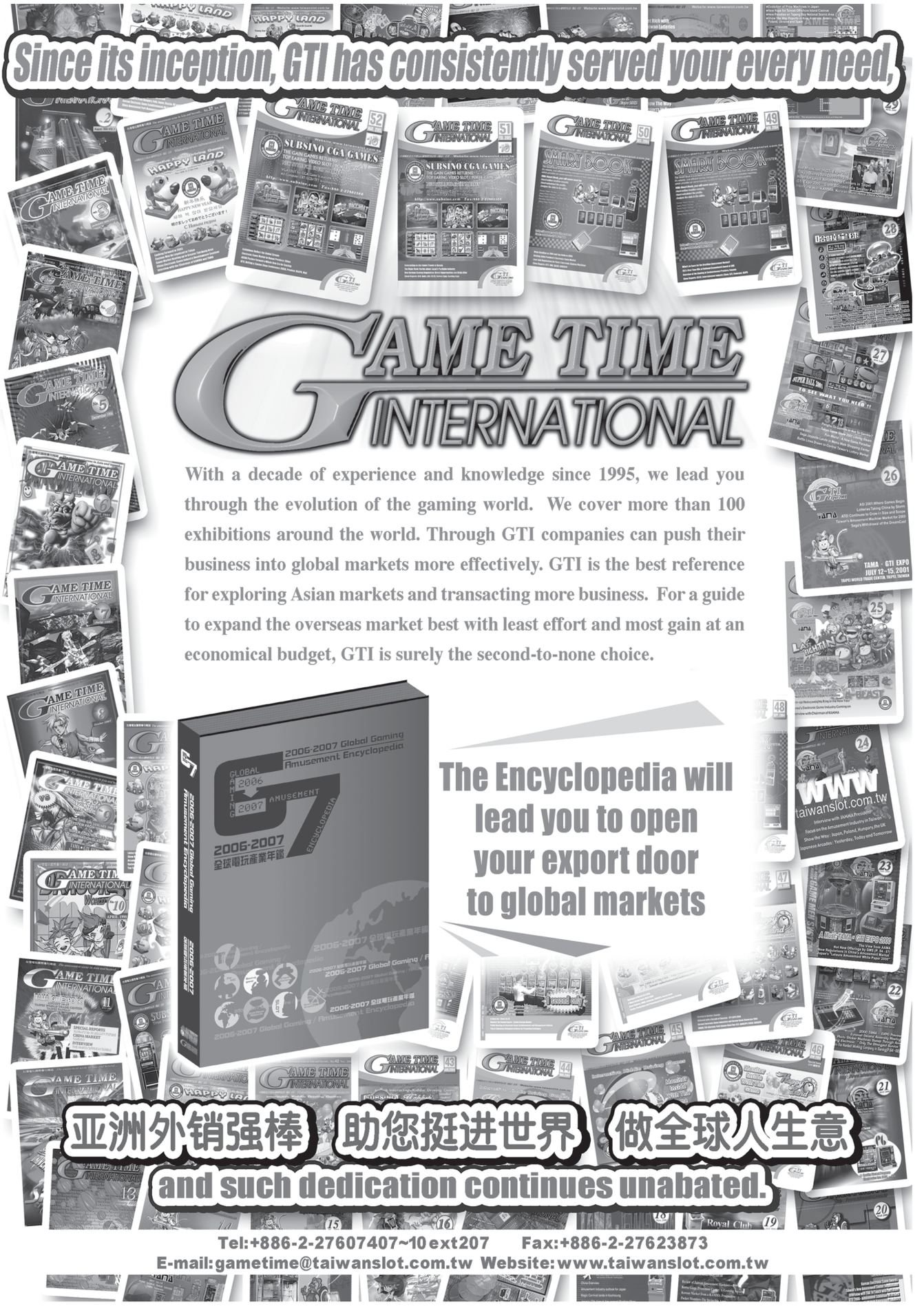
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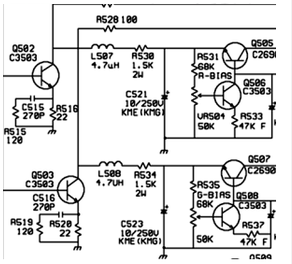
ELECTRONIC COMPONENTS

The individual components used in games are introduced. Parts such as resistors, capacitors, diodes, potentiometers and transistors are covered individually. Students learn how the components work and how to test them using the meter.

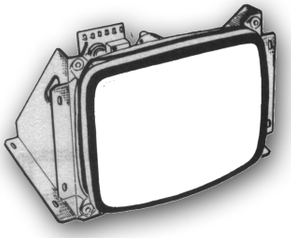
SCHEMATIC DIAGRAMS

Schematic diagrams are the "blueprints" for electronics. Learning to read schematics is easy once you know how the parts work!



POWER SUPPLIES

Power supply failure is a common complaint in many different types of systems. Power supply failures are discussed during the class, along with shortcuts for troubleshooting and repairing them.



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WALLINGFORD, CT – TransAct Technologies, Incorporated. celebrated its ten year anniversary as a publicly traded company. To coincide with the occasion, the Company has launched a newly designed website that reflects the TransAct brand and its industry-specific printers.

Bart C. Shuldman, chairman, president and CEO said, "TransAct Technologies has always strived to provide great products and brands to the markets we serve. Ten years of being a public company and delivering innovative products to our markets is proof of our success. I'm especially proud of our employees, whose dedication and hard work were crucial to getting us to this major milestone. I also want to take this opportunity to thank our shareholders for the support they have given us over the last ten years."

Shuldman continued, "Our new website clearly reflects our commitment to building the brands that have made TransAct the world-class company it is today, while positioning us for continued growth for the future."

The new website makes TransAct's home page easier to navigate, allowing the browser to search for information specific to POS & Banking, including Ithaca brand printers; Gaming & Lottery, including Epic brand printers; and TransAct Services Group, including sales and service for all TransAct brand products.

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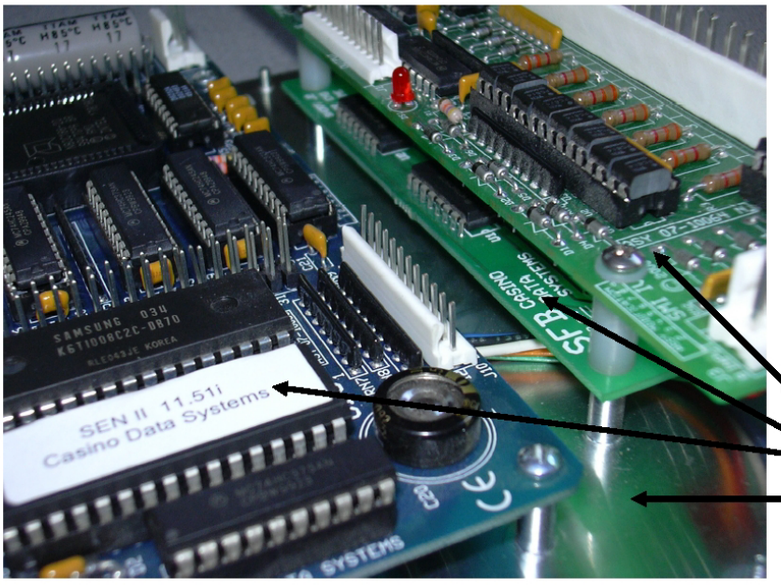
Part 1
Introduction to Host Systems

By Jason Czito

If you haven't worked in a casino without a host system, you may not realize what a wonderful thing they can be. Host systems, often called 'player tracking' systems, allow a casino to automatically and remotely gather information about the machines and, depending on the system, perform ticketing, player tracking, AFT, and whatever else slot manufacturers come up with. A host system networks the slot machines to a central server. Some systems only handle revenue. A system like this will read the meters from the game and store them in the server for the revenue department to use at their convenience (as opposed to physically visiting each machine and hand-recording the hard meters). Some systems only handle ticketing. A ticketing system will maintain a database in the server of tickets generated at the machines. When a ticket is to be paid, it can be checked against the database, and revenue information about the tickets can be drawn from the database. Today, many systems combine this functionality, but if you've ever wondered why some machines have an option for more than one SAS address, for example, it's for those casinos that are running more than one system. (Say they purchased a revenue system and later added on a separate ticketing system, for example). This article covers Aristocrat's system, called Oasis. It'll begin with hardware descriptions of the

The Sentinel assembly is a piece of hardware that polls a slot machine for its information and provides the machine with information needed from the server.



The Sentinel assembly is made of three parts: The Sentinel board, the SMI4 board, and their mounting plate. Some configurations will have an additional board, a fiber optic interface board.

- SMI-4
- SFB
- Sentinel II
- Mounting Plate

networking hardware that interfaces directly with the machine (including the user interface) and work its way to the server at the back of the house. Then we'll cover configuring and interacting with the hardware, how the drop works, and take an overview of how the system is typically implemented.

Chapter 1
The Sentinel Assembly

Aristocrat is the company that makes Oasis (Online Accounting and Slot Information System). The core of this system is a big database. Oasis hardware reads the information from the slot machines on the casino floor and feeds it to the database. Oasis software presents the information from the database to the users in different formats, depending on what needs to be done. For example, the revenue department uses software that filters money-related information in the database. The Slot department uses software that displays machine conditions which require an attendant. Slot repair uses software that tells information about machine tilts and errors. The first step in the journey starts at the slot machine. The slot machine's information is what this system is designed to monitor. Each slot machine is given its own Sentinel assembly.

The Sentinel assembly is a piece of hardware that polls a slot machine for its information and provides the machine with information needed from the server.

The Sentinel assembly is made of three parts: The Sentinel board, the SMI4 board, and their mounting plate. Some configurations will have an additional board, a fiber optic interface board.

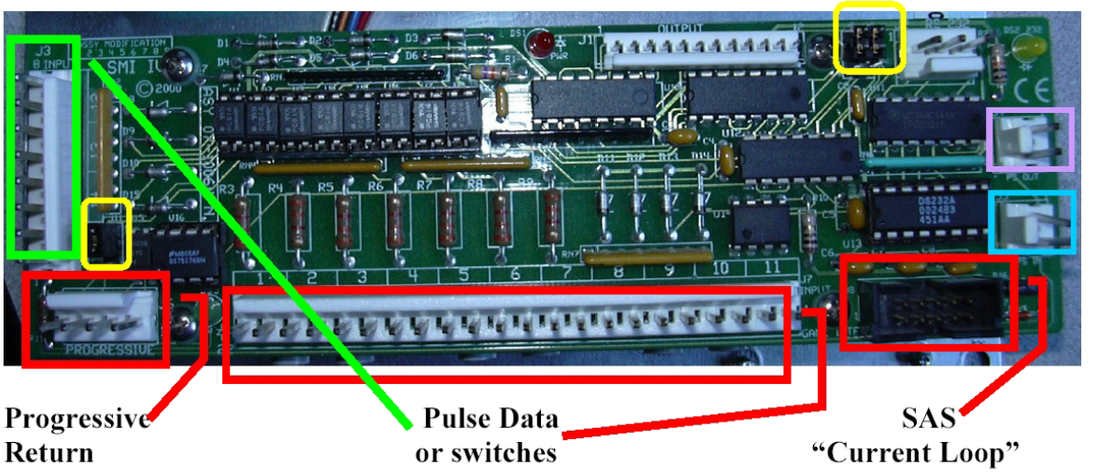
The SMI4 (which stands for Slot Machine Interface) is designed to be the interface between the slot machine and the Sentinel board. It performs the following functions:

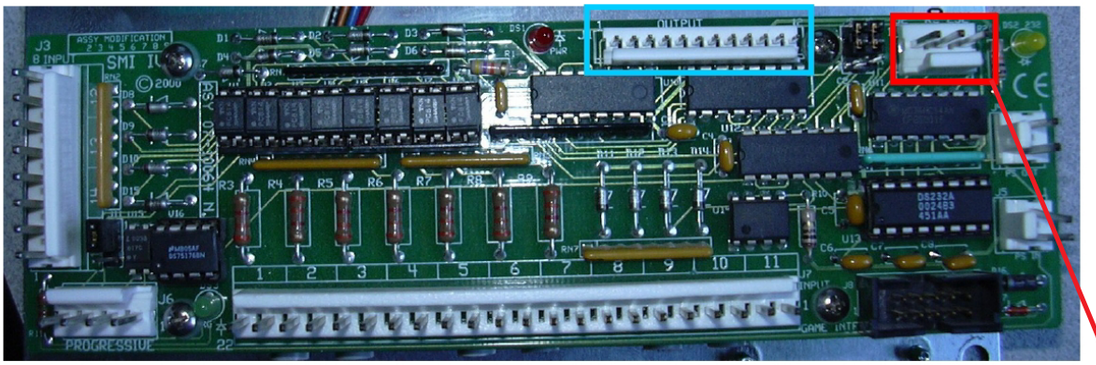
> It cleans up and translates pulse data.
> It cleans up and translates SAS communication in "current loop" format.
> It provides progressive information to CDS' Turbo Progressive.

If it seems like a waste to have this board manufactured just to talk to a few archaic machines that only use pulse data, it was designed in the days when hard meters were the only option for communication with machines. The Sentinel is able to communicate with any slot machine, and the SMI4 provides backward-compatibility for older machines.

The Progressive return pins (J6) are used for communication with CDS' Pro Turbo Progressive system, which isn't covered in this article. It's easy to spot because it is the only port that uses four pins and it says "progressive' beneath it. The green LED to

The SMI4 Board





the right of these pins is used to signal progressive return communication.

The three pairs of jumpers (J9, J10, J11) circled in yellow are used to configure the progressive system. Different jumper configurations designate different slot machine connections when using the progressive system.

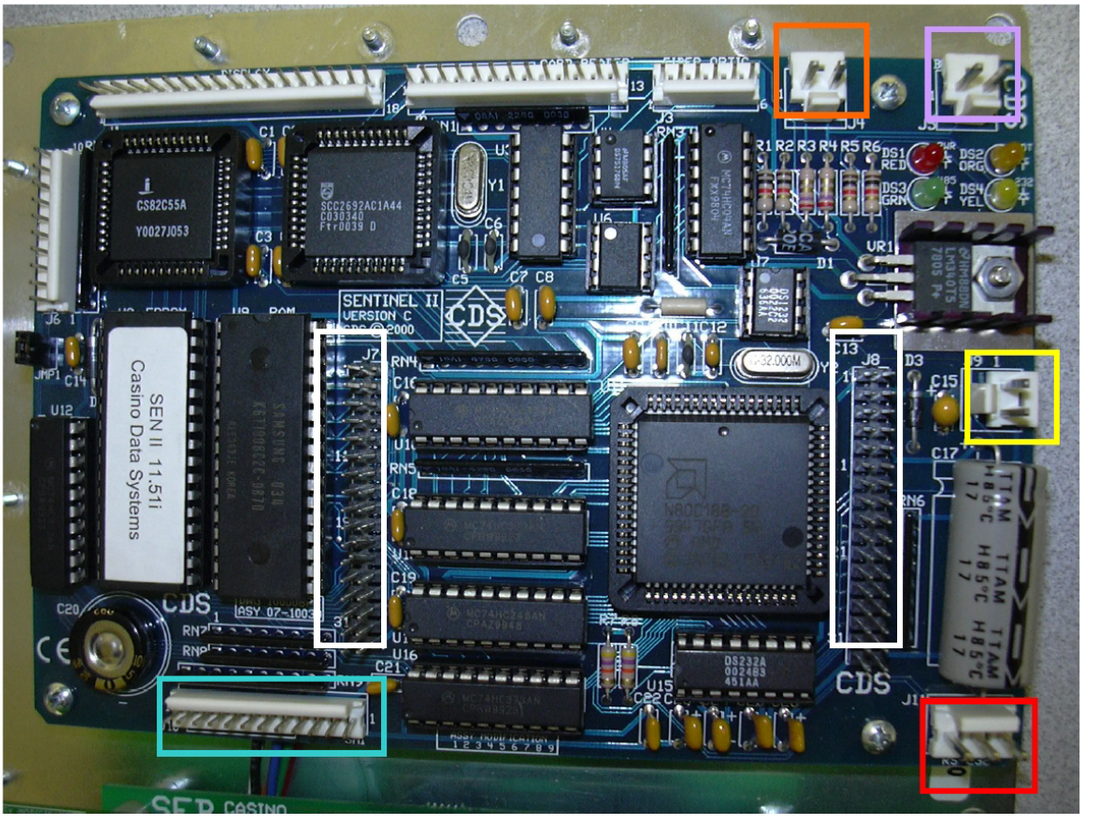
The pins used to handle incoming pulse data (J7) are grouped into pairs. You can see the pair labels above the actual pins in the picture (there are 11 pairs). On older games, the same signal that would trip a hard meter (pulse data) would be assigned to one of these pin pairs, and the information would thus be collected electronically. Optionally, they may be connected to a door switch, and the door state is then communicated electronically to the system. The pins highlighted in green are an extra 8 pins (J3, pin pairs 12-15) that are found on newer SMI4 boards. Older SMI4 boards are colored red and do not have these pins.

The SAS plug (J8) is used to connect with slot machines that transmit SAS in "current loop" format, which is an older protocol used on slot machines with rudimentary processor power. Atronic machines and old IGT S+ games use this plug. Newer IGT games may use this plug as an option, but don't depend on it. If this plug (or the progressive return port) is used, power must be supplied directly to the SMI4. The power supply will plug directly into the pin pair circled in blue (instead of the Sentinel board). The Sentinel will get its power from a jumper between its power input and the pins on the SMI4 circled in purple. The pin pairs are labeled PS IN (J5) and PS OUT (J4), respectively, denoting that they are to be connected to the Power Supply.

The pin set circled in blue (J1 labeled "output") is the interface between the Sentinel board and the SMI4 board through which travels information from the pin pairs (J3 and J7). When the Sentinel has power and is correctly connected to these pins, the red LED to the left of the pins will light.

The pin set circled in red (J2 labeled "RS-232") is the interface between the Sentinel board and the SMI4 board through which travels information from the SAS plug (J8). It is jumped to the RS-232 interface on the Sentinel board, since the SMI4 translates the signal into RS-232. When communication is taking place, the yellow LED to the right of the pins will flicker.

Doors are monitored by the SMI4 in a unique way. A change of door state causes the meter to increment by one. Even meters represent a closed door and odd meters represent an open door. Therefore, by looking at the number, you can tell the status of the door. If the meter says 42, you know it is closed and you know it has been opened 21 times (assuming the switch hasn't misbehaved in the past). Occasionally the switch will falter and the meter will increment without the door opening. In this case, the Sentinel will report an open door when the door is in fact shut. To remedy this, you must simply correct the meter value by manually jumping the pins that the



The Sentinel Board

door cable is connected to. This simulates the switch state changing, causing the meter to increment. Once you match the meter value to the state of the door (even for closed, odd for open), the Sentinel will report the correct status of the door. The value of the meter is irrelevant – it is the parity that contains the information.

The SMI4 board has circuitry built into it to prevent runaway meters (from pulse data coming in to J3 and J7 – not serial data). For example, let's say we have a drop door wired to pin pair 9 and the switch is faulty, causing it to open and close erratically. The drop door meter will increment rapidly, which the SMI4 will recognize as a fault (10 or more meter increments in a minute is the threshold). The SMI4 will cease recording the drop door meter, but it will do it on an odd number. This shows us an open door state, drawing our attention to the problem. Resetting the power on the Sentinel board will clear this state, and allow recoding of the meter once again. The SMI4 board will wait five minutes on its own before reading the faulty pins again.

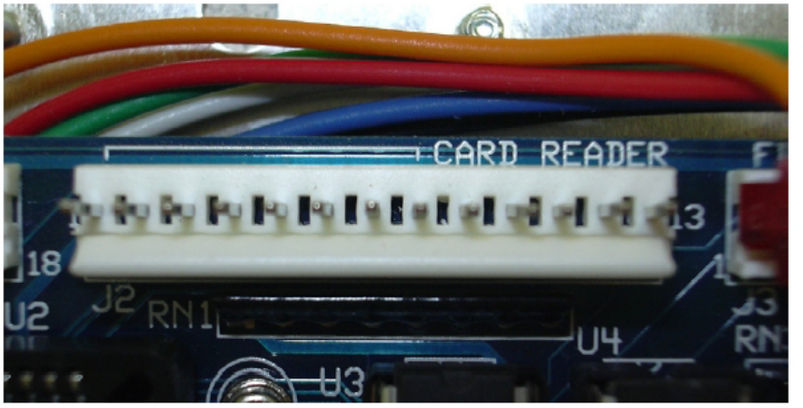
The Sentinel Board

The Sentinel board has two inputs for information from slot machines. The 3-pin RS-232 interface (J11) is the primary interface (circled in red). The SMI interface (J10 – circled in blue) is where pulse data from the SMI4 enters the Sentinel. Most of the machine information in modern machines comes into the Sentinel board via the RS-232 interface.

Power to the Sentinel board comes either directly from the power supply or from a jumper off of the SMI4 board (itself connected to the power supply). It plugs into the pins circled in yellow (J9).

The Sentinel board communicates with Oasis through wires connected to the pin pairs circled in orange and purple. The pair circled in orange ("Bank In", J4) is the line through which the Sentinel communicates with the system. The pair circled in purple ("Bank Out", J5) is the

line out for the next Sentinel in line to communicate on. The Home Run cables connect to these pins. There is an option to communicate with Oasis via fiber optic cables, which will be explained later.



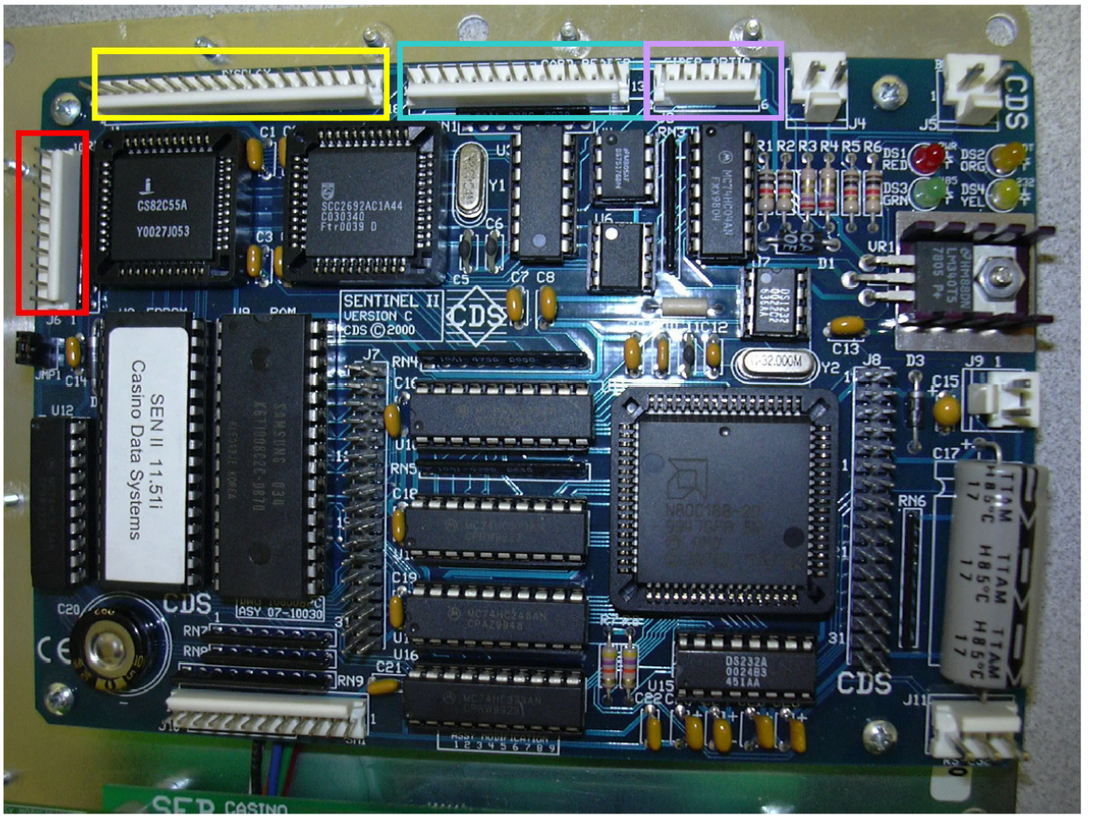
The pins circled in blue (J2) are for the cable that connects to the card reader. It's labeled, "card reader". It is a 13 pin connector, but the first eight of the pins are typically used for card readers. These eight pins are bracketed on the Sentinel board for easy identification.

The sets of pins circled in white are for an optional multimedia board. This board would drive lights and sounds on the user interface (marquee lights around the card reader, beep sounds when a button is pressed, etc.), but Aristocrat no longer supports this.

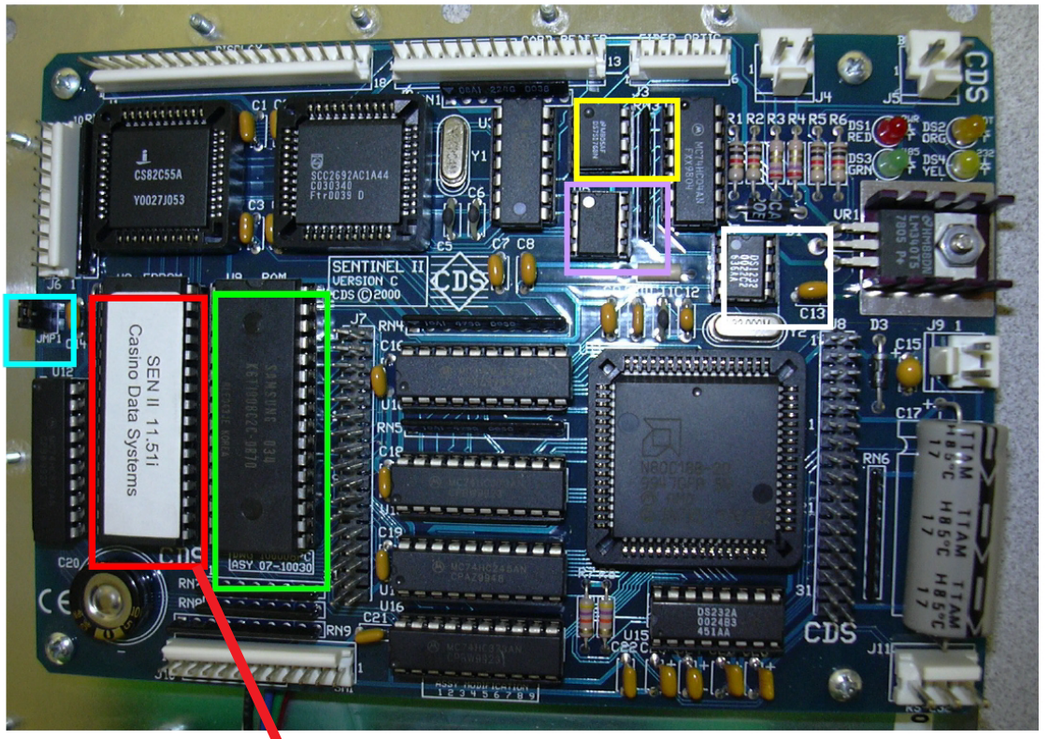
The pins circled in red (J6, below) are for the cable that connects to the keypad. It's labeled, "keypad."

The pins circled in yellow (J1) are for the cable that connects to the display. It's labeled, "display."

The pins circled in purple (J3) are for the cable that connects to the Sentinel Fiber Board (SFB). These are only used in the configuration where the SFB is used. If a Sentinel is connected to Oasis using the typical Home Run lines on J4 and J5, and an SFB board is connected, communication will cease. Only use the SBF interface if the Sentinel will communicate to Oasis through fiber optic cables.



won't have to reprogram it.



The chip circled in white (U7) is the Watchdog chip. It prevents the processors from freezing up and restarts them after power failures and other glitches.

DS1(see page 32), the red LED labeled "PWR" is the power LED. If the Sentinel is receiving 9vDC power with the right polarity, this light will be on. If the Sentinel isn't receiving power or the plug is on backwards, this LED will not light.

The chip circled in red (U8) is the Sentinel EPROM. It stores the program that runs the Sentinel. Some of these EPROMS are flashable, in which case the program can be changed from the Poller (covered later). The jumper (JMP1) circled in light blue is write protection for the Sentinel EPROM. If you plan to flash the EPROM, this jumper must be connected.

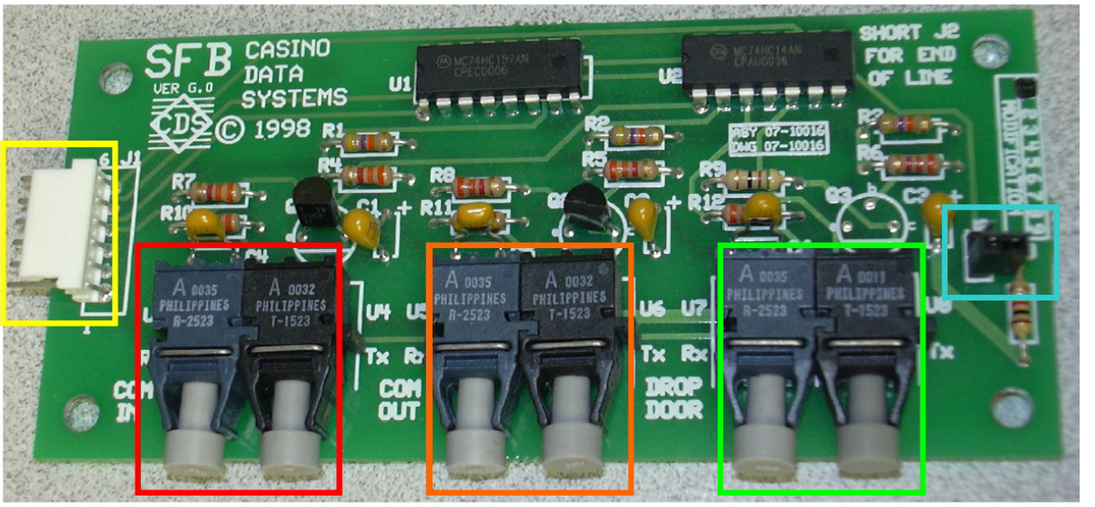
The chip circled in green (U9) is the RAM chip. Part of the chip's memory is dedicated to certain meters. In the event that the Sentinel is disconnected from the system, these meters can safely increment without fear of loss. These are the revenue meters (Coin In, Coin Out, Coin Drop, etc.). The other half of the RAM is free to be filled up with other transactions (ticket validation transactions, for example). If the system goes offline, there are only a limited amount of transactions that the Sentinel can buffer before it uses up the remaining memory and the Sentinel (depending on firmware version and system settings) will lock the machine up on cash out requests.

The chip circled in yellow (U4) is the COM chip, and it handles communication between the Sentinel and DPU. It's an RS-485 line transceiver. If it dies, the Sentinel will not be able to listen for packets, taking it offline.

The chip circled in purple (U6) is the EEPROM which stores configuration data. If you must replace a Sentinel board, the EEPROM can often be brought from the old one to the new one, and you

DS2, the orange LED labeled "WDT" is the Watchdog LED. A healthy Sentinel will have its Watchdog flash about twice a second. If the EPROM, the chip in U1, U5 or U11, the Watchdog or the RAM is missing or faulty, it will not light. If the EEPROM or the processor in U2 is missing or faulty, it will not flash correctly. If it is flashing slower than about two times per second, the Sentinel will have communication problems.

DS3, the green LED labeled "485" monitors RS-485 communication between the Sentinel and the DPU. It will flicker during normal com-



The Sentinel Fiber Board

munication.

DS4, the yellow LED labeled "232" monitors RS-232 communication between the Sentinel and the slot machine. It will flicker during normal operation.

A working Sentinel board not connected to the Oasis system or to a slot machine should have the Watchdog and Power LEDs functioning when power is applied. Communication with a DPU will then light the green LED. The yellow LED may flicker without communication to a slot machine if a communication protocol has been selected. It is displaying the Sentinels attempts to contact the machine. Once a machine is connected, it will flicker much faster, as responses from the machine will also flash the yellow LED.

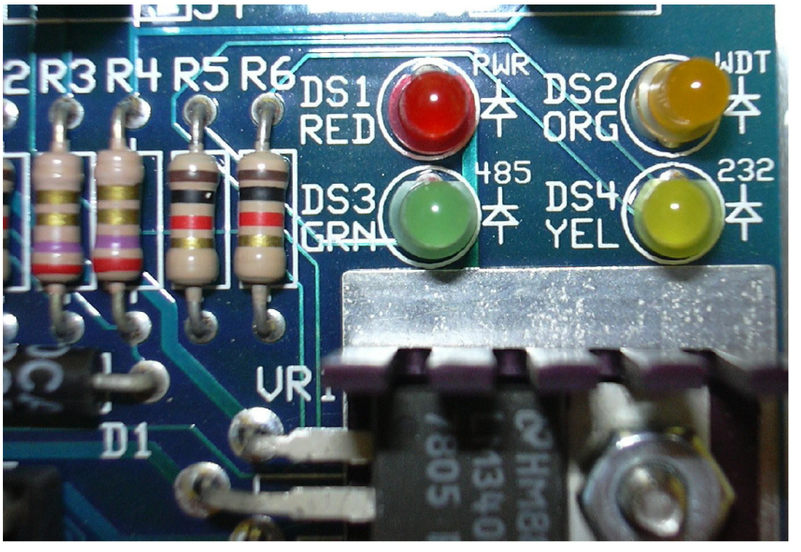
The Sentinel Fiber Board

If the Home Runs are to be fiber optic, the SFB (Sentinel Fiber Board) must be used, and the DPUs must be equipped to handle fiber optic as well, with a similar board. Some machine manufacturers request that fiber be used in place of copper.

The pins (J1) in the yellow rectangle are where the SFB connects to the Sentinel board.

The fiber ports in the red and orange rectangles here are the "Bank In" and "Bank Out" plugs for the home run (labeled "Com In and "Com Out"). Each individual port is labeled with either Tx or Rx. Coming out of the DPU will be a pair of fiber optic cables, one of which (assuming the DPU is turned on) will have red light coming out of it. This cable will go into the Rx side of "Com In", and the dark cable will go into the Tx side. If there is power coming to the SFB via the Sentinel, red light will shine from the Tx side of "Com Out".

The drop door ports in the green rectangle are to monitor the drop door via fiber optics. When the SFB is powered, a red light will shine out of the Tx port. This goes to a special drop door switch which simply breaks or



passes the beam of light, which continues on through another fiber cable to the Rx side. When the SFB is connected, the drop door will not be read by the pin set (J7) on the SMI4, even if it is connected and configured to do so. To trip the drop door meter when the SFB is being used, simply shine a strong beam of light into the Rx side of the drop door fiber port.

The jumper (J2) in the blue rectangle must only be set if that Sentinel board is the last one on the Home Run. If it is set somewhere before the end of the Home Run, the Sentinels after it will not be able to communicate. If it is not set on the last Sentinel of the Home Run, none of the Sentinels on that Home Run will be able to communicate. Connecting this jumper defines the end of the Home Run.

The Sentinel must have power for the fiber to work and the Home Run to be complete. If a Sentinel in the Home Run loses power, it and all Sentinels after it will not communicate.

- Jason Czito
jczito@slot-techs.com

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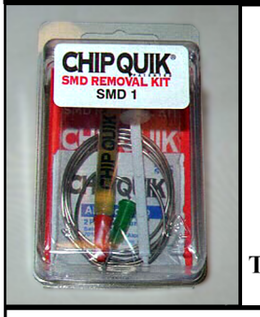

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TransAct / Ithaca 850 Printer - Top 4 Most Common Problems

By Russ Wigé

There are a lot of ways for a slot machine to experience problems. Like any good slot technician, you have a mental toolkit of how to deal with common problems. Below are four useful tools to keep handy.

#1 Pinched Ribbon Cable

This issue was covered in Slot Tech Magazine's October 2005 issue. Typical ribbon cables can lose their shape and flexibility after long periods in the hot interior of a slot machine. When this happens, the cable may be pinched when the printer is racked in after adding paper. Damaged cables are susceptible to electrical shorts that may damage printer components. TransAct recommends replacing all old-style cables with part number 85-05684 "Ribbon Cable w/ Guard". The flexible plastic sheath on this cable protects the wiring from damage and ensures a consistent accordion shape even after long use. The response to this simple improvement has been extremely positive.

#2 Hot Plugging the Ribbon Cable

When swapping out an Ithaca 850 printer for service, always insure that the printer is powered down before unplugging or plugging in the ribbon cable. Failing to do so can destroy components on the controller and/or interface boards.

Warning: Turning off the game will not reliably power down the printer. Some games have outlet strips with the printer's power supply plugged into the un-switched outlet. Always check the printer's LED and bezel lights to ensure it is completely powered down.

#3 Top-of-Form Sensor Calibration

Unfortunately, many slot techs are unaware that they are inadvertently triggering a calibration routine when they transfer firmware during a printer swap-out. The Top-of-Form (TOF) sensor calibration routine runs at power-up if the printer detects that the printer's firmware has changed significantly. Typically, this occurs when changing between different manufacturers' firmware. For the calibration to be successful, a ticket must be pre-inserted in the print-head so that the sensor is referencing white prior to powering on the printer. Failure to do so will affect the sensor's ability to distinguish the ticket's alignment mark.

#4 No Problem Found

It's not uncommon for TransAct's repair centers to receive printers for service that are actually working fine. Swapping out printers unnecessarily isn't how you want to spend your time. The best rule-of-thumb is to always make an attempt to print a test ticket from the game before swapping it out. Also, if the problem is intermittent, provide as much information as possible on the trouble tag.

Beware of game errors, too. Some games will "stack" errors due to back-end timeouts or other faults within the game. Clearing the top error shows the error waiting beneath, and so on. This can give the appearance that the printer is malfunctioning. Always clear the full stack of errors and attempt to print a test ticket before spending the time to swap the printer out. In the case of stacked errors, a replacement printer still can't function until all of the errors are cleared.

If you're proficient at handling these common issues, you'll find you spend a lot less time swapping printers. This leaves more time for the hundreds of other things on your task list.

- Russ Wigé
rwige@transact-tech.com

Epic OK With IGT

Printer Meets Stringent IGT USB Specifications For Use on All Slot Machine Models

TransAct Technologies Incorporated has announced that it has received notice that International Game Technology ("IGT") has tested and approved TransAct's Epic 950™ IGT USB printer for use in its existing and new slot machine platforms. IGT is a world leader in the design, development and manufacture of microprocessor-based gaming and video lottery products and software systems.

TransAct developed the Epic 950™ IGT USB printer in collaboration with IGT engineers enabling it to perform to IGT's stringent USB specifications. The printer meets the latest IGT USB specification and, once regulatory approvals are received, it will be available for all existing and new IGT gaming platforms.

TransAct's Epic 950™ IGT USB printer includes two game ports, NetPlex, and USB 2.0 Full Speed. In addition, the Epic 950™ printer includes many extraordinary features including TransAct's exclusive TicketBurst™ technology that ensures the ticket is completely printed and detached before it is presented; and Hot Swap QDT, a feature allowing the casino to change printer mechanisms without powering down the slot machine for simple repair and replacement.

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Three Tales From Behind the Cabinet Door…

By Michael Brennan

These stories all involve Atronic e-motion™ trouble-shooting experiences when hours were spent, heads were scratched, and the solution turned out to be something unexpected, simple, or a little bizarre.

Tale 1: Fix Me Deadly, featuring Tech Mark Hammer

It was a dark and stormy night, wet and humid-- humid enough to make my Atronic collared cotton shirt stick to my heaving chest like a black label sticks to a bottle of scotch.

I was eroding a rut in a casino parking lot, going back and forth from the smoky confines of the casino to my truck, grabbing tools and slowly grabbing a cold that would, in the future, leave me with a stuffy nose for days on end. This cold would no doubt leave my bathroom waste basket full of balled-up tissues, tossed about like a drunk trying to win a stuffed bear at a crooked carnival game.

I was in this predicament because of a misbehaving slot machine, a slot machine that, when healthy, was a dame of a game with sleek curves and a long, sensuous playfield that just wouldn't quit.

It was the kind of slot machine that would take 6% of your coin-in and leave you begging for more. E-motion was her name, entertainment was her game. But today she was giving me some mixed signals I hadn't seen before.

It all started when I powered up the baby. She went through her normal boot sequence, humming along into normal game mode. Then, she unexpectedly entered the audit menu that is usually only accessed by turning the audit key.

Believe me, I had turned her audit key many times before (and with great skill), but not this time. Her audit key slot was empty, like the deserted streets under my second-story office. Streets I know so well… Streets that, at 3am, I was the intoxicated king of, ruling over each cobblestone, spewing my brandy-soaked edicts of long-ago lost love to my concrete subjects.

I tried a RAM clear, new software, new filter boards, new multimedia board, even a new backplane, but nothing worked. I was about to give up for the day and retire to an evening of bourbon and antacid tablets, when I, somewhere deep in my soul, found the resolve of a marathon runner pressing onward toward the finish line with dehydrated lungs and blistered feet. Battered, but not beaten.

I grunted, cracked my knuckles, stepped back and told the game:

"You've forgotten something, kitten. You've forgotten that I am an Atronic technician, a technician that will stop at nothing to find the cause of this problem. Miss e-motion, you've forgotten that I know your contours the way a dog knows the inside of his food bowl."

Almost immediately after this little affirmation I noticed that the five-volt

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fuse on the signal filter board was out. I determined that this was caused somewhere near the coin-in area of the game. When I disconnected the coin board, the five-volt fuse LED came back on.

I held a socket wrench in my hand, feeling its cool steel press into my clammy palm. "I'm getting closer," I told myself as I unplugged every connection to the board, finally coming to the conclusion that the ribbon cable running to the drop optic was the cause of the machine's unfortunate state.

When I looked at the cable, it was pinched behind the hopper slide rails. Grounded it was. Grounded like a teenager who gets caught sneaking out at night to throw back tall boys with his best gal under the speckled moonlight.

I stared at the cable, tracing each of its ash grey ribbon leads—they looked like rows of a hazy cornfield. And I was about to sow its oats.

With the hands of a surgeon, I pulled out the ribbon cable, tossing it aside, letting it sit listless, contrasting with the brightly-colored casino floor. I cracked open a new ribbon cable, sniffed its newly-manufactured smell, and snapped it firmly into the appropriate connector. I made sure to route the cable correctly, to avoid the grounding issue.

This re-established the five-volt connection, and the audit menu faded away, like the cuffs of an over-worked, starched shirt.

My e-motion™ game was back up and working, looking as sultry as ever. I packed up my things, gave her a wink, and headed back out to help any other damsels in distress that might need assistance in the dark and stormy night.

Tale 2: Serviceman Seuss

There was a slot machine all blacked out,
Its displays and doors were out, no doubt.
And although the machine was dark as night,
Its bill validator and printer still had light.

This issue was a doozy, I was in a pinch.
I furrowed my brow like the old green grinch.

It would not fix when the fuses were switched,
It would not fix when connectors were twitched,
It would not fix when the main board was swapped,
It would not fix when the power was dropped.

The main board had power, but its status was bad,
Next I checked what power the CPU fan had.

I opened the multimedia box and shined a light,
On a fantabulous, grantabulous, wonderful sight!

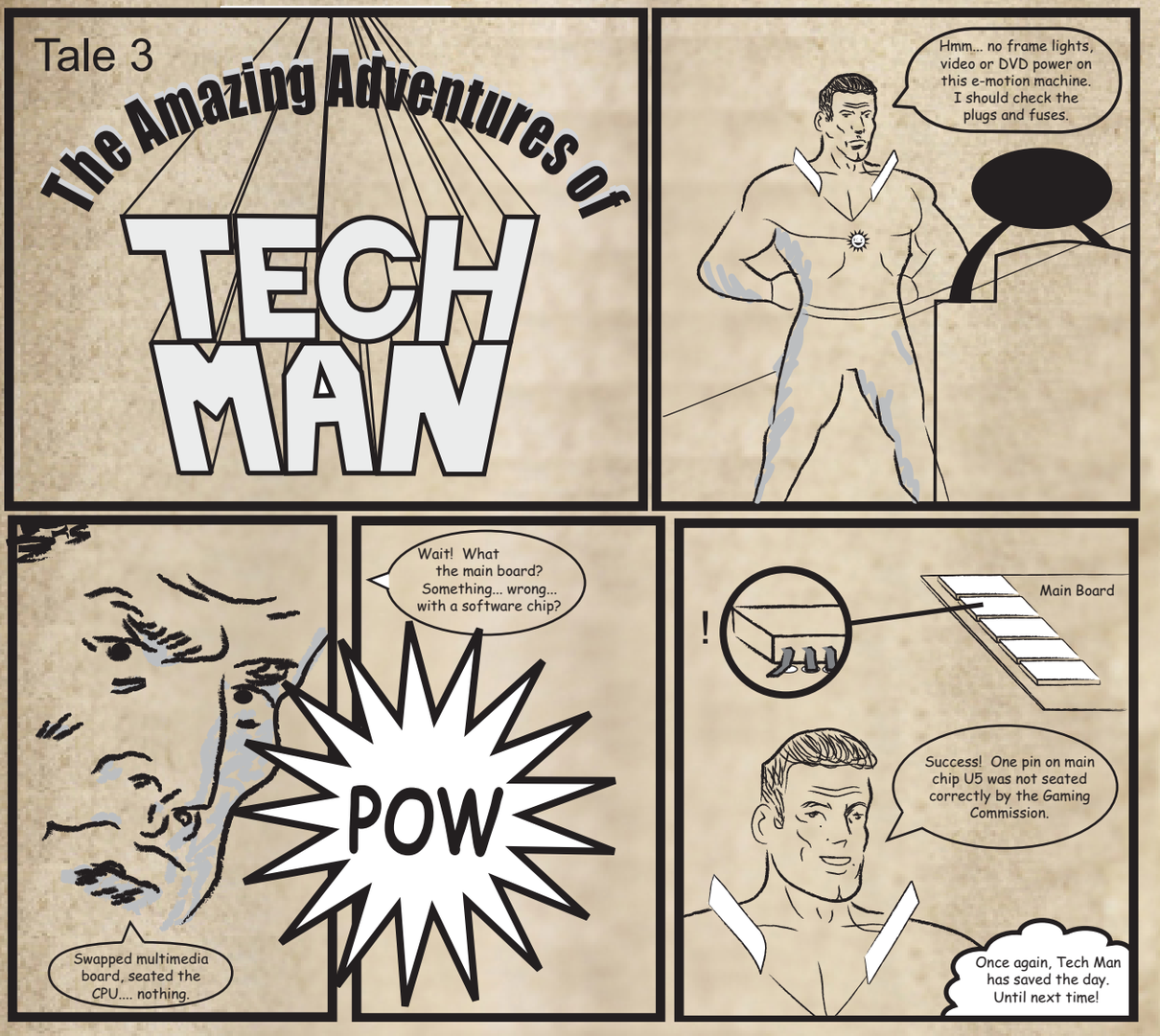
There in the box, lying blindly by its base,
Was a loosened connector,
a cable out of place!
The multimedia power cable had come loose,
Loose like a goose gotten loose from a noose.

I turned off the power, and plugged it back in,
And everything was good, so I let out a grin.
"Another game saved," I did deduce,
"By rhyming, on-timing, Serviceman Seuss."

- Michael Brennan

Tale 3

The Amazing Adventures of TECH MAN



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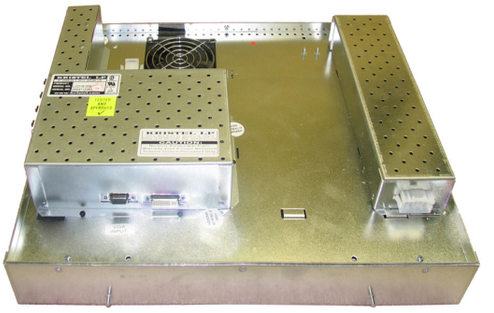
LCD Monitor Repair - A Photo Essay by Ray Holdren

(Kristel) and Jerry Langley, Slot Tech at Aladdin Casino , Las Vegas, NV.

Replacing the CCFL – Sharp LQ18E1LW31 LCD Panel

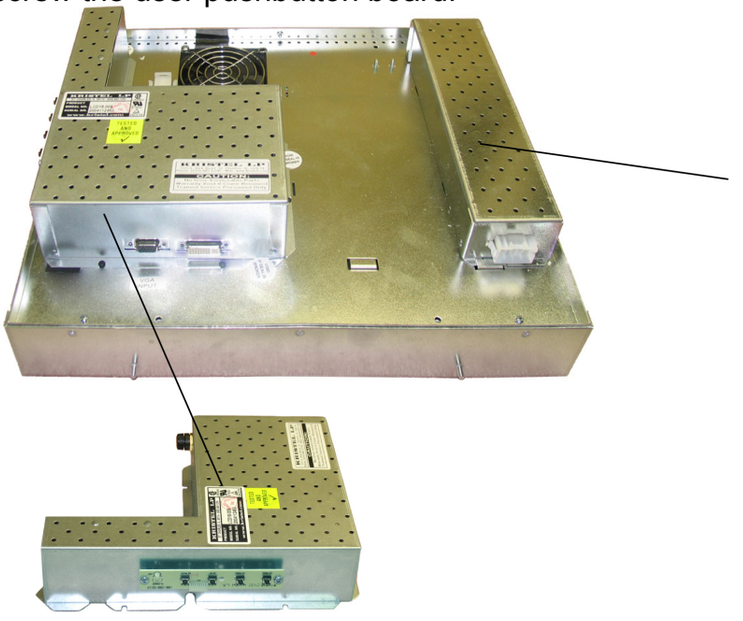
The Sharp & LG Phillips LCD panel contains 6 CCFLs. (3 top, 3 bottom – inside panel)

1. CCFL removal and replacement requires that the LCD panel be first removed from the monitor.
2. Secondly the LCD panel itself must be disassembled to gain entry inside the panel.
3. Finally the CCFL assembly can be removed.



- Make sure you have a flat surface and lots of room.
- Create a padded surface so as not to scratch or damage the front of the display.
- Lay the display face down on the surface.
- Be sure to have some screw holders so you don't loose the screws.
- Be sure to wear a static wrist band as electrostatic potentials can damage components on the main circuit board and in the LCD panel itself.

4. Remove the panel over the main board. You will need a special security bit for this. It requires a 3/32 Allen Security bit or a #10 Torx Security bit. (It is similar to an Allen wrench but with a hollow center). It can be purchases from a good hardware store or supplier.
5. Unscrew the user pushbutton board.



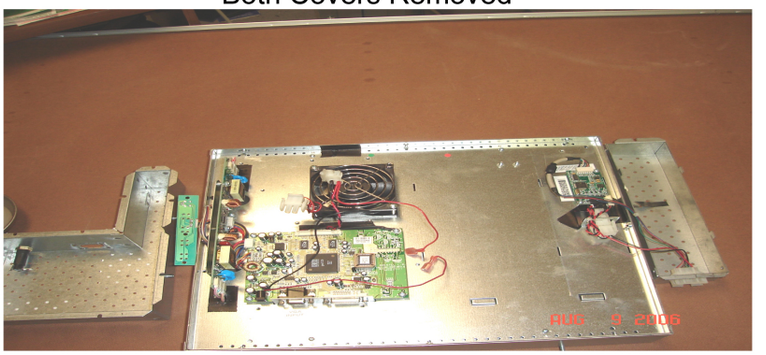
6. Remove the metal shield that covers the Touch Screen Board at the right of the display. This requires a Philips head screw driver. Remove and place to the side.

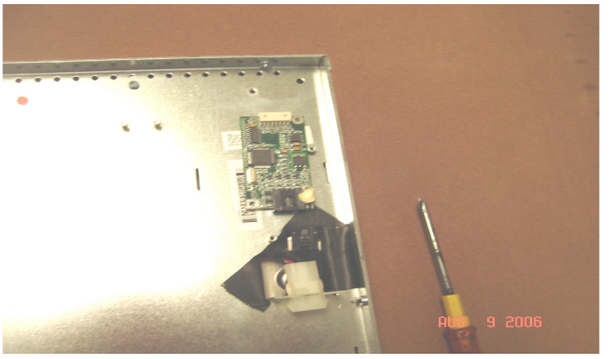
Replacing CCFL's on the Sharp LCD Panel

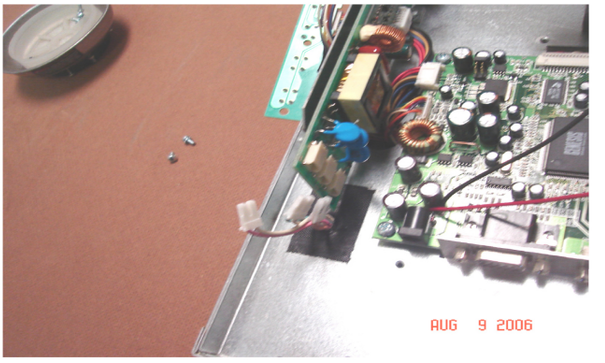
After the Covers are removed.

Disconnect the Ribbon Cable for the Touch Screen Controller and the 6 Connectors for on the Inverter for the CCFL's.

Both Covers Removed







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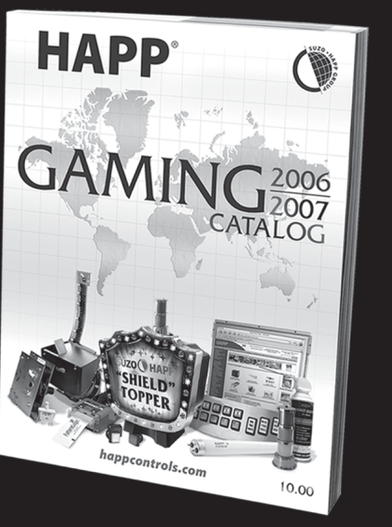

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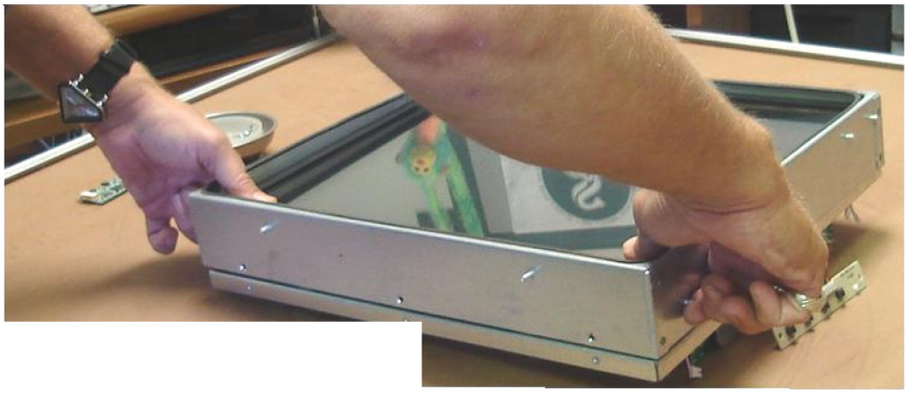
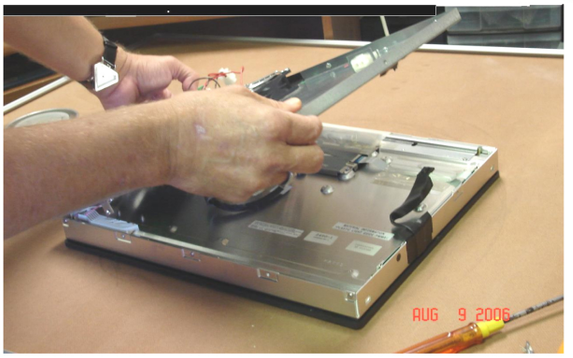
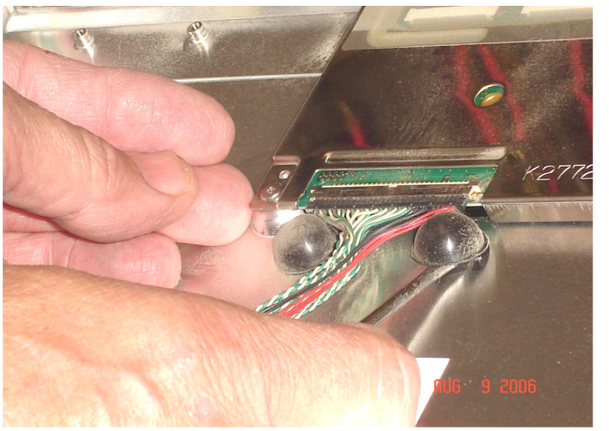
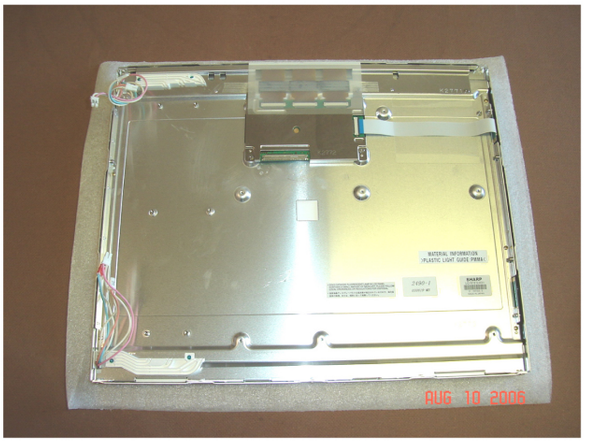
Remove the 6 Flat head screws and the 2 security screws on the sides.
Flip the panel face up and Remove the outside Bezel or Frame.
Before flipping it back onto its face , place a piece of foam under the panel's face to protect it.



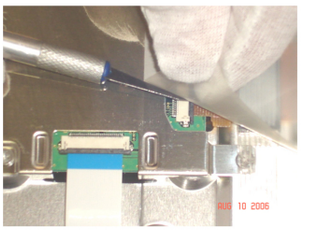
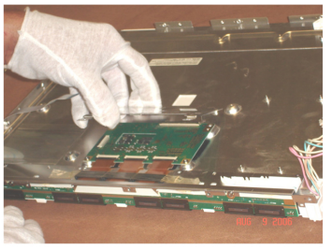
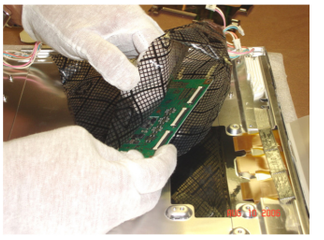
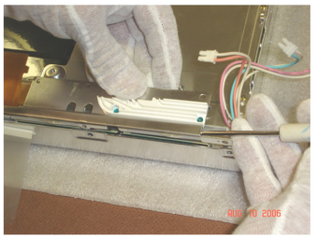
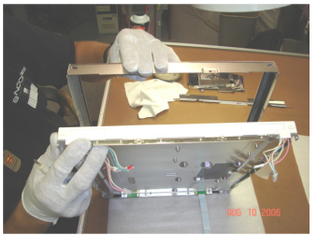


- Now you have access to the Main LVDS Signal Cable.
- Please Note the Way the Cable Is Plugged into the Socket BEFORE YOU UN-PLUG IT..
- You will need to plug it Back In The Same Way ,if you reassemble it & plug it in Backwards you'll blow the LVDS Receiver PCB and that's the end of the Panel.





- Put on Soft Cotton Cloves to protect the panel from the Oils on your hands.
- Remove the 6 outer screws.
- Remove the insulating and Metal Covers.
- Disconnect the Ribbon Cables from the LVDS Receiver Card.
- Remove the LVDS Receiver Card & put it in a Anti-static Bag then the Last Cover on the Back Panel.
- Pop the Plastic lock tabs in and Stand the Panel on its side and remove the Panels outer frame.

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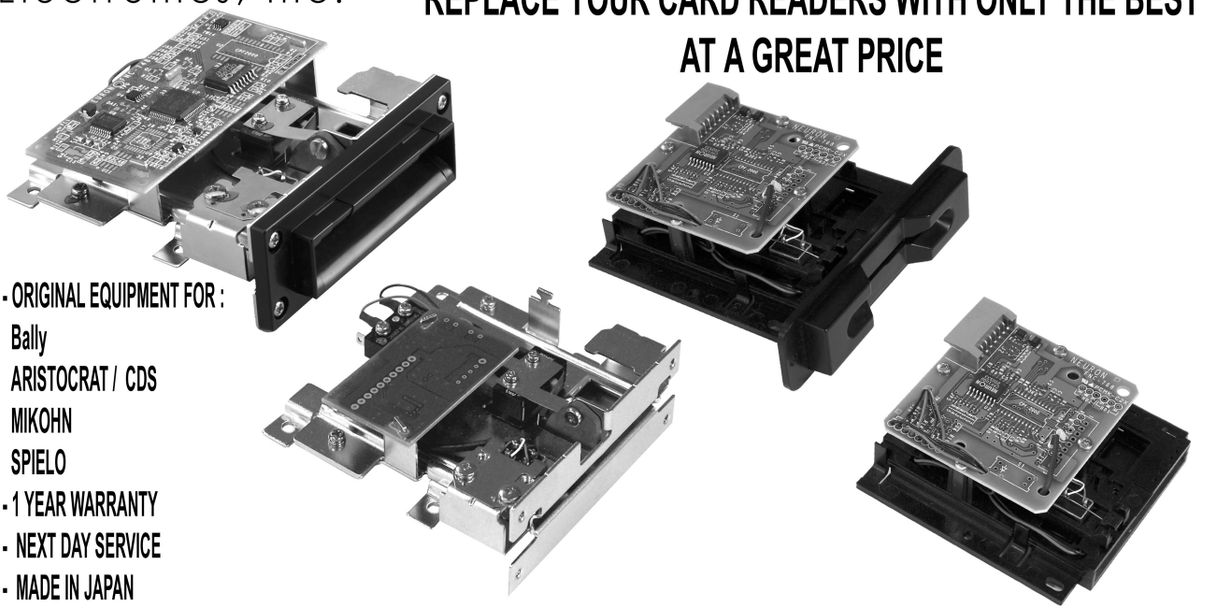

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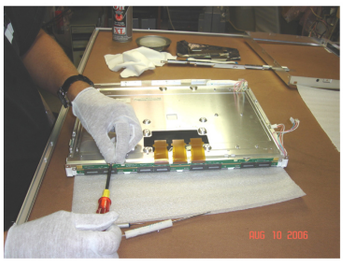
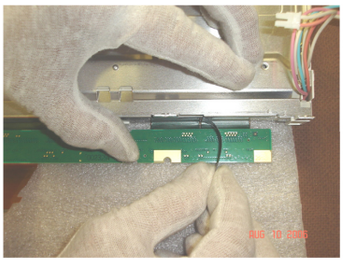
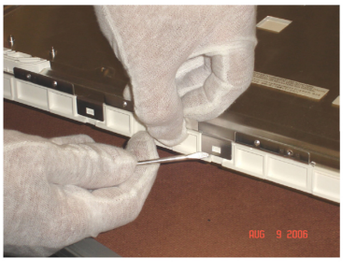
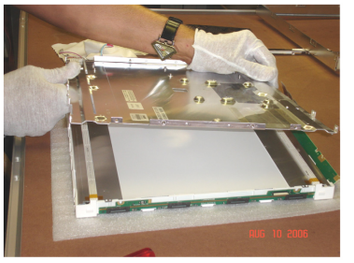
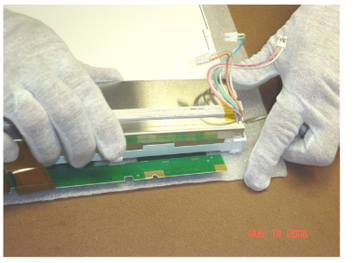
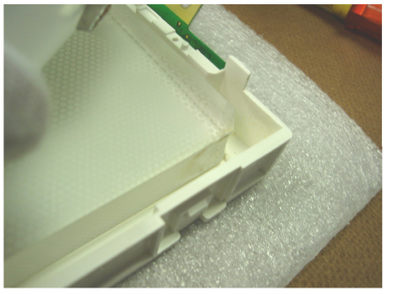
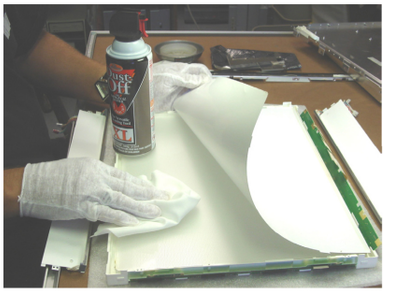
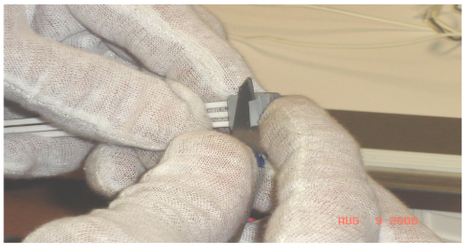
- Remove the screws holding the Source and Gate PCB's.
- After removing the screws on the Source PCB also Remove the Insulator ,when re-assembling the panel do not forget to put the insulating tape back before screwing the Source PCB down.
- Remove the 6 Brass Screws holding the Back Plane onto the Panels plastic support frame.
- Pop the Retaining Tabs on the Bottom of the Panel and Remove the Back Plane of the LCD Panel.
- Now we can Access the CCFL's. Be Very Careful removing the Lamp Assemblies. The lamps contain small amounts of Mercury and can be a health hazard if broken .

- **Now the fun part starts** .
- After Carefully removing the upper & lower Lamp Assemblies.
- Look Closely at the Defuser. You'll notice some burned sections or discolorations also a pillar of Acrylic used to hold the lamps in place.
- Scrape the burned sections and remove the Acrylic so the new lamps will fit properly.
- Clean all the Debris from the Layers of Film and the Defuser.
- Look at the old Lamp Assembly and the new one ,you may have to do a little carving on the rubber to make sure the Lamps will fit properly.
- Once Replaced , you can Re-Assemble the unit and Test it. Make sure to Re-Calibrate the Touch Screen ,it may have lost it's calibration while being disconnected from it's control pcb.

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Randy Fromm's Slot Tech Magazine is published monthly by:
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1944 Falmouth Dr.
El Cajon, CA 92020-2827
tel.619.593.6131
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e-mail editor@slot-techs.com

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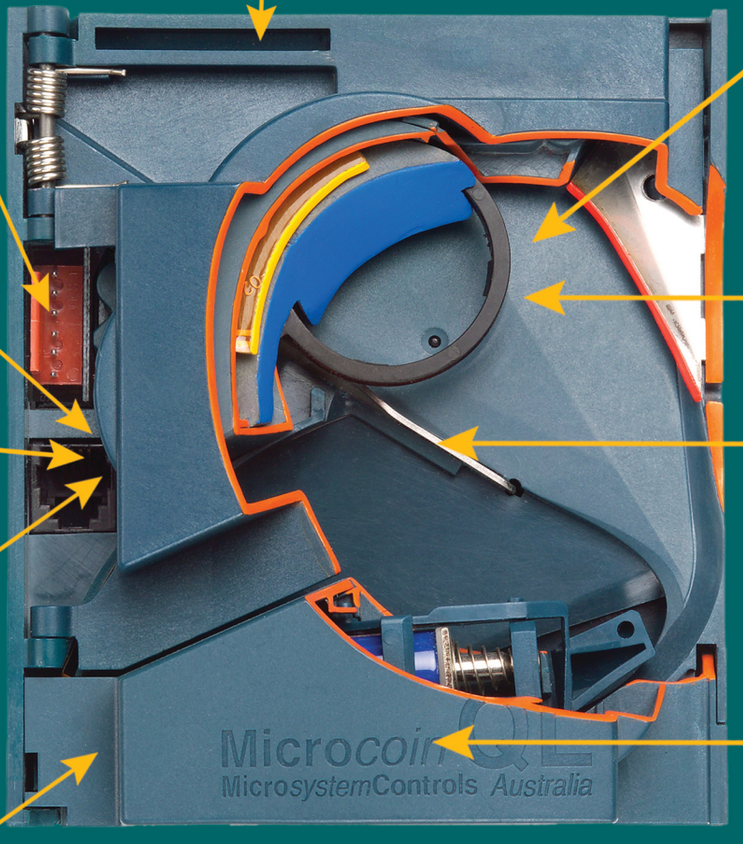

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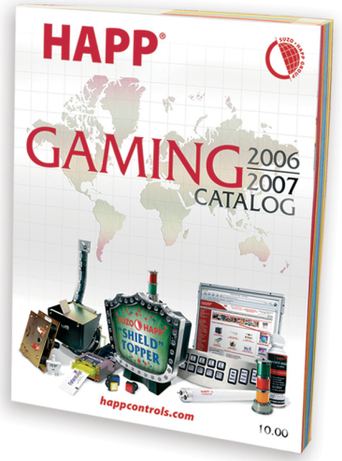

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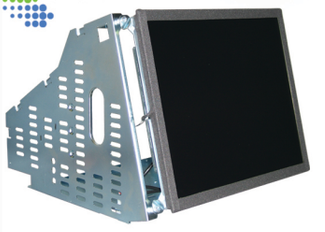

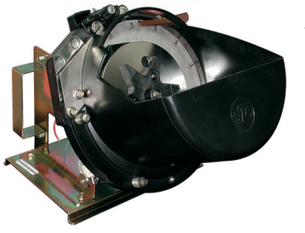

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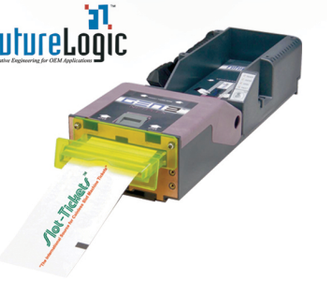

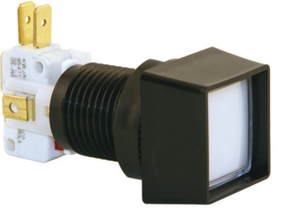

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