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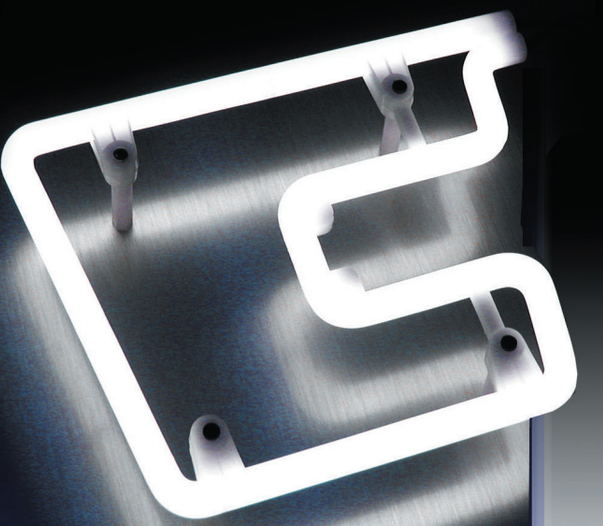

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July 2006

Page 4 - Editorial
Page 6 - Unlocking the Mysteries of the Mastercom 250 - Part 2
Page 14 - Quick Simple Repairs #15
Page 20 - IGT Slant Top Door Switches
Page 30 - Slot Tech Magazine Offers Tech Class to Public
Page 32 - Atronic Platform Architecture - Part 1
Page 40 - Williams Kristel 18-009 LCD Monitor Video Controller Board 100-100-G001
Page 46 - Subscriptions and Order Form

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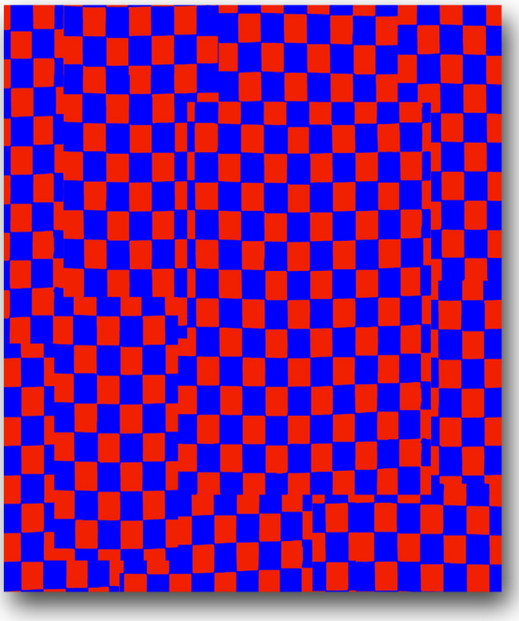
Try to relax your eyes.



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Slot Tech Editorial

This month sees part two of Ted Befus' Epic Battle of the Mastercom 250. When we left you last, our slot floor was in dire straits. Duplicate messages were running wild, leaving chaos in their wake. Lost ticket messages, duplicate tickets and non-functioning player cards were just a few of the problems encountered. Technicians lived in fear of the dreaded GMU and its unexplained nature. The saga continues on page six.

Pat Porath has his hands full this month with a printer RAM Error, an IGT Video Poker game with a non-existant ticket problem and even some funny stories from the gaming floor. However, Pat brings up an interesting thing to know about working on Atronic machines: There is a close connection between the button board and the flourescent lamps. Sometimes, a flourescent lamp failure is just that, a flourescent lamp failure. At other times, failure of the flourescent lamp to illuminate may be traced to a fault on the button board. Why would that be? You'll find a detailed analysis in Michael Brennan's article on Atronic's e-motion machine, also in this month's Slot Tech Magazine. Pat Porath's article begins on page 14. Michael Brennan's commences on page 32.

Please welcome our newest correspondant, Jason Czito. Jason is the Technical Manager at Black Oak Casino in Tuolumne, California. He had never even played a slot machine when he started as a floor attendant upon the opening of the casino. On the rare occasion that his spare time isn't spent outdoors, he can be caught playing video games on the PC. He resides in Soulsbyville and lives with his girlfriend, Mary.

His article on the door closure sensing circuit is really excellent. It's the thing that often has old and new techs alike scratching their heads,

slaming the main door closed again and again in an effort to clear the error. Just how many dang switches are there in that circuit? Jason shows 'em all to us and shows us just how they're all strung together in series. Every new slot tech needs to read this. Jason's article on IGT Slant Top Switches begins on page 20

Finally, Herschel Peeler takes us on a wild ride through the wild and wooley paths of the video PCB in the Kristel 18" LCD Monitor. The schematics aren't printed here. You'll have to get 'em online. The URL is included in the article. Herschel's article begins on page 40.

Oh yeah. One more thing. When people ask you "How can I become a slot tech?" I have the answer now. Sycuan Casino, here in El Cajon, California, has opened a slot tech school. It's a ten week program that includes three weeks of apprenticeship. I am going to lead the class. Point the newbies to http://slot-techs.com/sycuan. Much obliged.

Randy Fromm

See you at the casino.

Randy Fromm's
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Ted Befus
Michael Brennan
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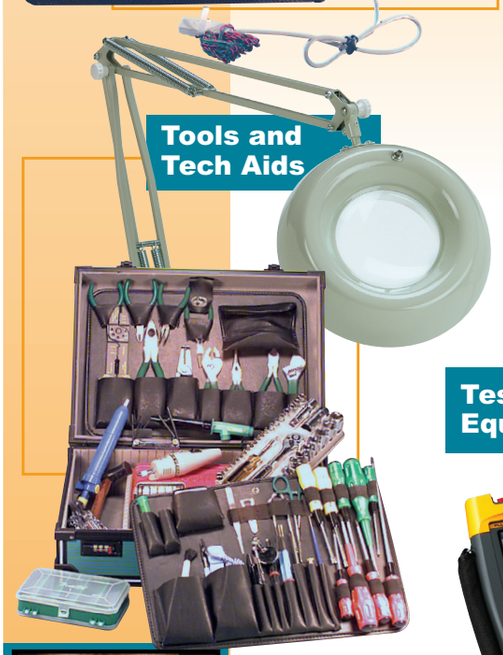

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Unlocking the Mysteries of the Mastercom 250 - Part 2

By Ted Befus

I'm sure you've all been breathlessly waiting for the conclusion to "Unlocking the Mysteries of the Mastercom 250." Well, wait no longer for the time is upon us.

When we left you last, our slot floor was in dire straits. Duplicate messages were running wild, leaving chaos in their wake. Lost ticket messages, duplicate tickets and non-functioning player cards were just a few of the problems encountered. Technicians lived in fear of the dreaded GMU and its unexplained nature.

Enter Bally Systems, armed with the knowledge of how to tame the GMU and leash the duplicate codes to a more acceptable status. It was with this knowledge that we could now breathe easily, no longer living in fear of what was.

Ok, that's enough drama, did I have you on the edge of your chair awaiting something shocking? Sorry to say, what you're about to read is not shocking, well not physically anyway.

In part 1 we briefly covered how to access the debug meters in the options of the GMU. Now we'll cover some of the problems we discovered on our slot floor and how we solved them.

After we had read meters on approximately 800 games for three days straight (that was a lot of fun, just in case you wanted to know. Boy, do I feel for some of you working with thousands of games right now) we were ready to determine the reason for our problems.

We first had to determine the criteria to make us look more closely at certain games from the meters that we read. Truthfully, we paid little attention to the first three meters (GmCMDn, GMSeq and GMCksm), unless they were exceptionally bad. Most of our games had no movement on these three meters. The ones we paid close attention to were meters 5,6,7,8 and 30 (NtCksm, NtRpol, NtMxRp, NtTQOv and DrtAer). Extra close attention was paid to meters 7 and 8 due to the fact that increments in those meters equates to lost messages.

We got fairly lucky. Out of 800 games, we may have had 30 games that needed immediate attention. Most of these games were from the same manufacturer (Atronic). Some smaller problems were scattered between our older Aristocrat (540) games and a few IGT problems.

Aristocrat 540

We started at our Aristocrat 540 games. They were the ones I mentioned in part 1 in regards to player cards not functioning. When a player inserted their card, the EPI display would show "STANDBY" meaning that the GMU had a message to send but it was waiting for the system to acknowledge it. This was noticed in the high error counts in meters 5, 6 and 7. The audit sheet seen in part #1 is an actual audit sheet from one of those games.

Once the EPI components and GMU were ruled out as suspects, we set out hooking our oscilloscope to the GMU transmit line coming from the

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slot line holding these games. As you'll see in figure 1, the transmit line was not pretty (if the figure doesn't look that good it's because I had to hand draw it. My scope doesn't have a capture feature. I haven't drawn anything since 10th grade art class!) See figure 1.

Now that was a lot of noise! To troubleshoot this problem, we separated all other banks of games associated with this particular line looking for an improvement in signal. It didn't improve. Next, we started disconnecting all the games still online until we were down to the first three games on the line. It was still noisy though. We checked for proper EPI grounding (which was good) and checked for leakage between the neutral and ground of the game auxiliary supply (less than 1 volt. No problem there).

Could it be the GMU power supply? We took a new supply to a nearby wall outlet and plugged it in. BINGO! No noise! Ok, now we think we've got it, so we swap supplies out and plug the supply into the game aux supply and check again. Uh oh, still no good. Hmmm, this is getting to be a real noodle scratcher. Then it hits us! We plugged the new supply into a wall outlet! We disconnect the supply and plug it straight into the power strip located under the game, that oughta fix it! NOPE! Still noisy. By now, I'm pulling out my hair as we're trying to figure this out. Then, we take a good look at the power strip. Lo and behold, it's one of our old strips that are known for causing problems! We replaced it with a new one and checked it again. PERFECT! Whew, I was starting to get a little frustrated.

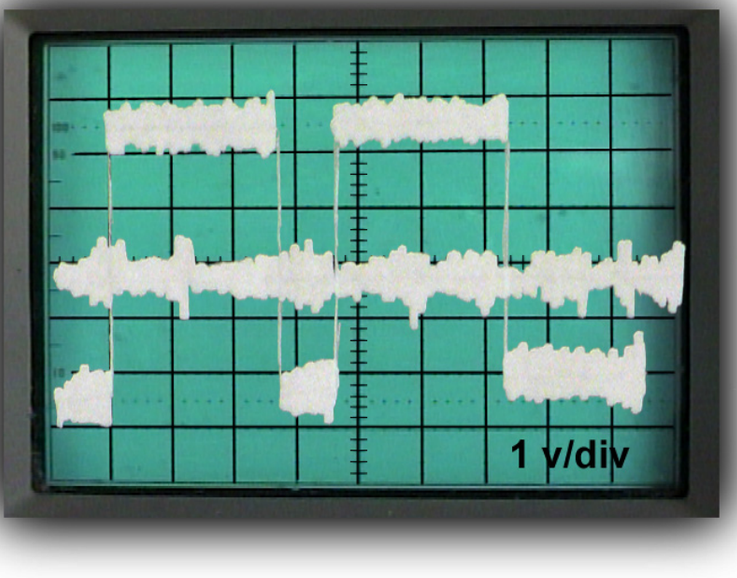
Editor's note: Why don't you purge your entire casino of these rascals? Surely this comes under the heading of preventative maintenance.

Atronic

Next up, an Atronic SAS game that had so many errors over three days that the meters actually rolled over sometime between counts! So, we go through the same motions as before, this time checking for a bad power strip first. That ain't it. Out comes the 'scope again and of course, another noisy line. Different looking noise than the last time though. So we're gonna switch out the GMU and no sooner did we unplug it than the line went absolutely NUTS! See figures 2a, 2b and 2c for what happened. Could it be bad machine power? We checked the game Power supply and found that the fan had quit. That could be it. Could there be noise from the 12V supply for the fan causing it? We replaced the game power supply. Nope. That ain't it.

Why would the line get bad after unplugging the GMU? Then one of us bumped the game power and the line cleaned up considerably. Why? It turned out that the GMU was picking up noise being radiated by the monitor. This isn't a problem on all of our Atronic games. Some of the games have a Ceronix monitor that comes in an enclosure. The enclosure acts as a Faraday

Figure 1



Line 11 a - GMU Transmit before changing power strip

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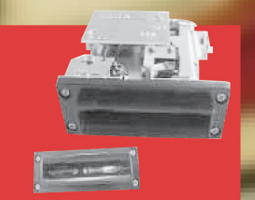
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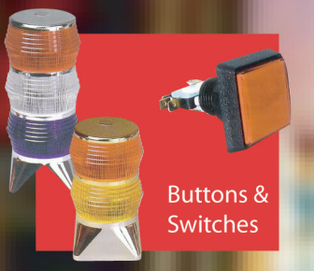
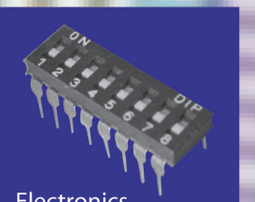

Buttons & Switches



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Shield, blocking the EMI. Our problem games didn't have the shield. To fix this, we have grounded all the GMU chassis to the game and set the GMU to the rear corner of the topbox to keep it as far away from the monitor as possible. Problem solved.

It turns out that a lot of our Atronic games had this same problem. We have since grounded the GMU chassis on ALL Atronic games. This has had a very positive impact on the cleanliness of our slot lines. To double check if this really worked, we reset the debug meters on the worst offenders and checked them the following day. The next day there were NO INCREMENTS on meters 1 through 8 in the debug meters! Cool!

That left one problem line, holding some of our more popular IGT TITO games. Out comes the 'scope again. Holy cow, what a lot of noise! See figure 3. After isolating all the games from the system, we had left only the homerun and all the harmonica boards connected (a harmonica board is simply a board with six RJ45 terminals that looks like a harmonica). With no games hooked up, it was still noisy. We started disconnecting all the harmonica boards one by one. As it turned out, that bank had two defective harmonica boards.

That spelled the end to a lot of our big problems. Do you remember in part 1 where I

Figure 2a

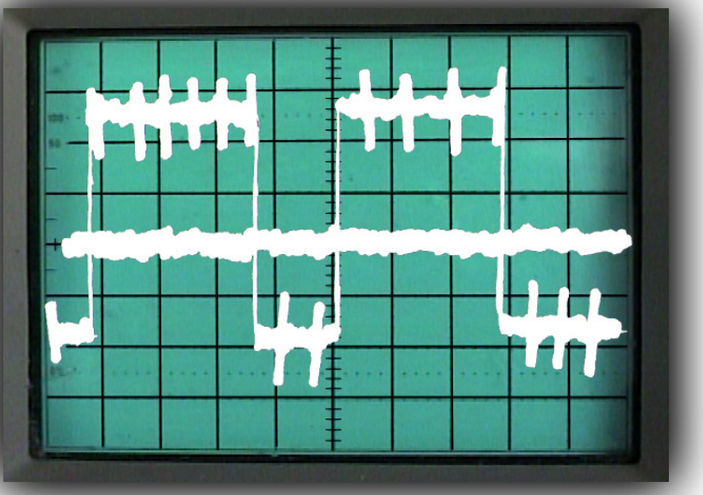


Figure 2b

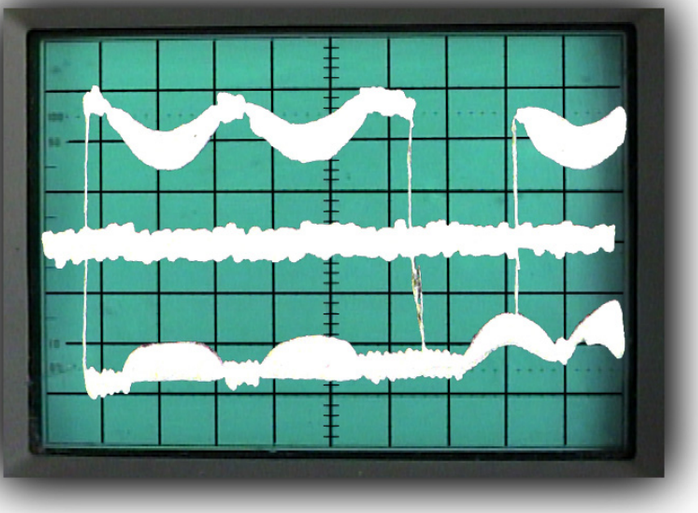
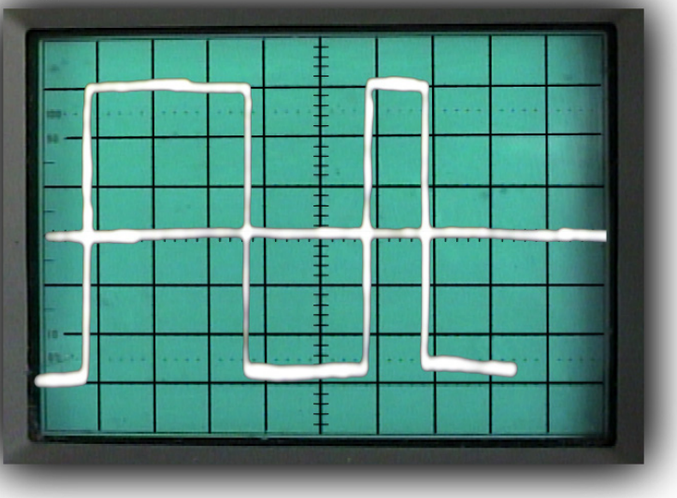


Figure 2c



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mentioned to pay particular attention to the duplicate code count from the GMU exception code count report? Before we started our audit, we were getting over 1300 duplicate exception codes during a 24 hour period. OUCH! We've been told that for a casino our size we should have a maximum of 200! After cleaning up the problems mentioned above, our count has dropped to nine! A world of difference!!!

I know what some of you might be thinking, that noise can't be that bad. Can it? We did a lot of things prior to the install of this system. We had fully shielded CAT6 wire (with a pair separator) pulled for all our homeruns and outfitted all our games with fully shielded CAT5e patch cables and made certain that our fuserack was properly grounded. I certainly was surprised by just how much noise there can be, even when you take precautions like we did, but then again I never expected to see the causes for it that we saw.

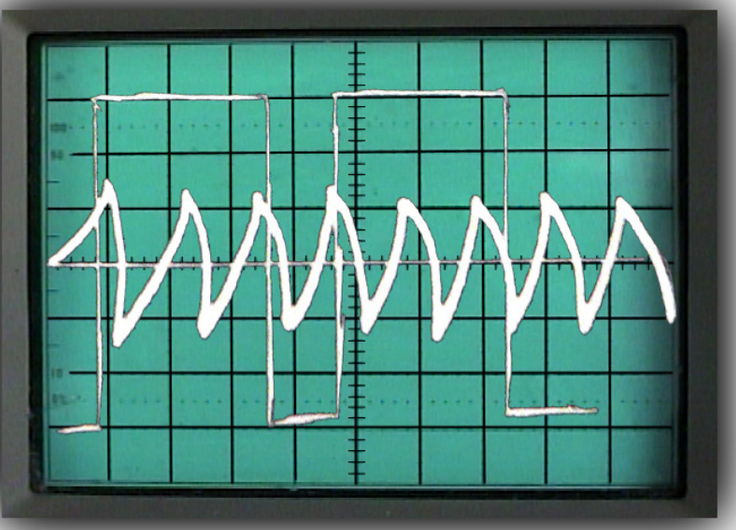
Our technicians need no longer to live in fear, for we have unlocked the mysteries of the Mastercom 250! Peace shall reign in our Casino once again!

I'd like to take a minute to thank Brandon Saeck from Bally Systems for providing me with a lot of the GMU information you saw in part #1.

Until we meet again.

- Ted Befus
tbefus@slot-techs.com

Figure 3



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Quick Simple Repairs #15

By Pat Porath

IGT S2000

This was a new one on me. First of all, it is an IGT S2000 game with a GEN 1 (Seiko) type ticket printer in it. It was a typical day at the office and the call was received: "We have a RAM error on a ticket printer."

This was very interesting as I had never run into this before on ANY game. Other errors are common such as "printer not communicating," "paper jam," "printer timeout" or even "printer disconnected" but never a printer RAM error. I have never even heard of one. Of course one of the things that came to mind was to do a partial RAM clear on the game. Perhaps a corrupt E-square on the back plane board was to blame. Maybe I should simply replace the printer.

Upon coming up to the game, a little bell went off in my brain. "IS IT PLUGGED IN?" A short but effective phrase indeed. BEFORE replacing the ticket printer, performing a partial RAM clear or rebuilding the game from the base up, let's power-down, reseat all connectors and try a simple reboot. Sure as the sun comes up in the morning, it came back beautifully with no errors. If the logical approach had been taken (replace the "defective" unit) there would have been one less spare on the shelf and the original would have to have been cleaned and tested before being tagged "good" and replaced on the spares shelf. Is It Plugged In?

This short phrase has helped me on numerous occasions. Not too long ago, I was working on an Atronic Emotion game that had lost communication between the game and the CDS Sentinal board. A quick way to tell is that there is neither a "door open" nor a "door closed" displayed when the slot door is physically opened and closed. I checked the green light on the Sentinal and it was flashing normally. This told me that there was good communication between the Sentinal and the computer system. The main game board and the communication board were reseated. Still nothing.

Ok, time to check out the Sentinal again. Upon closer inspection, I saw that there wasn't a game interface cable plugged in ANYWHERE. This makes sense now. How is it supposed to work if it isn't even plugged in?

The machine was powered off and the connection was made. STILL nothing. It needed a "COM board clear" performed on it. To perform this procedure, remove the game COM board (the one above the main board) and remove the two socketed integrated circuits at U34 and UXX. Install the "COM board clear" chips and power up the machine. Once the game has come up, power down and reinstall the original chips. The game came up fine this time with no errors. Communication between the game, the Sentinal and the tracking system had been re-established.

FUNNY STORIES From the Gaming Floor

In the "good ol' days" of the floor (when we didn't have project after project and not so many slots on the floor) we would sometimes have with the customers.

One hilarious thing that happened was on a few old Universal nickel machines. They would tilt with a code 21 if

coins were inserted too fast. If a customer would "speed load," it would tilt. I had an older gentleman that was getting upset because of the tilts. I told him if he wouldn't speed load, the tilts wouldn't occur. Of course, it wasn't long before the game would tilt on him again. I was getting a little irritated as well, so I came up with a plan. I told him that if he put the nickels into the game with the head side facing inward, the game wouldn't tilt as much. Sure enough, he was looking at EVERY nickel he put in to make sure the head of the coin faced the game. VERY funny! We (slot attendants at that time) would walk by and start to chuckle. "Look at this guy putting in nickels, with the head of the coin toward the game."

With him looking at the coins, it slowed his play and eliminated the tilts. Funny, but true. Technically on that specific model of Universal, it has three sets of grey coin-in optics: The two main coin-in, and a "drop coin-in" optic. We talked to a Universal tech and he stated that it was a timing issue between the optics and the game program and that not much could really be done about it. A tech could clean the coin-in path, clean the optics and adjust them but nothing would help with the code 21s when a customer speed loaded coins into the game. The code 21 was also common on the IGT S-plus games if the coin-in optic was really dirty. To resolve the problem, simply

disassemble the coin-in assembly, clean the optics and clean the coin-in path.

Something else that happens once in a while is when a nickel player will walk up to a game and see the number five. Thinking it's a nickel game, they put in a ten-dollar bill, spin it twice and guess what? The credits are GONE. It was actually a five-dollar machine, not a nickel game. We would walk up to see what the problem was and explain to the customer that it is a five-dollar game, not a nickel game. Sometimes they wanted a refund. I would LIKE to say "What do you think this is, WAL-MART?" but of course, I say that I'm sorry that it happened and remind the patron that they did indeed get their spins. Of course, if the customer had won on their two spins, and had seen the dollar amount of what they won, there wouldn't be a problem at all.

Almost a Jackpot Winner T-shirt

I love this idea. In the old casino, we had "Almost a Jackpot Winner" coffee mugs and T-shirts made up. I don't recall the exact procedure (we are talking eight years ago) but when a customer hit a hand pay on a machine, they would receive an "almost a jackpot winner" T-shirt. Of course if someone had red and white sevens on the line and the blue just below, it would qualify for a T-shirt or coffee mug. It's a consolation prize and customers LOVE free prizes. It was funny because I would walk around the gaming floor or even stores in town, and there would be casino patrons wearing their "almost a jackpot winner" shirts.

It was low cost advertising for the casino. Of course you can't give out boxes and boxes per day but the old saying applies here that "a little goes a long way." A little bit of extra customer service goes a long, long way in gaming.

"That sure was a close one. Here is your Almost a Jackpot Winner" shirt.

Even if a customer had a minor game malfunction, such as a reel tilt and they "claimed" mixed bars were on the pay line, giving them a t-shirt would turn around their sour mood.

If I'm on the floor and a customer says they inserted a $20 bill into the game and didn't get any credit, I'll ask them if they remember the serial number of the bill. Believe me, you'll get some hilarious reactions. Of course this should only be done if you can see the bill or you have the keys to get access

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to the cashbox contents. When you ask the customer if they know the number, try to do it with a straight face.

Atronic e-motion Lamps

As we know, all lamps in slot machines should be working properly. There seems to be, at the casino I work at anyway, an issue with the top light fluorescent in the Atronic e-motion games. It's not always the same thing. Sometimes the failure is in the button panel board (yes, the button panel board controls the button lights – they're the colorful lights on the side of the game – and the top light) and sometimes it is the ballast. The ballasts are swapped out and repaired. Sometimes we have to swap the button panel to get the fluorescent to come on. The panel involves two ground wires and six connectors. The trick, once you know where it is, is HOW to get access to the button panel board. On the inside of the game, opposite side of the lower LCD monitor there is a fairly large round gray knob. Push the knob downward and you will hear a click. This unlocks the board. The other large gray knob on the opposite side of the upper LCD is to unlock the top glass. Without knowing about the release knob, the top glass is hard to get out (I've done it). The first thing, of course, is to change out the bulb. If it doesn't work, swap the button panel. If the bulb lights, the problem is in the board. If the bulb does not light, the problem is with the ballast.

NOTE: Once the button panel is swapped and the bulb does light up, SWAP IT BACK TO THE ORIGINAL GAME. On some of the Atronic e-motion games there are buttons to select winning "one way" or "two ways." The other games have a "repeat bet" button and "bet 210 credits" button. If two different games are next to each other and there is this specific situation, a customer can't select "one way" because the button isn't there. That's what happened here once. The panels were swapped for troubleshooting but not swapped back to their original positions. Another symptom of a bad button panel board is when the button lights are all on and dim.

For more on the Atronic Button Board and a complete schematic diagram, please refer to "Platform Architecture Review, Part 1" beginning on page 32Platform Architecture Review, Part 1 of this issue.

IGT Video Poker Game - Ticket Doesn't Exist

Most of us that have TITO games have more than likely heard of a ticket that "doesn't exist" in the tracking system. This game was a bit tricky to figure out (for me anyway). One of the first problems was getting on the machine to look at it. It was being played steadily all day and when I looked at it first thing the following morning, there was a guy already playing it.

Later on in the day accounting called.

"Do you know there is a problem with this game?"

"Umm yea, we know about it, we are just unable to get on it."

So finally I HAD to ask the customer if I might look at the game. I do not like to do this at all but in my opinion, it had to be done. Every ticket that was going to be turned in at the cage wouldn't be in the system because the game wasn't communicating. The basics were checked and sure enough, no COM. There was other work that was done to the game and I had a hunch that it would be in the "global" part of the CDS. It ended up that it was. The "global card" is somewhat of an option card. You can enter the machine number, the Sentinal ID number, progressive on or off, what type of communication is needed such as "IGT Winner" and "SAS." All of this, ESPECIALLY with ticketing, has to be perfect. On this game, only one setting looked suspicious, the protocol. It was set at "SAS200ms" instead of regular "SAS". It was set, umm…no I don't like to use the word "set" with slot machines; it was OPTIONED (there we go) accordingly and there hasn't been a problem heard of since.

Power Surges - 'Tis the Season for Thunderstorms

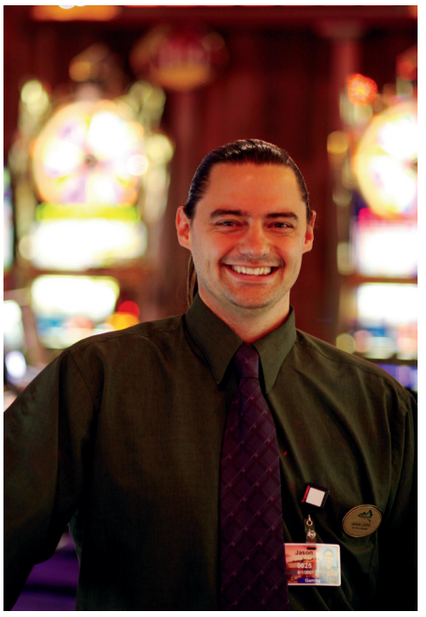
As the summer season comes upon us, so do thunderstorms, many of which include power outages. At the casino I work at, we have a generator that is mainly used for the absolute basics. It powers emergency lighting and basic power needs but not the slot machine power.

When the power does go off, there are usually a few choice words that are said and when it comes back on the fun begins. The progressive signs are supposed to come right back up; that is how a lot of them are designed these days. They are controlled, more-or-less by a PC and boot up when the power comes back on. But it doesn't always work this way. If a sign display is black, try rebooting the PC. The power indicator light may be on. If so, press and hold the power button in for a few seconds and then let it go and it will boot up. When there doesn't seem to be any sign of power to the PC, try tapping the power button once. More times than not, the sign will come up beautifully. All of the progressive amounts will come right back to where they left off and the whole works. We did have a case where a plasma screen failed. You could smell burning inside. Some of progressives are Windows based. If it is an in-house progressive and the keyboard is there, simply click on the icon and bingo! There are your progressive meters.

NOTE: If you lack experience, be sure to ask for help. A lot of damage can be done to a progressive system if it isn't set up properly. Be very careful in these areas. You would not want a customer to hit a valid jackpot and the sign not lockup. Not good. Next time an experienced tech is working on a progressive sign or working on a progressive system, ask questions. I believe I can safely say, the majority of techs will answer. Find out where the controller is. On an in-house progressive that is in the casino I work at, if there is a failure code on the

sign, the controller needs to be rebooted. Simply unplug the power for a few seconds and plug it back in. A lot of the times it will clear the error.

- Pat Porath
pporath@slot-techs.com



IGT Slant Top Door Switches

By Jason Czito

Troubleshooting the door sensor system for IGT slant top machines (80960 platforms) can be puzzling unless you've had the time to sit down with the schematics and wade through the diagrams. There are a number of doors monitored with optics, Cherry, and micro switches, all on the same circuit. The schematics mention switches that aren't always present and don't include aftermarket additions. This article will explain how the system works, what to keep an eye out for, and tricks for troubleshooting. We'll start on the motherboard.

Coming off the motherboard on J11 are six wires (three pairs) that go to the following components: the jackpot reset key switch, the coin drop door sensor, and the main door sensor(s). The wires coming off of pins 1 and 2 of this plug are the ones we're interested in. When all the sensors/switches of the game are functioning and all doors are closed, the connection between these two pins is made, and the machine knows that its main doors are closed. See figure 1.

Let's trace the line from pin 1 through the series of switches. The first switch that this line encounters is the door encoder optic (see figure 2). It's a light-activated switch (phototransistor) that, during normal operation, is activated when the emitter (LED) attached to the top door is brought before it when the door is closed.

Next in line is the bill validator door switch (see figure 3). It's a double-throw microswitch activated when the bill door latch slides into place. It's located under the slit for the top hook of the door latch, accessed from the backside.

Then comes the coin bucket switch followed by the front door switch (see figure 4). These are both basic Cherry switches. The coin bucket

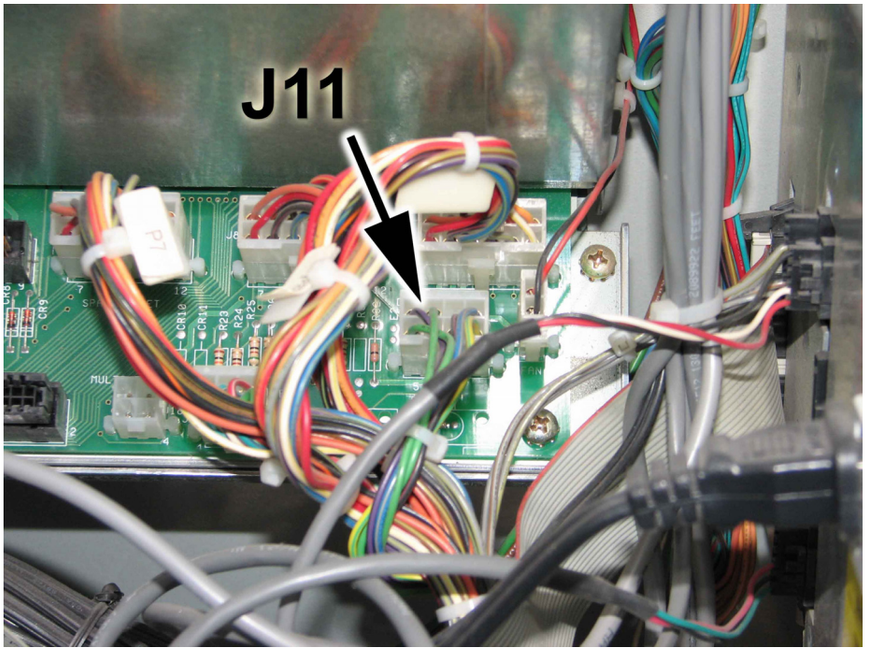


Figure 1 - When all the sensors/switches of the game are functioning and all doors are closed, the connection between pin 1 and pin 2 is made, and the machine knows that its main doors are closed.

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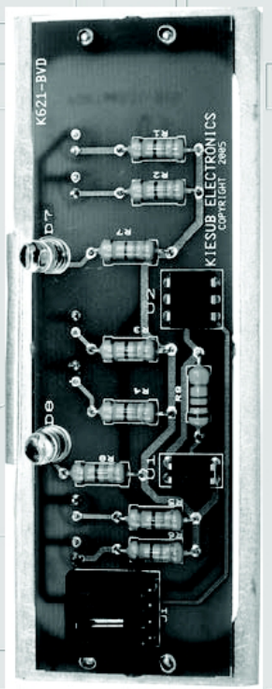

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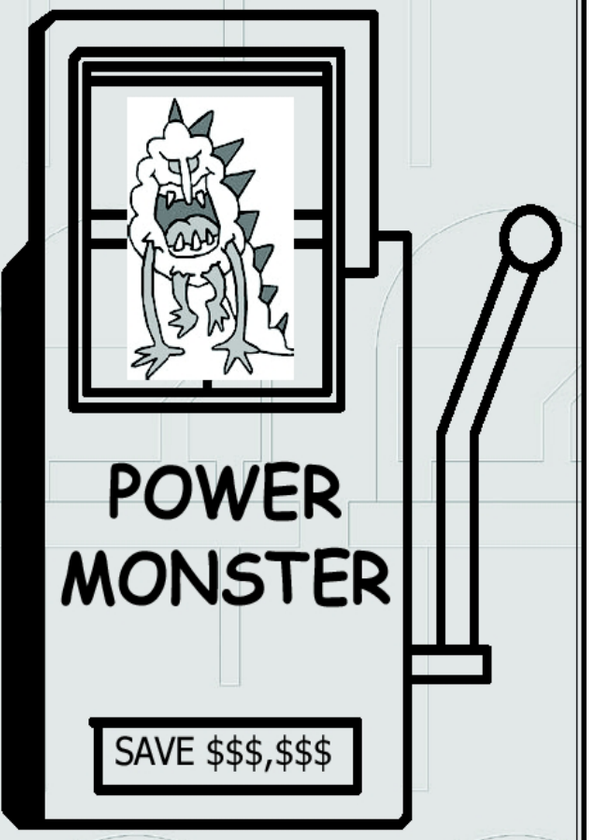

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switch (only visible in this picture by the contacts hanging down) is activated when the coin bucket is set in place. The front door switch (on the right) is activated when the front door panel is set in place.

Next comes the switch in the top box, which is also a Cherry switch activated when the door is closed. After this switch, the line returns to the motherboard on pin 2 of J11. For the main door to show closed, all of these switches must be working at the same time to close the circuit between pins 1 and 2 of J11. Remember that the encoder switch needs a functioning emitter to close the circuit (see figure 5). Also keep in mind that your machine may or may not have these exact switches.

In a functioning machine, this emitter will transmit pulses of infrared light, not visible with the naked eye. The machine expects to see these pulses replicated on pins 1 and 2 of J11 when the doors (and therefore the circuit) are closed. This is why the machine doesn't recognize the door closing when an LED flashlight is shined into the optic – it knows what pulses it's sending via the emitter and expects to see the same pulses from the main door circuit. If you go into the game menu and select "Diagnostics, Inputs and Outputs Tests, and Processor Board I/O Test, you'll be able to see these pulses in the form of rapidly changing switch states (see figure 6). You can see the Coin Drop Door and the Bill Validator Door switch states changing in this picture, as the pulses go through them. If you extend the emitter from the top door down to activate the encoder while in this menu, you'll see the Main Door switch state of this menu flicker with the pulses for a

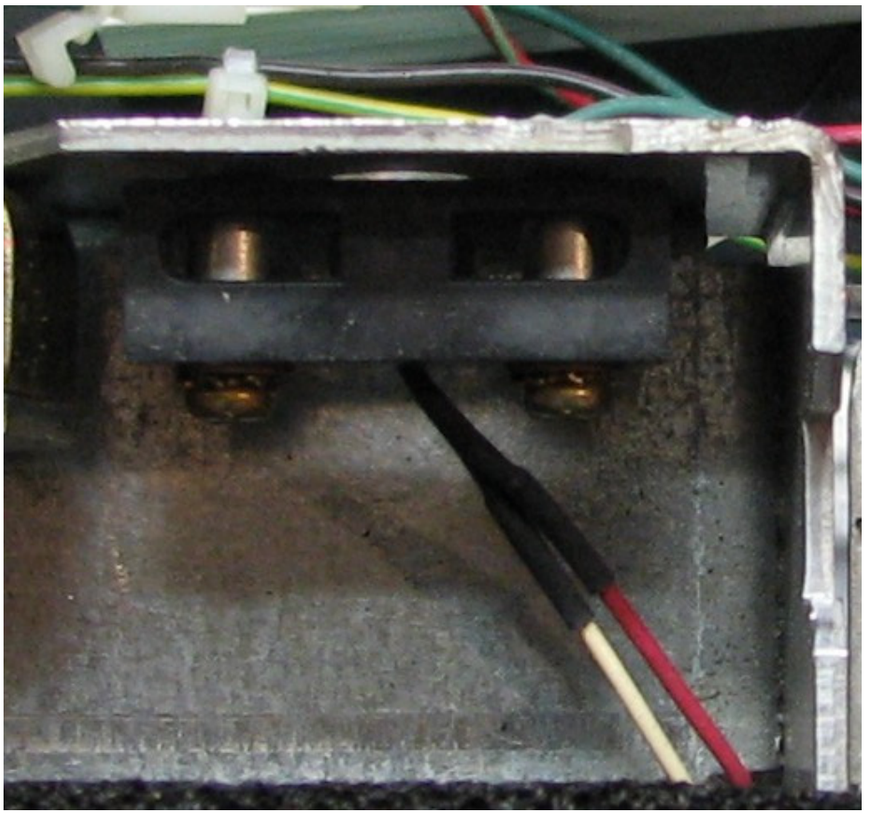

Figure 2 - This is the phototransistor for the main door. It is also referred to as the "encoder."

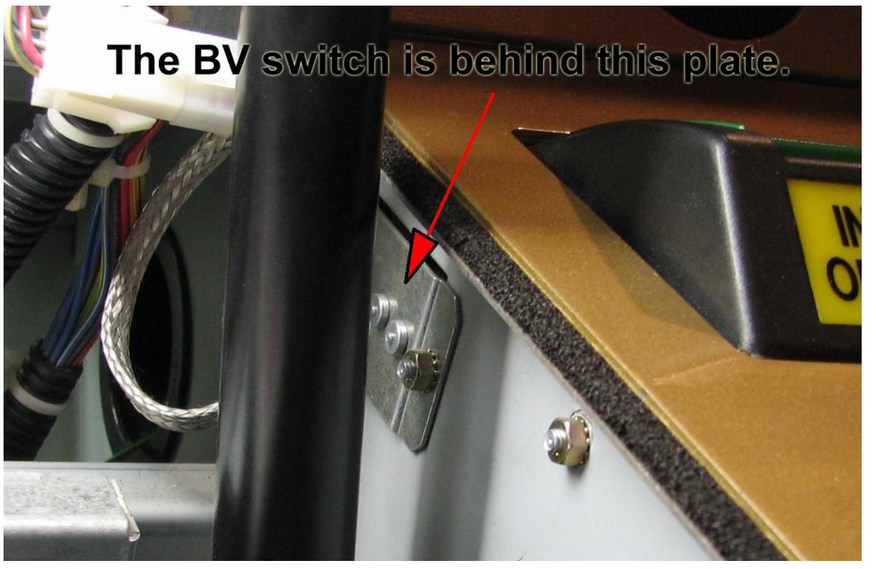

Figure 3. This is the bill validator door switch. It's a double-throw microswitch activated when the bill door latch slides into place. It's located under the slit for the top hook of the door latch, accessed from the backside.

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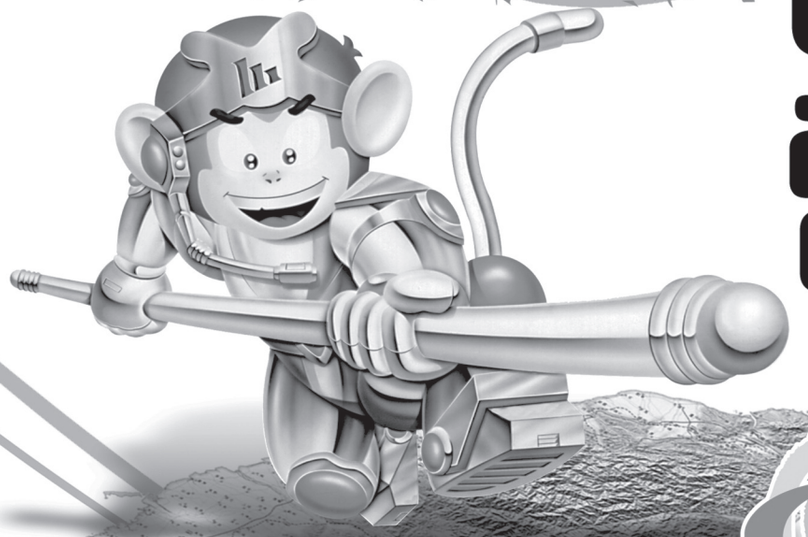

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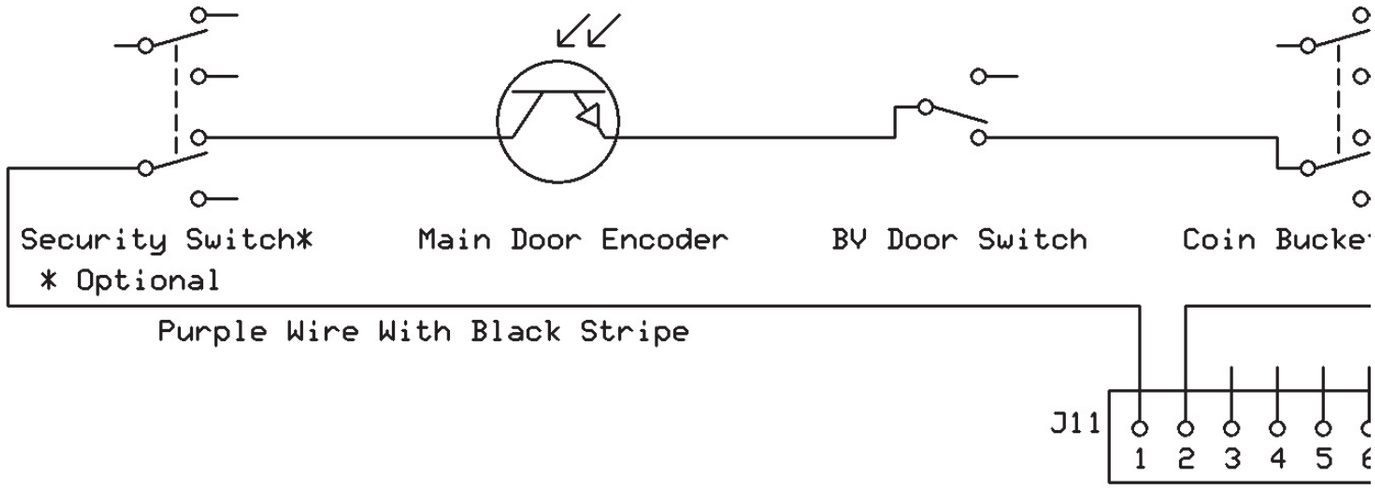
Figure 8



moment before the machine recognizes the pulses and exits the menu (because it thinks the door is now closed).

Variations of this will exist in the field. Figure 7 is from the Game King 19" Slant top manual, showing the section with the door switches. Note that J347 holds the two wires that run the LED on the main door hatch that will activate the "Encoder, Door Open Receiver."

I don't see the "Printer Door" switches present often in the field, for example. Our games have an additional switch installed per CN3199, which calls for installing a bit of hardware along with an extra switch in the series. If your games are coinless, you may have your coin buckets covered up with a plate. I've come across a handful of machines where the IGT tech had removed the now use-

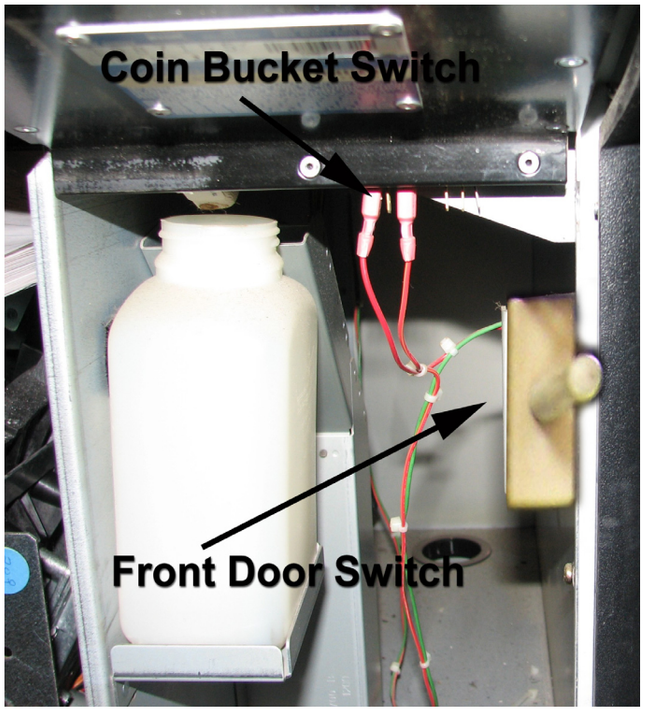


Figure 4. - This is the coin bucket switch and the front door switch. These are both basic Cherry switches. The coin bucket switch (only visible in this picture by the contacts hanging down) is activated when the coin bucket is set in place. The front door switch (on the right) is activated when the front door panel is in place.

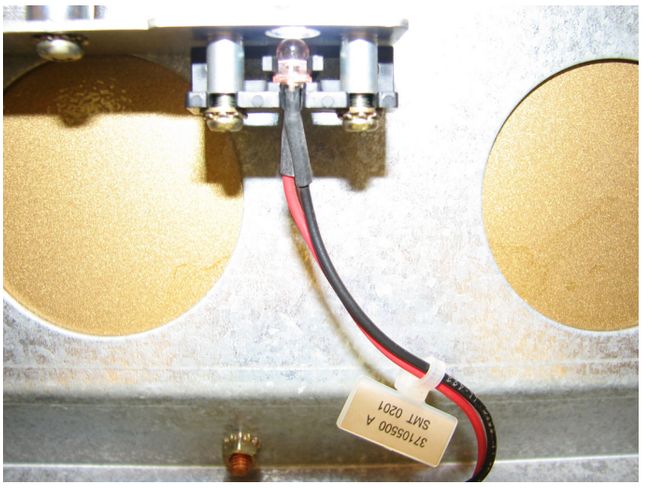
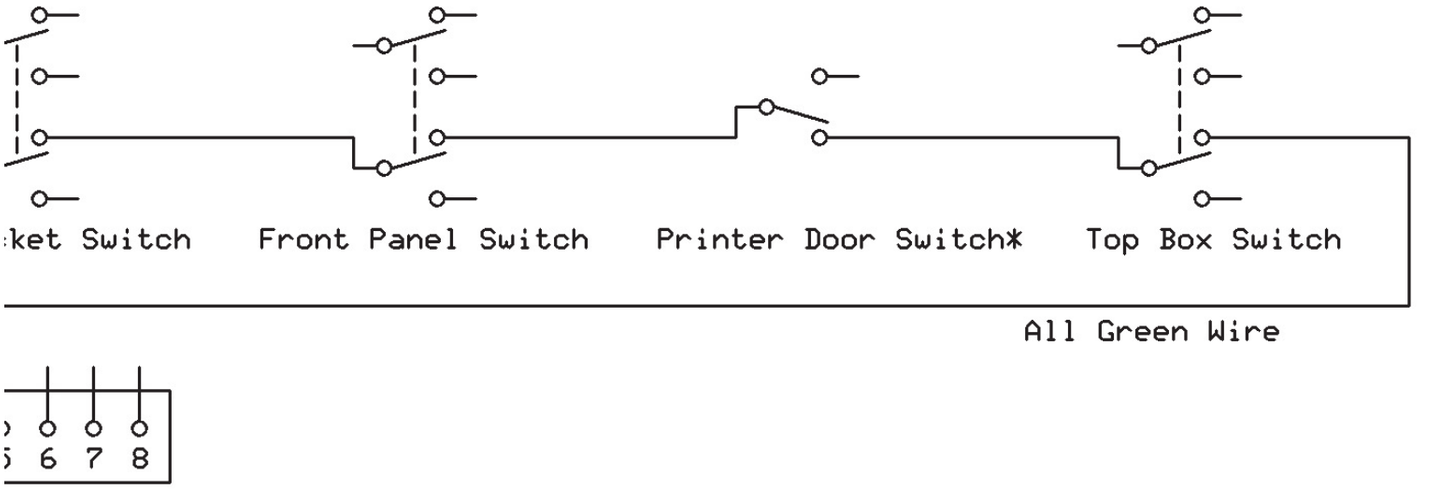


Figure 5 - The front door infrared LED emitter.

less "Coin Bucket" switch and bypassed the



wires. The diagram itself even mentions an optional jumper in place of the top box switch. Figure 8 is a simplified diagram of the entire switch system including some optional switches. There are certainly other possibilities for switches to be in this series that I haven't mentioned here, especially on games with elaborate top boxes.

Now that we have an overview of the door switch system, we can look at how to troubleshoot it. If you're this deep in figuring out why the machine doesn't recognize that its doors are shut, make sure you've checked them all for

closure before diving in. A good percentage of these issues turn out to be top box doors that were accidentally opened when the attendant pushed the door lever the wrong way, and just need to be pushed shut. Drop teams can also be rough on the bill validator doors, causing physical problems with this switch/latch mechanism.

The physical working of the Cherry and micro switches in the circuit are easy enough to test with a meter: use the continuity test or measure ohms on the pins of the switch in question. Ensuring that these switches are activated by their respective doors is just as important (in the event that a switch works just fine, but the door doesn't properly close it). With all the doors closed except the main top door and with the machine powered down, unplug J11 (see figure 9). Insert one lead of the meter into pin 2. Plug the other lead into the pin 2 (green wire) of J346. This picture also shows the additional switch from CN3199 installed and its connection in relation to the optic.

If you don't get continuity at this point, the circuit is broken somewhere between these two points, and you can isolate where the break is by checking continuity at points in the circuit respectively closer to pin 2 of J11. It's very important to be familiar with the switches present on your machine, or this can be pretty trying on your patience. Test as much of the circuit as you can with this method. If you show a good connection between pin 1 and all the door switches up to the encoder, yet the game still shows that the door is open, the problem may lie in the optics.

The encoder is easy enough to test. Connect the red lead of the meter to the red wire and the black lead to the white wire. Put the meter on continuity (or ohms) test and shine an LED flashlight on the optic. If it's working, you should get continuity. Keep

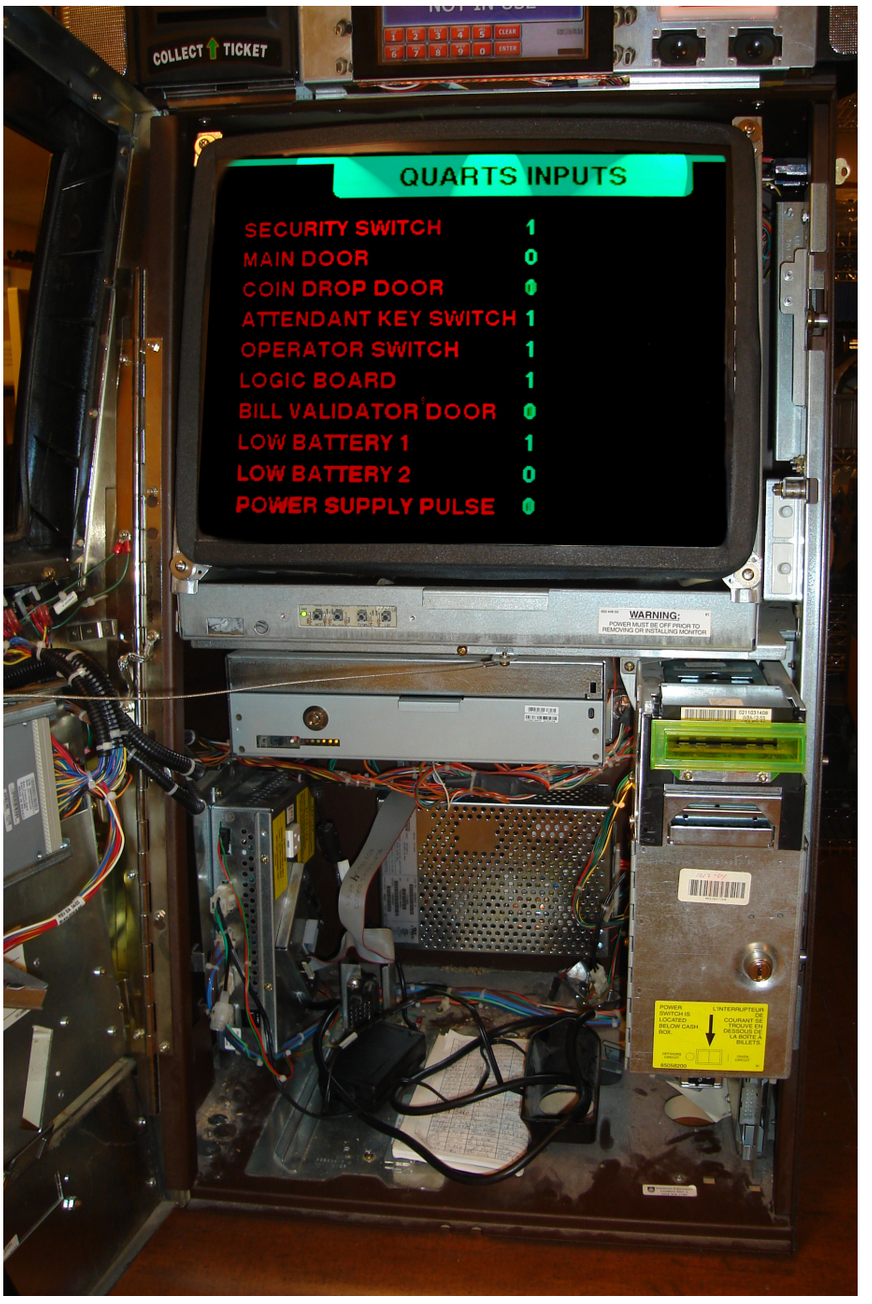


Figure 6 - If you go into the game menu and select "Diagnostics, Inputs and Outputs Tests, and Processor Board I/O Test, you'll be able to see these pulses in the form of rapidly changing switch states. You can see the Coin Drop Door and the Bill Validator Door switch states changing in this picture, as the pulses go through them.

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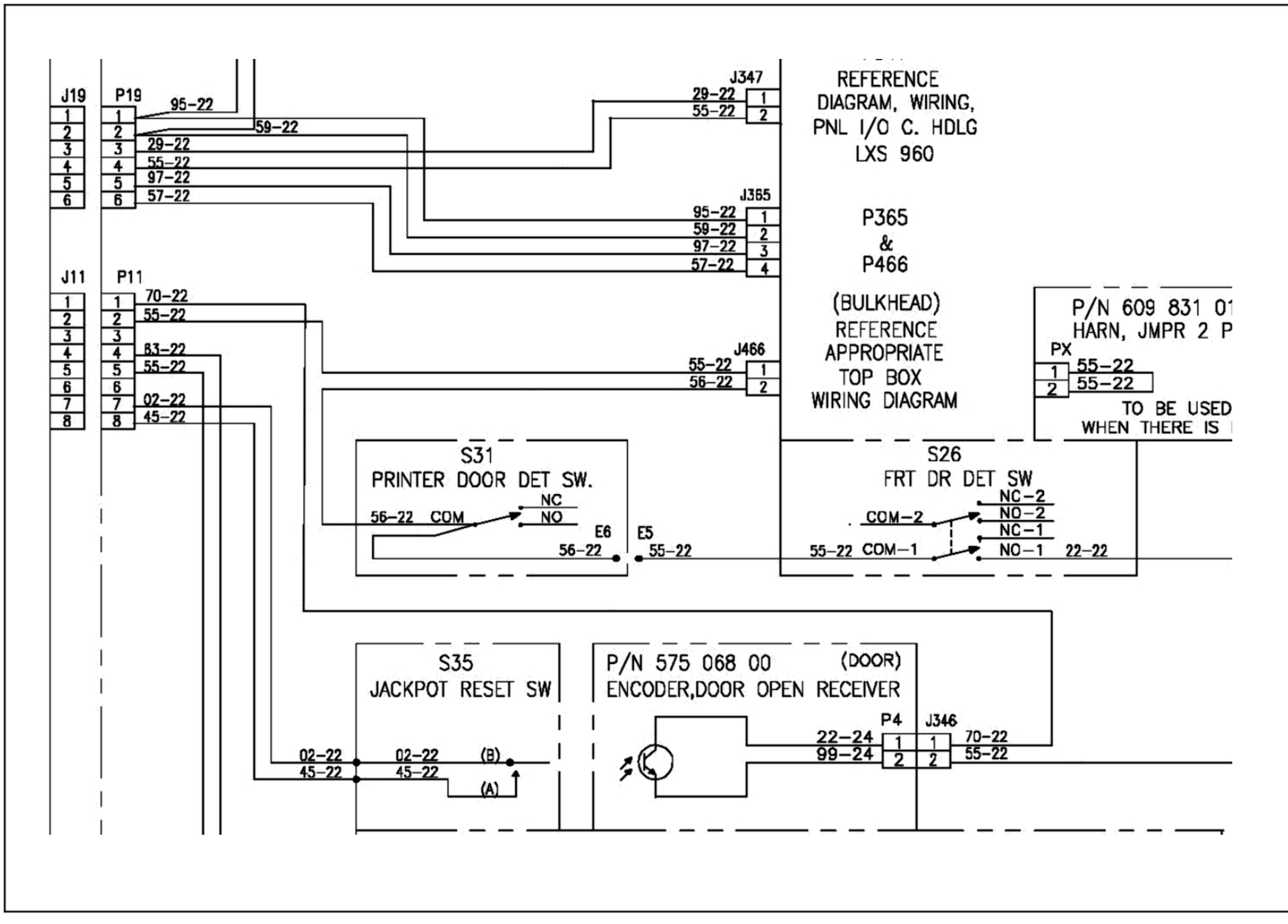
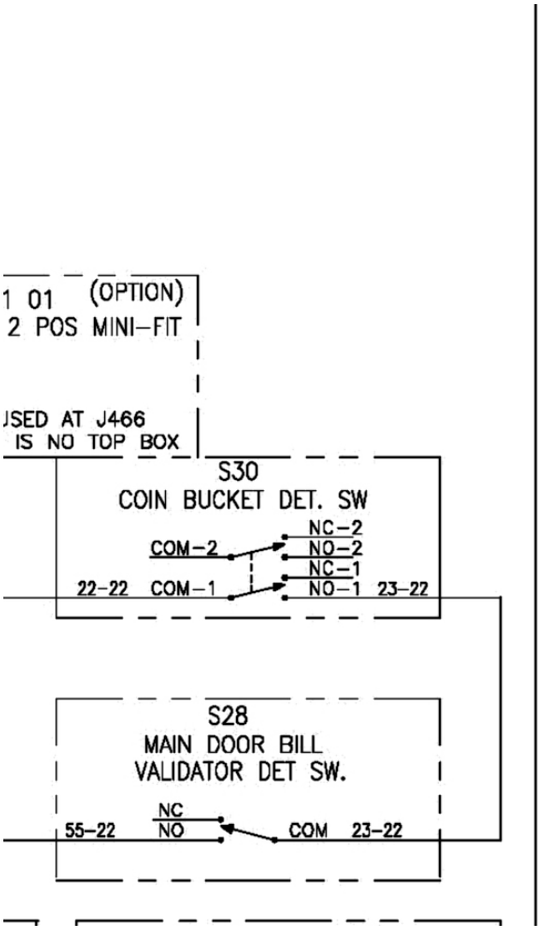


Figure 7 is from the Game King 19" Slant top manual, showing the section with the door switches. Note that J347 holds the two wires that run the LED on the main door hatch that will activate the "Encoder, Door Open Receiver"

in mind that this depends in the quality of your flashlight – when I do this test, I'll get the continuity beep every couple of seconds. We'll save testing the emitter for last because the problem usually comes from the other half of the switch system, and if we've verified that the other half works, this provides a convenient way to test the LED in game. Again, close all the switches so the only break in the door closure circuit is the encoder and go into the processor board diagnostic menu. Verify again that shining your LED flashlight will cause the main door state to change to 1. Pull the emitter out of its holder carefully and pull a little slack down so you can hold it before the encoder and watch the switch state. If it doesn't change with the machine LED before it, but your flashlight LED changes it, something is amiss with the emitter circuit. No voltage present? Bad LED? There's not much more to this half of the switch system, as this LED connects directly to the motherboard.

Be aware of which switches are present or not on your machines. Does your slant top game use an 044 board? The plugs may be numbered differently. An 'optic jumper' which is basically an LED and encoder held in position facing each other with heat shrink, and with extended wires may be helpful. This allows one to 'connect' the optic part of the circuit while leaving the door open for



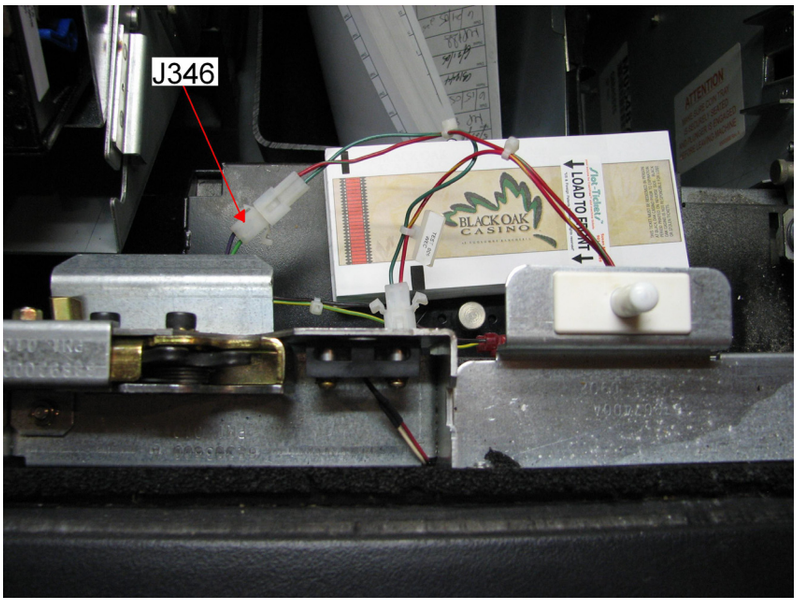


Figure 9 - With all the doors closed except the main top door and with the machine powered down, unplug J11. Insert one lead of the meter into pin 2. Plug the other lead into the pin 2 (green wire) of J346. This picture also shows the additional switch from CN3199 installed and its connection in relation to the optic.

easier troubleshooting mechanical switch issues. Keep simple things in mind – the LED must be 'visible' to the encoder when the main door is closed, or the door will show open even though all the switches are functioning, for example. Practice these techniques on a working game so you know how they should behave in a functioning machine, and troubleshooting these switches will be a breeze.

- Jason Czito
jczito@slot-techs.com

Slot Tech Magazine Offers Tech Class to Public

Slot Tech Magazine has announced the establishment of a permanent technical school for slot machine technicians. The school is located in the newly built training facility at Sycuan Casino in El Cajon, California, County of San Diego.

The SycuanSchool for Slot Machine Technicians (pronounced "Seek Juan" or "See Kwan") is a cooperative effort between the Sycuan Casino (one of San DiegoCounty's largest casinos) and Slot Tech Magazine. Slot Tech Magazine has been training casino slot techs since 2001. Until now, this training had been limited to the casinos themselves. A casino often would invite the magazine's crack team of technical instructors to visit their property and provide in-house training for their own slot techs.

"For a number of years, it has been Slot Tech Magazine's ambition to open up this training to the public at large," commented Slot Tech Magazine publisher Randy Fromm. "This in response to the numerous inquires we receive each week asking the Big Question: 'How can I become a slot tech?'"

"But this type of training is really impossible without the equipment upon which to learn and to practice," continued Fromm. "The SycuanSchool for Slot Machine Technicians was born as a perfect marriage of a first-rate, professional training program and a real, working casino environment with a new, purpose-built training facility. There is nothing else in the world like it."

The ten-week slot tech training program at Sycuan Casino includes an apprenticeship program. Students will have a three-week apprenticeship with the opportunity to begin their new careers as slot techs during each of the three shifts in the 24/7 life of a casino: day shift, swing shift and "graveyard" shift.

When students complete the ten-week course at the SycuanSchool for Slot Techs, they will be fully prepared to step into a slot tech position at any casino in the world and begin work with complete confidence and familiarity with the equipment and troubleshooting procedures.

"There is no other slot tech school in the world that is completely operated by a working, casino," said publisher Fromm, who is also the lead instructor at the school. "While there are two really great institutions for slot techs (The Atlantic Cape Community College in Atlantic City, New Jersey and the Blackpool and FyldeCollege in Blackpool, England) academic training really doesn't hold a candle to industrial experience when it comes to this type of work."

"By operating in a working casino environment, students are immersed in the 'real deal' from the very beginning, working on the latest types of slot machines," continued Fromm. "The SycuanSchool for Slot Techs has the direct support of major manufacturers of slot machines, who have provided the school with new, fully functional slot machines. They are networked together just as they are on the casino floor, providing a real-world learning environment during the classroom portion of the school."

During the ten-week class, bench work will be performed on REAL failures, retrieved from the casino floor. With

Sycuan School for Slot Technicians

over 2000 slot machines (and poised to add more) there is a steady stream of repair items coming through the slot shop. It will be impossible for students to leave this class without an intimate knowledge of this type of repair because this is what they will be doing for most of the class!

"This is not just a "foot in the door" school," said Fromm. "Unless you're completely brain dead, you will know how to fix slot machines, in many cases, down to the component level. You will know how to fix bill Validators. You will know how to fix ticket printers. You will know how to fix monitors. You will be able to say 'I am a Slot Tech.'."

For further information, visit the website at http://slot-techs.com/sycuan

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Atronic Platform Architecture - Part 1

The Playfield

By Michael Brennan

It's time to follow traces on circuit boards and track multi-colored wires around bends and through harnesses. It's time to untwist ribbon cables and examine their pin-outs. Basically, it's time to get a bit more technical.

This month's article is the first in a series that will delve deeper into our e-motion™ cabinet, examining layout, architecture and interconnectivity.

We will closely examine circuit boards and their connectors, focusing on how components and boards are wired together, illustrated by connector pin-out tables. We'll explain how a board behaves during game play, and get into some common issues and trouble-shooting tips.

A good place to begin is in the playfield, which contains monitors, buttons and speakers, and houses the frame light control board and the button board.

Frame Light Control Board

The frame lights surround the game's monitors, and are controlled by the frame light control board, which is located behind the lower TFT. This board gets cues from the main board via the multimedia board and manages the color and animation of the frame lights. Some of its connectors (P3-P7) should not need to be accessed, but all connectors are explained below.

P3 - P7: These connectors drive each LED board, which consist solely of red, green and blue LEDs.

P1: This Microfit 8 connector runs to P9 on the button board, which is where the frame light control board derives its power. Some communication is included. This connector has the same pin-outs as button board P9.

P2: This DB9 connector uses RS232 protocol and is cabled to the multimedia board at X6. The multimedia board sends the frame light animation sequence commands to this connector, which is relayed to each frame light board.

When you start up an e-motion™ game, part of the boot-up sequence involves transferring data from the CD in the CD-ROM drive to the frame light control board. Animations from the disc get transferred from the multimedia board to the frame light control board, which stores them.

During normal game play, the main board will instruct the multimedia board to play different frame light animations for certain game events. Then, the multimedia board simply sends short commands to the frame light control board, which references the command to a stored function. This results in the frame lights activating certain colors and lights, without a lot of extra data running back and forth from the two boards.

If you are experiencing problems with the frame lights, this board is a good place to look, as well as the button board, since the button board provides power to the frame light control boards.

If the frame lights are "stuck" on a certain animation, the frame light control board is

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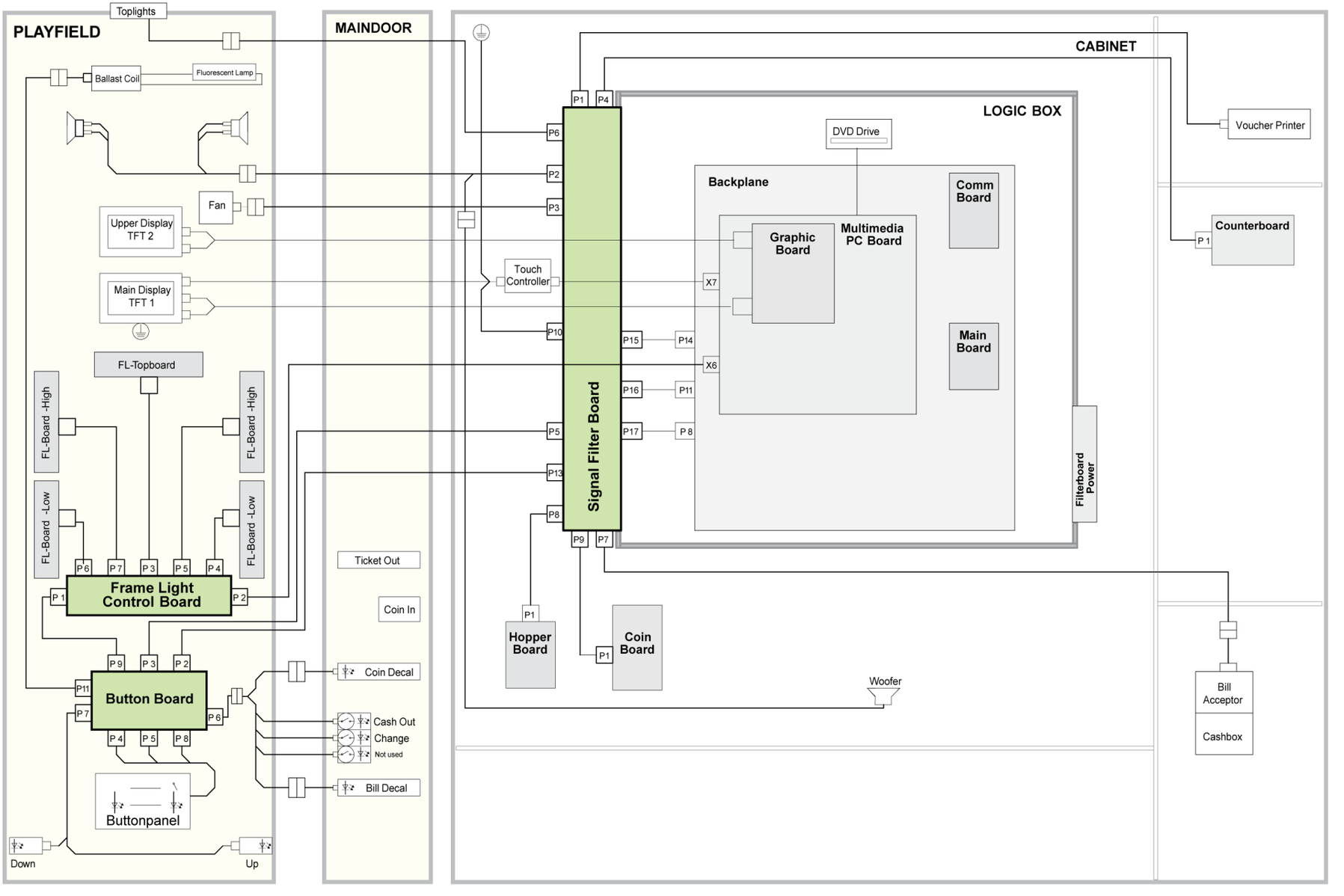
Atronic Wiring Diagram

Frame Light Control, Button & Signal Filter Boards



only following the last command sent from the multimedia board. Communication may be lost between the boards.

If you ever swap out a frame light control board, be aware of the top connectors (P3-P7). Each is keyed in an opposite direction, and may break if you are not paying attention and attempt to force a connection.

Button Board

Located in the playfield, the button board controls the LEDs under each button and also provides power to the frame light control board and the top playfield fluorescent lamp. All its connectors are accessible and explained below.

P2: Power comes from the signal filter board to Minifit 6 connector P2 on the button board. Voltages (+5, +12 and +24) at P2 are not for the button board's own use but are routed from the button board to other components, like the frame light control board and top lamp. P2 has the same pin-outs as P13 on the signal filter board.

P3: Power for the button board's own use (+5 volts) comes from the signal filter board to P3, an RC16 connector. Also, all communication to the button board comes through this SPI protocol. P3 has the same pin-outs as P5 on the signal filter board.

P4: This Microfit 16 connector runs to the button panel, controlling buttons and LEDs "A" through "H." Button designations are shown in the figure.

P5: This Microfit 14 connector runs to the button panel, controlling buttons and LEDs "I" through "O."

P6: The P6 Microfit 12 connector is cabled to a harness that is routed through the playfield to an in-line connector that splits to: the "cash out" switch and LED (pins 5 and 6), the "change" switch and LED (pins 3 and 4), the bill decal LED (pin 12), and the coin decal LED (pin 11).

P7: This Microfit 6 connector is cabled to the playfield height adjustment switches and corresponding LEDs (both up and down).

P8: This Microfit 10 connector runs to the playfield and is mostly unused.

P9: Supplying power to the frame light control board, P9 is a Microfit 8 connector.

P11: A Microfit 4 connector, P11 supplies power (+5, +12 and +24 volts) to the upper playfield fluorescent lamp.

When an e-motion™ game is powered up, the board goes through a self-test. All LEDs flicker on and off briefly. Then the board returns to a waiting state. When certain credits are available, the main board and button board are in communication (via the signal filter board and backplane) referencing credits and illuminating available buttons.

Button Board Connector Pins

P2	
1	3V3
2	12V
3	GND
4	5V
5	24V
6	GND

P3	
1	5V
2	5V
3	nBP_RES
4	BP_DET1
5	NC1
6	MISO_BUTT
7	MOSI_BUTT
8	SCK_BUTT
9	PS0_BUTT
10	PS1_BUTT
11	PS2_BUTT
12	PS3_BUTT
13	NC2
14	NC3
15	GND
16	GND

P4	
1	BUTT_A
2	LAMP_A
3	BUTT_B
4	LAMP_B
5	BUTT_C
6	LAMP_C
7	BUTT_D
8	LAMP_D
9	BUTT_E
10	LAMP_E
11	BUTT_F
12	LAMP_F
13	BUTT_G
14	LAMP_G
15	BUTT_H
16	LAMP_H

P5	
1	BUTT_I
2	LAMP_I
3	BUTT_J
4	LAMP_J
5	BUTT_K
6	LAMP_K
7	BUTT_L
8	LAMP_L
9	BUTT_M
10	LAMP_M
11	BUTT_N
12	LAMP_N
13	BUTT_O
14	LAMP_O

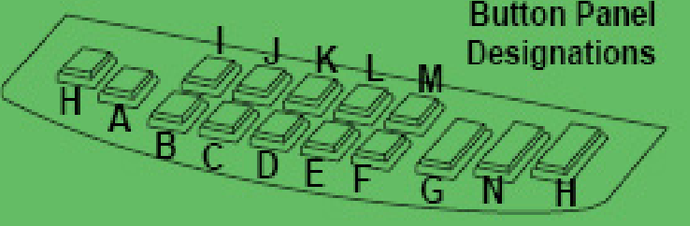
P6	
1	GND
2	12V
3	BUTT_Q
4	LAMP_Q
5	BUTT_R
6	LAMP_R
7	BUTT_S
8	LAMP_S
9	BUTT_T
10	LAMP_T
11	B_OUT1
12	B_OUT2

P8	
1	GND
2	12V
3	NC
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC
10	NC

P9	
1	12V
2	5V
3	NC
4	GND
5	nBP_RES
6	MOTION
7	B_INP1
8	B_INP2

P11	
1	12V
2	5V
3	GND
4	24V

P7	
1	GND
2	12V
3	BUTT_W
4	LAMP_W
5	BUTT_X
6	LAMP_X



Button Panel Designations

Other Buttons

Q: Change Button
R: Cash Out Button
O, S, T: Not Used
W & X: Playfield Adjustment Buttons (up & down)

You can test each button LED by pressing the service button on the logic box. Select "Other Tests" from the Diagnostics tab, then touch "Button" to light up each LED.

If all the buttons are dim (except for the "See Pays" button) the problem may be caused by a faulty transistor on the button panel. This issue is usually caused by hot-swapping a button board and inadvertently shocking/ shorting it. This can be resolved by replacing the transistor at T1.

Signal Filter Board

The signal filter board prevents any damaging EMI from entering and harming components in the logic box. It transfers power and communication to boards and items outside the logic box. It also contains game fuses. It is a passive component network and distribution block for main connectors.

P1: This Minifit 10 connector runs to the ticket printer, connecting to the printer manufacturer's adapter. RS232 communication, +12 and +24 volts, are transmitted from P1.

P2: Audio runs through P2, which is a Microfit 8 connector. In-line connectors run to the top playfield speakers and the woofer, which is located under the power switch. These speakers are line-powered.

Signal Filter Board Connector Pins

P1	
1	24V
2	GND
3	RXD_TICK
4	TXD_TICK
5	nRES_OC
6	12V
7	GND
8	CTS_TICK
9	RTS_TICK
10	GND

P2	
1	SPL1
2	SPL2
3	NC1
4	SPM1
5	SPM2
6	NC2
7	SPR1
8	SPR2

P3	
1	GND
2	GND
3	IN1_BACK
4	IN2_BACK
5	IN3_BACK
6	IN4_BACK
7	OUT1_BACK
8	OUT2_BACK
9	OUT3_BACK
10	OUT4_BACK
11	5V
12	12V

P4	
1	5V
2	5V
3	nCR_RES
4	MISO_CNTR
5	MOSI_CNTR
6	SCK_CNTR
7	nENA_CNTR
8	24V
9	12V
10	12V
11	GND
12	GND
13	GND
14	GND

P6	
1	CL_TOP
2	12V
3	CL_MID
4	CL_BOT

P8	
1	5V
2	5V
3	GND
4	GND
5	NC
6	nH0_RES
7	MISO_HOPP
8	MOSI_HOPP
9	SCK_HOPP
10	nENA_HOPP
11	RXD_HOPP
12	CTS_HOPP
13	TXD_HOPP
14	RTS_HOPP
15	24V
16	24V
17	24V
18	12V
19	12V
20	12V
21	n12V
22	GND
23	GND
24	GND
25	GND
26	GND

P7	
1	12V
2	GND
3	nRES_OC
4	RXOC_BILL
5	CTOC_BILL
6	TXOC_BILL
7	RTOC_BILL
8	12V
9	24V
10	GND
11	STCK_SW1
12	RXD_BILL
13	CTS_BILL
14	TXD_BILL
15	RTS_BILL
16	GND

P9	
1	5V
2	5V
3	nCN_RES
4	D0_COIN
5	D1_COIN
6	D2_COIN
7	D3_COIN
8	D4_COIN
9	D5_COIN
10	RDWR_CNE
11	RDWR_CN0
12	RDWR_CN1
13	RDWR_CN2
14	24V
15	12V
16	12V
17	GND
18	GND
19	GND
20	GND

P5	
1	5V
2	5V
3	nBP_RES
4	BP_DET1
5	NC1
6	MISO_BUTT
7	MOSI_BUTT
8	SCK_BUTT
9	PCS0_BUTT
10	PCS1_BUTT
11	PCS2_BUTT
12	PCS3_BUTT
13	NC2
14	NC3
15	GND
16	GND

P13	
1	3V3
2	12V
3	GND
4	5V
5	24V
6	GND

P10	
1	12V
2	GND

P15-P17: Not Shown

P3: This Microfit 12 connector is routed to the playfield fan, near the button board. It carries +5 and +12 volts, along with other communication and control.

P4: A ribbon cable (RC14) runs from P4 to the hard meters at the meter board, carrying communication data and power (+5, +12 and +24 volts).

P5: The button board receives its power and communication from a ribbon cable that runs from P5 (RC16 and SPI protocol). P5 supplies the +5 volt power that is for the button panel's own use. It does not supply power that the button board provides for other components. This connector has the same pin-outs as P3 on the button board.

P6: This Microfit 4 connector is routed to the game's candle or toplight. It provides +12 volts of power and the signals to turn on the three different lamps.

P7: This Minifit 16 connector transmits power (+12 and +24 volts) and communication to the bill validator.

P8: This RC26 connector snaps into a ribbon cable that transmits communication to and from the hopper board, along with +5, +12 and +24 volts of power. Note that the hopper board powers the motor that moves the playfield up and down. This power is contained in this ribbon cable. Even coinless games contain a hopper board because of its additional functions.

P9: If the e-motion™ game uses coins, P9 (RC20) supplies power and SPI communication to the coin board.

P10: P10 is a Minifit 2 connector that runs to the touch screen controller and Earth ground. Twelve volts of power are included. P11 has the same pin-outs and capabilities.

P13: While P5 provided power to the button board expressly for its own use, P13, a Minifit 6 connector, supplies additional power (+5, +12, and +24 volts) to the button board, which distributes it to components like the frame light control board. This connector has the same pin-outs as P2 on the button board.

P15: An RC26 connector, P15 transfers communication for the bill acceptor, candle top light, speakers, ticket printer, and additional in/out main board signals from front-side connectors to the backplane.

P16: An RC40 connector, P16 transfers communication for the coin board, hopper board, button board, counter board, and additional in/out main board signals from front-side connectors to the backplane.

P17: This Minifit 12 connector transfers power from the backplane to signal filter board front-side connectors. Many grounds, plus +5, +12, and +24 volts are included.

The signal filter board also contains all the game's fuses, located on the front part of the board. Each fuse is accompanied by an LED that is illuminated if power is present and the fuse is working properly. F1 is a wire bridge for +5 volts. Its LED is D1. F2 is the +12-volt fuse, rated at 6.3 amps. Its accompanying LED is D2. The third fuse, F3, is for +24 volts, rated at 4 amps and with an LED labeled D3.

If multiple game components are not working or behaving erratically, check to see if they all use the same voltage. If this is the case, the problem could be as simple as a blown fuse. Instead of swapping out each non-functioning component, check the signal filter board first. If a fuse LED is out, the fix might be a new fuse or possibly a new signal filter board. This is an important first step in trouble-shooting an e-motion™ game, preferable to the knee-jerk practice of "swaptronics."

That covers three e-motion™ circuit boards and their connectors, which mainly existed outside of the machine's logic box. Further articles in this series will get inside the logic box, exploring the interconnectivity and architecture of the machine's core functionality.

- Michael Brennan
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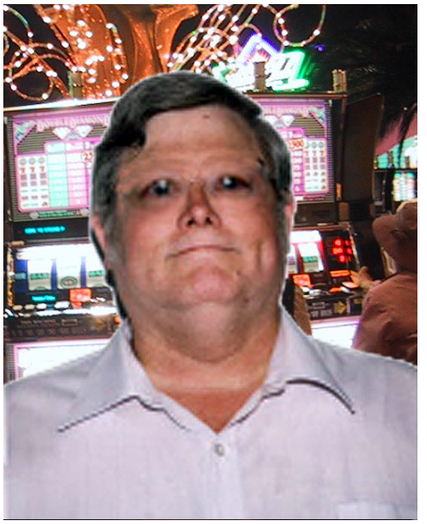


Williams Kristel 18-009 LCD Monitor Video Controller Board 100-100-G001

By Herschel Peeler

This is also known as a 5120 Video Controller card because that is the main chip on the board. These boards don't fail often but keeping spares on hand is difficult. Kristel does not sell the board but they will take them in for repairs. If you want to take on repairing them yourself, there are a few things you can do.

The approach suggested is the same as you would take for any other microprocessor-based board. Pull the Reset line active and scope out peripheral circuits. If nothing is found, let go of the Reset line and see what happens during Power-On-Self-Test. After the board comes into operation we can observe the screen for hints of where problems may be. Let's take a tour through the circuits. You can find the schematic at http://tinyurl.com/gdjju

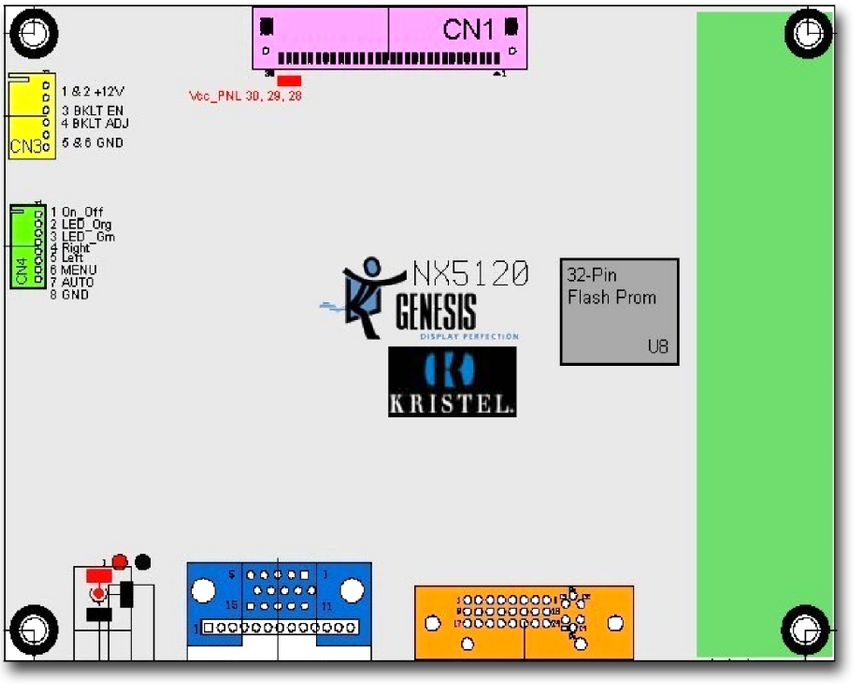
Pull the Reset Line Active

Solder a small wire across capacitor EC24 on sheet 4 of the schematic. U9 and U10 are the Reset circuits for the gm5120. I would expect only one of these to be installed, or maybe neither and Reset is controlled by EC24, R28 and D3.

Power

The first question is always, "Does power come up?" The board runs on +12 Volts that comes into the board on CN6 on page 7 of the schematics and passes through fuse F1, 5 Amp fast blow. U11 and U12 make up a Buck Switching Regulator that brings this down to +5 Volts. U4 converts this +5 Volts down to +3.3 Volts. U14 converts the +5 Volts down to +2.5 Volts. Switch U1 brings the power out to the Panel Voltage and will be either 5 Volts or 3.3 Volts depending on a jumper, JP1. Being mostly surface mount, finding good test points is difficult but if it helps any:

Panel voltage can be checked across capacitor EC1 (+5 or +3.3). We should have +12 Volts across capacitors EC25 and EC2. We should have +5 Volts across capacitor EC23,



C51 (pins 16 and 32 of U8). We should have +3.3 Volts across capacitors EC16, EC21, EC22, C43 (L18 to ground), C40 (L17 to ground), C36 (L16 to ground), EC26, EC27 (L19 to ground), EC29, C57 (L20 to ground), C16 (L3 to ground), EC9 (L5 to ground), EC10 (L7 to ground), C10 (L2 to ground), EC7 (L4 to ground), EC8 (L6 to ground). We should have +2.5 Volts across capacitors EC30, EC14, C65 (L21 to ground). We should have slightly less than the +12 Volt line across EC11 (D1) and about 5.1 Volts across D6. These are power to the sound system.

Reset

If power comes up okay, the next question is "are the peripheral circuits working?" If we have symptoms to work from, we can concentrate on circuits that relate to those symptoms. Not having any at this time, we will go through the circuits and mention what each is for.

With Reset held active we should expect no activity coming out of the gm5120. We can look at the peripheral circuits in their static state.

Sheet 2

We have here the video interfaces coming in from the game. We may use either the VGA connector CN7 or the alternate CNA7. U15 is an EEPROM. I suspect in here is a pattern that is used to tell the game what kind of display is connected. Coming out of CN7 we have our color signals (Analog) Red, Blue and Green. The Vertical and Horizontal Sync come out of CN7 and feed U13. We can 'scope pins 10 and 12 of U13 while we inject a ground or +3.3 Volt level to the cathodes of ZD3 and ZD4 to test the sync circuits.

At this point we can't test U15. We will come back to this later.

If we are connected up to a VGA signal source, we should be able to see Video and Sync signals going.

Sheet 3

We have here the alternate DVI (Digital Video) input that may also come from the game. We will use either the VGA or DVI inputs in operation. U16 is the EEPROM for the DVI input to identify the type of monitor to the system.

If we are connected up to a DVI signal source, we should be able to see Video and Sync signals going.

Sheet 4

U5 is the EEPROM for the gm5120. U8 is the Flash EPROM with our program the gm5120 runs. X1 is our crystal for the operating frequency of the gm5120.

U7, the gm5120, we will come back to after we finish our discussion of static circuits.

Sheet 5

Sound circuits. U6 is our stereo audio amplifier. We could plug a phone jack into CN9 from our PC sound out and put a couple of speakers on CN2 and CN10 and test this circuit. A voltage (+3 to +5 Volts) on the Mute input should kill the sound. Volume is controlled by a voltage on the PWM1.

Sheet 6

These are the video signals going out to the LCD display itself. These are differential signals. Each signal has a (+) and (-) side to it. To scope these lines, we must put a two-channel scope in differential mode. We will come back to this after we let the reset line go.

Sheet 7

Here are our voltage regulators. Most of these we checked when we did initial voltage measurements. Not previously mentioned, we have power going to the Inverter that powers the CCFLs that back light the LCD screen on connector CN3. If we have +12 Volts okay we can bring up the CCFLs by putting pins 3 and 4 of CN3 between +12 V and ground. This turns the CCFLs on and off.

Connector CN4 goes to our control pad with five buttons and two LEDs. We can connect these and test them at this time. We should be able to turn the LED Green and

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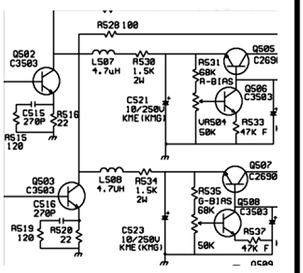
The individual components used in games are introduced. Parts such as resistors, capacitors, diodes, potentiometers and transistors are covered individually. Students learn how the components work and how to test them using the meter.

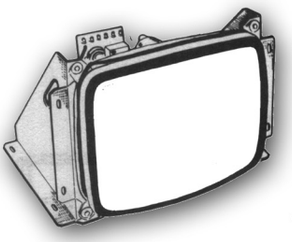
SCHEMATIC DIAGRAMS

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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Yellow by putting a jumper across pins 2 and 3 of Q3 and Q4. CN4, pin 1, should go high and low as the Power On button is pressed. The lower end of R12 should follow. Our four panel buttons (Right, Left, Menu, Auto) we should be able to see at Resistor Pack RP2, pins 1, 2, 3 and 4, and also on pins 8, 7, 6 and 5.

VCC Panel goes to Sheet 6, CN1, and is power to the LCD interface chips.

Letting Go of Reset

If we are happy that all the peripheral circuits look okay in a static condition, the next step is to let go of Reset and see what happens in the first few seconds following reset.

Sheet 2

If we are connected up to a VGA signal source, we should be able to see Video and Sync signals going. We will probably not see signals on the EEPROM unless we are connected up to a Williams Bluebird game. If we were, we would expect to see a few seconds of "DDC SDA A" (Data) and "DDC SCL A" (Clock) signals going on as the game interrogates the display to find out if it is the right type.

Sheet 3

If we are connected up to a DVI signal source we should be able to see Video and Synch signals going. We will probably not see signals on the EEPROM unless we are connected up to a Williams Bluebird game. If we were we would expect to see a few seconds of "DDC SDA A" (Data) and "DDC SCL A" (Clock) signals going on as the game interrogates the display to find out if it is the right type.

Sheet 4

X1 should start oscillating at 14.318 MHz and we should see this across R27. Going around the gm5120, ignoring power lines because we already checked for power problems, we would find the following in use.

Pin 113 is PPWR (Panel Power Control) Pin 114 is PBIAS (I wouldn't venture a guess at how to interpret that). What it goes to is the On / Off control for the Backlight CCFL lamps. Pin 207 is Mute output to the sound system. Pin 205 and 204 are ISP port Clock and Data to U15 on Sheet 2. Pins 6 and 7 are Clock and Data to U16 on sheet 3. Pins 171 through 136 are our Analog VGA video signals. Pins 194 through 192 are our Digital DVI video signals. Pins 8 through 36 are Address and Data lines to the Flash chip. We should see activity on most of these lines. Pin 118, "TCON OCLK" AKA "DISP CLK 5" we can name "Display Clock" goes to U2 and U3 on sheet 6. Pin 115, "DEN" is the Display Enable to U2 and U3. Pin 117 and 116 are Vertical and Horizontal Sync signals to U2 and U3. Pins 110 through 55 are our Video signals going to the LCD's decoders on the TFT screen itself. Pins 49 and 48 are the output controls to the Green and Yellow LEDs on the control panel. Pins 44 and 45 are Serial info going to the Debug Port at connector CN5. We can't do much with this and it shouldn't influence normal operation. Pins 51 and 52 are Data and Clock to U5, the EEPROM for the gm5120. Pin 39 is GPIO 8 (General Purpose I/O port, bit 8. the "Auto" button on the Operator's Panel. Pin 43 is GPIO 3 (General Purpose I/O port, bit 3. the "Menu" button on the Operator's Panel. Pin 46 is GPIO 6 (General Purpose I/O port, bit 6. the "Right" button on the Operator's Panel. Pin 47 is GPIO 7 (General Purpose I/O port, bit 7. the "Left" button on the Operator's Panel. Pin 42 is GPIO 2 (General Purpose I/O port, bit 2. the "Power" button on the Operator's Panel. Pin 41 is GPIO 1 (General Purpose I/O port, bit 1, or "PWM1" is the Volume Control for U6. Pin 40 is GPIO 0 (General Purpose I/O port, bit 0, or "PWM0" is the Backlight Brightness Control for the CCFL.

We haven't seen enough of these to compile a list of common failures yet. Given specific symptoms you should be able to go to the parts of the circuit that relates to that function and troubleshoot with a reasonable degree of certainty.

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- hpeeler@slot-techs.com

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

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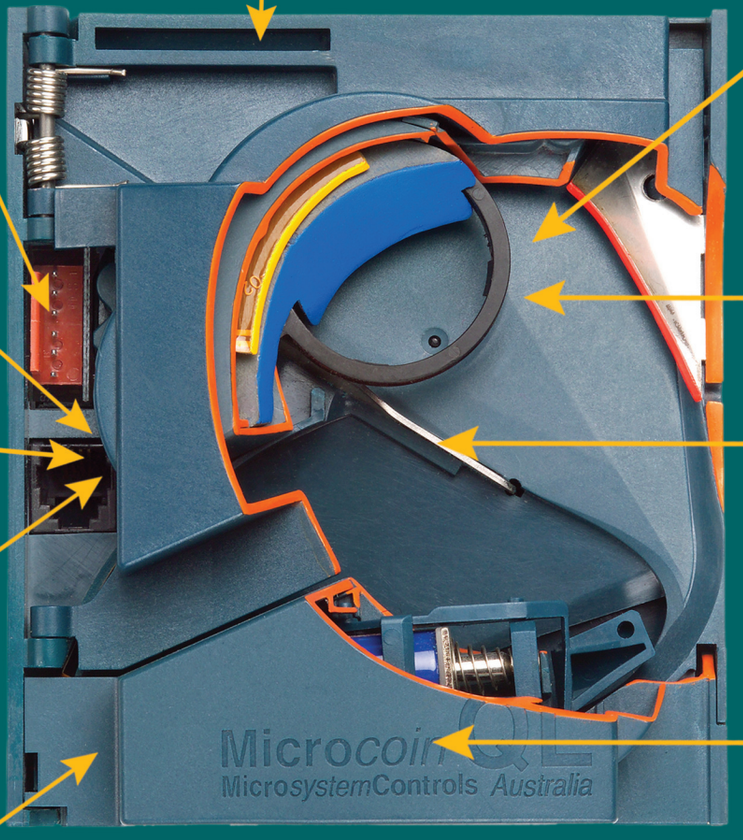

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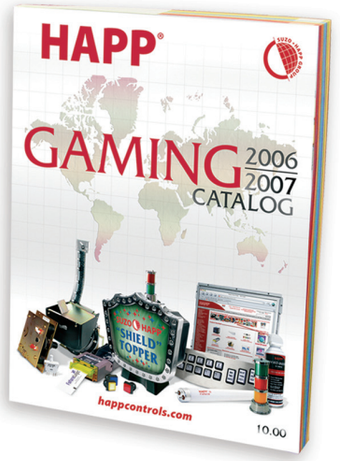

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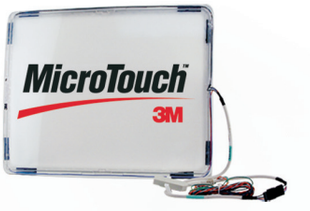

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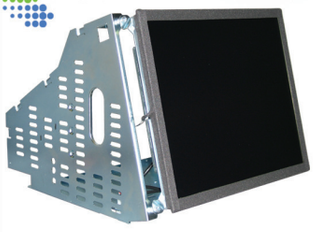

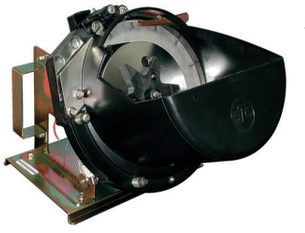

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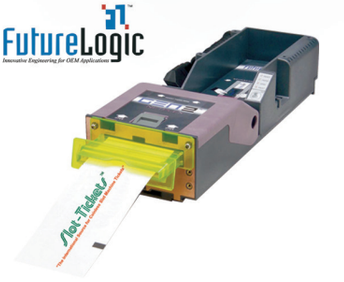

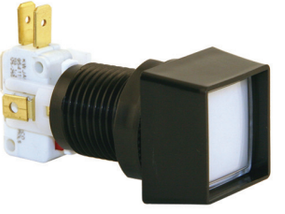

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