

May, 2001

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Inside This Month's Slot Tech Magazine

As usual, this month's Slot Tech Magazine has a little something for slot techs of various skill levels and abilities. It also has four additional pages, so if it seems a little thicker than usual, you're not imagining it.

In our continuing discussion of semiconductors, this month's Slot Tech Magazine features a family of semiconductors known as "thyristors." These are parts like TRIACs and SCRs. IGT used TRIAC control for the lamps in their popular S-Plus machines.

You'll learn what they are and how they work. They're pretty interesting devices. Turn to page 4.

Coin hoppers are an important component of slot machines. Being mechanical devices, they're prone to wear and to failure. Beginning on page 8, Frank Sutter discusses hopper repair in this first of a multipart series on the subject.

The second part in a continuing series on monitor repair begins on page 14. This month, we take a look at how a monitor can be broken down into seven different sections, making it much easier to pinpoint monitor failures by narrowing the problem down to a single section and safely ignoring the rest of the monitor circuitry.

Replacement parts can be a real bugaboo if you don't know where to get 'em. Beginning on page 16, Dennis Gambuzza discusses some useful replacement parts for slot machines and where to get them.

Do you know how to do a hopper fill check. Heck, do you even know what a hopper fill check is? Veteran floor slot tech Pete Bachran discusses hopper fill checks, what they are, when to do 'em and how to do them properly. Pete also presents us with a hopper fill check card that you can copy and use in your casino.

This month's Slot Tech Magazine presents the debut of a new monthly troubleshooting column, Jammin' with Chris Hunt. Chris presents us with some excellent troubleshooting tips. In this issue, Chris discusses a CC33 dollar comparator that is accepting nickels & quarters, Bally Gamemaker machines (all models) where bills will not enter the bill validator unit, a Bally Gamemaker that will not come back on after being shut off, an IGT Touchscreen that will not calibrate or when the calibration does not last and finally, an IGT PE+ video poker showing a



Randy Fromm

coin-In timeout on screen. This is all good stuff, especially the coin-timeout problem. This one can save you hundreds of dollars in repair.

Slot Tech writer Bart Holden always has something interesting to share with us. Read all about Bart's toasty problems with an IGT S-Plus Upright slot machine beginning on Page 24 with his latest contribution: Power Harness or Roasted Marshmallow? You be the judge.

It may not be as fun and interesting as electronic troubleshooting and repair but slot machine bases need fixing too. It's a shame to see a beautiful machine sitting on a cracked or broken base. Brown Manufacturing has a novel approach to slot base repair that doesn't even require taking the machine off the base to fix it. Read all about it on Page 26 - Getting Down to Base-ic Repairs.

Mixed in the pages you'll also find coverage of the grand openings at the Pala Casino and the Valley View Casino as well as some snapshots from the NIGA show held in April in Albuquerque, New Mexico.

Until next month, see you at the casino.

Randy Fromm

Randy Fromm

Randy Fromm's Slot Tech Magazine

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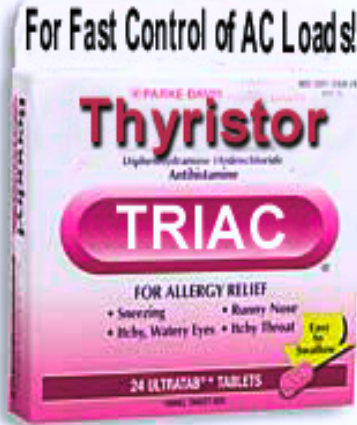
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Take a TRIAC and Call Me in the Morning

Getting to know the thyristor family
of solid-state switches.



It sounds like something straight out of a Madison Avenue advertising campaign for an over-the-counter pain reliever.

"Use TRIAC; the high-speed thyristor you've been waiting for." or "4 out of 5 electronic engineers recommend silicon controlled rectifiers for relief from potentially embarrassing switching problems." or "More designers depend on TRIAC than any other method of AC control."

So, what the heck is a "thyristor"? What does a "TRIAC" do? Who names these things, anyway?

A thyristor is simply a solid-state power switch. A thyristor can be used to control the power to many different types of "loads." In the amusement industry, thyristors are used to control lamps, motors, and solenoids. For example, a basketball game might use a thyristor to control a motor that raises and lowers the ball trap at the beginning and end of the game. A thyristor might be used to ring a bell or flash a strobe light when tickets are earned by a player. In the world of industrial control, thyristors are used to control heating elements, automatic fans, conveyor belts and hundreds of other electrical devices. The lamp dimmer on the wall of your home uses two different types of thyristors to control the

amount of power going to (and consequently the brightness of) the bulb. The common thread here is that a thyristor is used to control a load. It is an output device; a controller of power.

The term "thyristor" is used to denote a very small family of solid-state switches. There are three types of thyristors, only two of which typically are used in the gaming industry: silicon controlled rectifiers and TRIACs. A third type of thyristor, called a "DIAC," is used

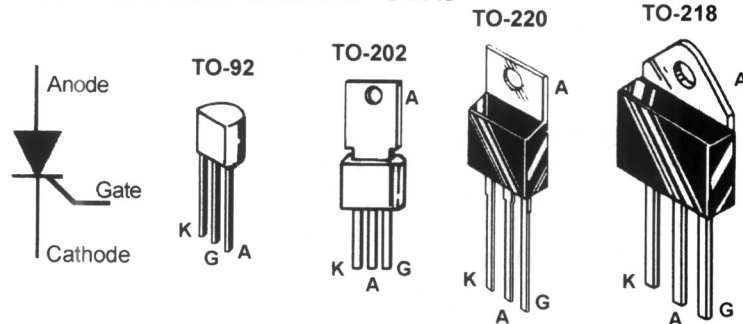
in conjunction with a TRIAC and is found primarily in the aforementioned household light dimmers.

Silicon Controlled Rectifier - SCR

Talk about a dumb name for a part, what's the deal with the silicon controlled rectifier? Silicon is obviously the name of the element from which the device is constructed. But 99.9999% of all semiconductors are made of silicon so there's nothing special there. In last month's Slot Tech Magazine we looked at the

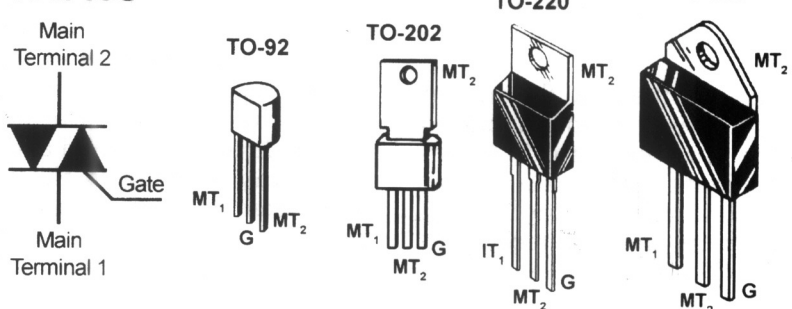
FIGURE 2

Silicon Controlled Rectifiers - SCRs

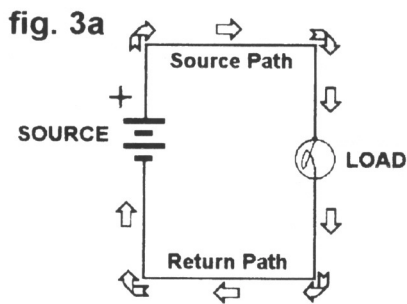


SCRs come in a variety of different "packages." The amount of load current (amperes) determines the size of the package. Higher load current means a larger package must be used. These are, in many cases, the exact same packages with which we are already familiar: the TO-92, TO-220 and others. Note that the letter "K" is used to denote the "cathode" so that it is not confused with "G" for "gate." Also note that in most instances, the "anode" is also connected to the metal tab at the top of the device.

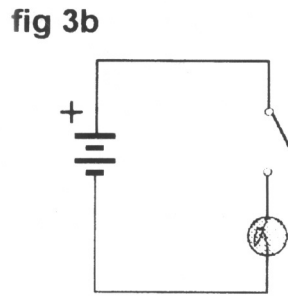
TRIACs



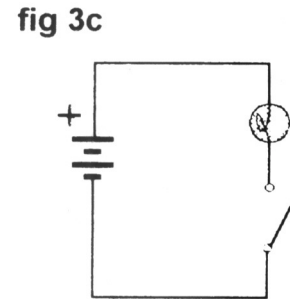
TRIACs are all but identical to SCRs. The only difference is that TRIACs work twice as efficiently with alternating current (AC.) Instead of "anode" and "cathode" the main terminals are called "main terminal 1" and "main terminal 2." The triggering input is still called the "gate." As with the SCRs, the metal tab is connected to the center lead (MT₂) of the device.



This is a simple, complete circuit consisting of a battery, a lamp and two wires. The battery is our “source” of electric current and the lamp is using power from the source. In a circuit like this one, any device that consumes power is called a “load.”



If we use a switch to break the source path (fig. 3b) the lamp will turn off. That’s pretty obvious. But switching out the return path (fig. 3c) will accomplish the same thing. This is a common way to control a load.



simplest semiconductor, a one-way gate for electric current called the diode. Another term for diode is “rectifier.”

So a silicon controlled rectifier is a diode that can be controlled. In practice, nobody calls this thing a “silicon controlled rectifier;” it’s simply referred to as an “SCR.” An SCR is a diode that can be turned on and off. The schematic symbol for an SCR looks like a diode. The two main terminals are the anode and cathode just as before. However, because we want to control the device, a third lead has been added. This is the input that controls the SCR. It’s called the “gate.” Turning on an SCR is known as “gating” it.

Like a transistor, an SCR has three leads. And just like transistors, SCRs come in a variety of different “packages.” The amount of load current (amperes) determines the size of the package. Higher load current means a larger package must be used. These are, in many cases, the exact same packages with which we are already familiar: the TO-92, TO-220 and others.

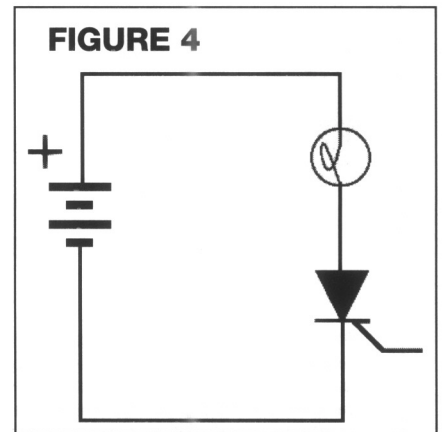
It’s easy to understand how an SCR works. Take a look at the circuit in figure 3a. This is a simple, complete circuit consisting of a battery, a lamp and two wires. The battery is our “source” of electric current and the lamp is using power from the source. In a circuit like this one, any device that consumes power is

called a “load.”

A wire connects the positive lead of the battery to one end of the lamp. This wire is the “source path” that carries the electric current from the source to the load. The remaining wire connects other end of the lamp to the negative terminal of the battery. This wire is the “return path” that carries the electric current back to the source from the load.

According to the schematic diagram, electric current flows from + to -. Following the schematic diagram, the electric current flows out of the + terminal of the battery along the source path, passes through the filament of the lamp (making it glow white hot) and returns via the return path to the - terminal of the battery.

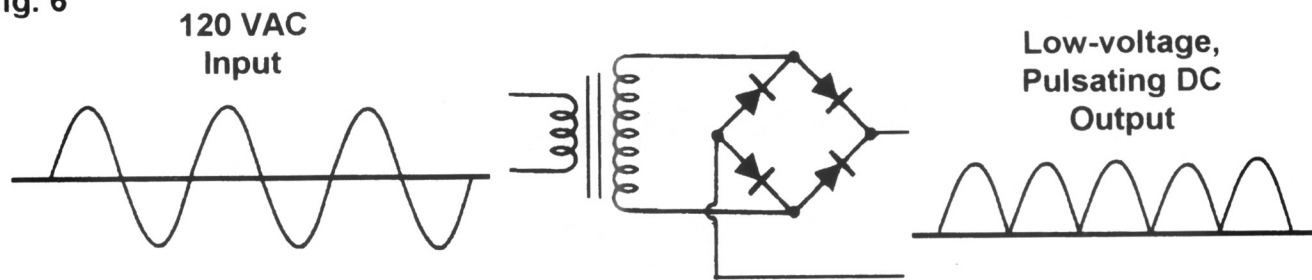
In this circuit, the lamp is on all the time. It might be convenient to be able to turn the lamp off when we don’t need the light. If we want to turn the lamp off, all we have to do is install a switch to break the circuit. It doesn’t matter where the switch is installed. If we use a switch to break the source path (fig. 3b) the lamp will turn off. That’s pretty obvious. But switching out the return path (fig. 3c) will accomplish the same thing, won’t it? Think about it for a second. Breaking the return path is the same as having just one wire hooked up to the bulb isn’t it? Naturally you wouldn’t expect the bulb to light up



with just one wire attached, would you? This scheme (controlling a load by switching the return path) is the most common method of turning things on and off. It’s often referred to as a “ground switch” since the return path and ground are generally one and the same.

Let’s replace our mechanical switch with an SCR (fig. 4.) Notice that the SCR is in the return path of the circuit. Like the diode we saw in last month’s Slot Tech Magazine, the arrow of the SCR schematic symbol points in the only direction it will allow the current to flow. But unlike the diode, the SCR doesn’t always conduct, even if it’s pointed in the correct direction. Remember, this is a *controlled* rectifier. It must be turned on by applying a small amount of electric current to the gate. It doesn’t take much gate current to turn on the SCR. The amount varies from device to device but it can be as low as 200

fig. 6



microamps (200 millionths of an amp) in some cases. This gate current can come from any number of different sources such as a computer or other electronic circuit. By using an SCR, we can use a tiny amount of gate current to control a load current that is thousands of times greater. In other words, we can use a little current to control a big current. Cool, huh?

Weird Thing Alert: Although the gate is used to turn on the SCR, the gate input cannot be used to turn the SCR off. Say what? If putting current on the gate turns the SCR on, doesn't it make sense that removing the gate current will turn the SCR off? Well grasshopper, what makes sense ain't necessarily so. Once the SCR has been gated, it will remain turned on, even after the gate current has been removed. That's right! Just a single, short pulse of gate current will start the SCR conducting and once it begins conducting it will remain that way no matter what happens to the gate.

To turn off the SCR, the current flowing through it from anode to cathode must be cut off. A momentary break in the main current flow is all it takes to turn the SCR off. When the circuit is reconnected, the SCR remains off until it is gated once again.

The "latching" characteristic of an SCR can be an advantage in some applications but make the component totally useless for others. For example, a simple over-voltage protection circuit for a power supply can be made from an SCR and a zener diode. This circuit, called a "crowbar," uses the zener diode to detect an over-voltage condition. If the power supply output exceeds

5.6 volts, the zener diode begins to conduct (this is the only component that allows electric current to pass opposite the direction the arrow is pointing.) The instant the zener begins to conduct, it gates the SCR which is connected directly across the output of the power supply and ground. This shorts the output of the power supply directly to ground and prevents any damage to the logic board from an over-voltage condition.

The latching characteristic is an advantage here because as soon as the SCR is turned on and the output voltage of the power supply drops below 5.6 volts (on its way down to 0 volts or ground) the zener diode will no longer be conducting and there will be no gate current. Of course it doesn't make any difference now because once gated, the SCR will remain on until the power supply itself is turned off.

On the other hand, SCRs cannot be used to control the directional flasher (turn signal) lamps in a car. It would be easy enough to turn the lights on with an SCR but once they were on, they would stay on. Turning them back off would be another matter entirely.

And yet, SCRs were used as lamp drivers for the "switched illumination" in the early Bally electronic pinball machines of the seventies. These are the lamps that are controlled by the computer and used to indicate the status of the playfield (1000 points when lit, free ball when lit, etc.)

So how could these lamps be turned on and (more importantly) turned off with SCRs? The secret lay in the type of power used in the lamp circuit. It was not the pure

direct current of a battery but a "pulsating DC" power supply that was derived from a transformer and a bridge rectifier. The transformer was used to lower the 120 volt AC line to the low voltage required by the lamps. This low, AC voltage was then changed to pulsating DC by the four diodes in the bridge rectifier. Notice that the output voltage of the bridge rectifier drops to 0 volts every 1/120th of a second. This is called the "zero crossing." Zero volts means zero amperes of current so the SCR automatically shuts itself off at the next zero crossing after the gate current is removed.

The SCR is somewhat limited in another way as well. The schematic symbol of the SCR indicates that it conducts only in one direction. When the SCR is gated, it essentially acts just as a normal diode; conducting when the current flows in the same direction as the arrow symbol but not conducting when the current flow is reversed. This one-way action means that we cannot use an SCR to control alternating current. Half the time the polarity will be reversed and nothing will pass through the SCR, even if it's gated!

AC Control with TRIACs

To control alternating current, we use another member of the thyristor family: The TRIAC. Conceptually speaking, a TRIAC is like two SCRs connected "front-to-back" with their two gates tied together. A quick glance at the schematic symbol itself reveals the two arrows pointing in opposite directions. This is a big dang clue that the TRIAC is used for controlling AC loads. Instead of "anode" and "cathode,"

the two main terminals are called "main terminal 1" and "main terminal 2." The control input is still called the gate.

So, this is pretty doggone logical isn't it? To carry that logic a step further, consider the name "TRIAC." The component has 3 leads (TRI) and works on alternating current (AC.) You know, there's really no mystery to electronics and reading schematic diagrams once you understand how these simple components work.

TRIACs are generally used to control lamps, actuators and other devices that are AC powered. The IGT S-Plus slot machine is a perfect example of triacs controlling AC loads. All of the button lamps are controlled by TRIACs. There's one TRIAC for each lamp.

Testing Thyristors

Unlike transistors, there is not a sure fire test for thyristors that you can perform with your digital multimeter that works for all devices all the time. However, you can test an SCR or TRIAC to see if it is shorted. When tested out-of-circuit between anode and cathode (or between MT1 and MT2 for TRIACs) the device should test "open." If it's shorted, it's bad.

The symptom of a shorted thyristor is usually pretty obvious. Either the load that is controlled by the device stays on all the time (such as a motor that runs continuously or a lamp that remains lighted) or, in cases where the thyristor is meant to control a high current, momentary load such as a large solenoid, the shorted thyristor blows the fuse.

If the device is not shorted, it may still be bad. If you have a thyristor-controlled load that is not working and you suspect the SCR or TRIAC is bad, the sure fire check is simply to replace the device and see if that fixes the problem.

Replacement Components

Thyristors are rated more-or-less the same as diodes: by voltage and current. The voltage rating is the maximum voltage that the device can handle when it's turned off. In other words, it's the maximum voltage that the component can block. The current rating of a thyristor is the maximum amount of current that can pass through the component between anode and cathode or between main terminal 1 and main terminal 2. Large packages can naturally handle more current than small ones. There are some other specifications for thyristors as well but in practice these are the only two with which we need to be concerned.

ten just a fraction of a volt) but high voltage (like 120 volts) between the other two terminals. Improper installation can have disastrous results, in some cases shooting 120 VAC directly into the low-voltage circuitry.

Good engineers design around this (and the possibility of a thyristor failure doing the same thing) by using "opto-isolators" in the gate circuit. The opto-isolator completely isolates the high-voltage thyristor circuit from the low-voltage circuit that drives it. The subject of opto-isolation will be covered in a future issue of Slot Tech Magazine.

THYRISTOR SUBSTITUTION GUIDELINES

1. Voltage - Use the same or higher.
2. Current - Use the same or higher.



Replacing thyristors is the same as replacing diodes. If you need to obtain substitute replacement component, you can always use one of the same or higher voltage rating and/or current rating. For example, a 200 volt, 4 amp device can be replaced with one rated at 400 volts and 8 amps.

Of course, if the packages are different, you'll need to check the "basing" (which lead is anode and cathode or MT1 and MT2 and the gate) to make sure you install it properly. You need to be careful here as a thyristor like a TRIAC often has very low voltage at the gate (of-

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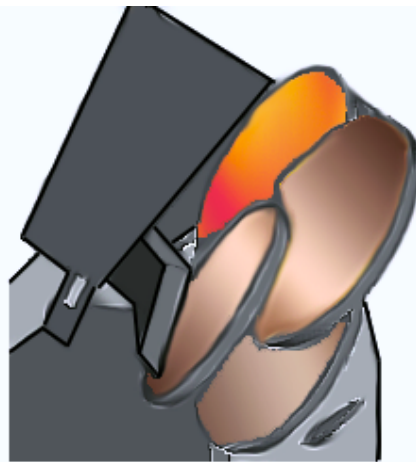
Understanding Coin Hoppers

By Frank Sutter

The very best of every profession are those who practice the fundamentals to perfection. They know that it is the simple, repetitive, almost automatic procedures, like a backhand stroke in tennis or a chip shot in golf, that absolutely have to be right. While it's true that the fundamentals are, by definition "simple" if mistakes are made in the performance of these basic tasks, the foundation that the individuals career is based on will be weak, and nothing much will ever be built on it. That's why I'm writing this series of articles on one of the most common procedures slot technicians perform on the floor, that of clearing a hopper jam. These provide the perfect example of the "weak professional foundation", because if these troublesome and frequent faults are not handled correctly and quickly, a technician's time will quickly disappear, and his productivity will never get beyond average.

The first important dividing line in hopper repair is if there is a customer on the game or not. If there is a customer on the game, your focus has to be getting the game in playable condition again in the minimum time possible. Here, I'm talking about cutting corners, taking shortcuts, and using "field engineering" techniques if necessary to make the machine work for at least

a little while longer. On the other hand, if there is no player on the game, the important thing is to insure that your repair work is complete and correct, so that the game will stay up for the maximum possible time.



Look closely at the point where the knife meets the pinwheel. Most commonly, you will see coins doubled at the knife.

Accordingly, when you arrive at a game that has a player and the hopper has jammed, your role is not to fix the defective hopper but rather to simply clear the jam. In this situation, you represent an extension of the slot attendant function. Even if you remove foreign matter from the hopper to clear the jam and you strongly suspect that you could find more if you dug through the hopper, the focus must still be to clear the current jam and get the player going again. Later, when your suspicions have proven correct and the game

does in fact go down repeatedly for hopper jams, the customer eventually will be dissuaded from continuing play on that machine and allow the attendant to put the game down.

Your necessary focus on getting the game up as quickly as possible will sometimes be made much easier to maintain by the players themselves, who will almost certainly be looking over your shoulder to make sure that you don't "rig the game" and cause them to start losing. Gamblers in general are a very superstitious lot. You can't take it personally or let it rattle you. If you have serious problems with enduring close observation from the customer, don't feel alone. I'm on your side. The sad reality is that you will face these problems for as long as you work on the casino floor. Just try to keep in mind that if it weren't for those wonderful folks who hold the belief that today might be their lucky day, you might not have this job. On the bright side, most folks are friendly and patient and they won't give you too much trouble, as long as you are making a good faith effort to get their game up quickly.

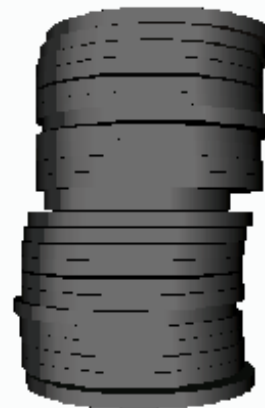
Under more fortunate circumstances however, let's suppose that you have arrived at a game that has been put down for a hopper jam and

there is no player. In this case, there will be no short-cut work or any customer to deal with. The next decision you need to make as you approach the game is what type of hopper you will be dealing with. Slant top games have escalator style hoppers, while upright games have side-eject hoppers. Each type has its own repair considerations and should be handled differently. I'll explain some of these differences as we go along.

The next step is to open up the game and find out what type of jam you are dealing with. Look closely at the point where the knife meets the pinwheel and examine inside the exit chute on a side eject or along the escalator if the hopper has one, for obvious coin jams. Most commonly,

you will see coins doubled at the knife. The slot attendant is able to clear the majority of these jams. When they can't, they call the tech on duty at that moment for assistance so the problem gets taken care of. Sometimes the tech is busy and the game has to be put down for later. Because there is no player on this game, your job this time will also include finding out what caused the problem and trying to make sure that it doesn't happen again.

If coins have wedged themselves under a graphite or plastic knife, it may be bent or may have snapped off. It has been my experience that when you see this, you will find some kind of foreign matter in the hopper about 85 to 90 percent of the time. Unfortunately, since there is



Make stacks with the coins and examine the side of the stack for different diameter coins.

no player, your job now is to examine the contents of the hopper. Most techs find this to be an extremely onerous task.

If the knife is graphite and it hasn't actually snapped but rather simply bent, remove the knife before you begin to

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examine the contents of the hopper. Once the knife is removed, carefully examine the tip of the knife for wearing. Be advised that it doesn't take a whole lot of damage to impair the knives performance.

If the knife tip is damaged, it can sometimes be restored to extend its useful life by gently and carefully filing the worn spots away with a small file. If you try this, make sure you restore both the bevel of the knife's top surface, and the shape and sharpness of the tip.

Knife tips are not supposed to be needle sharp, but rather slightly blunted. Your repair style is, of course, entirely up to you but I like to do the heavy filing by holding the knife and working the file. I do my fine reshaping by holding the file still and drawing the knife across it. You can add a significant amount of time to the useful life of the knife but there is a limit to what level of damage can be repaired in this way. If the wear is excessive, you will have to replace the knife.

Here's a tip I learned from having gone through the contents of more than just a few hoppers. After you are satisfied that the knife will be serviceable, you will be attending to the hopper. You will have to put that knife down somewhere to rest. Why not let it rest somewhere warm inside the machine? My personal favorite spot was to wedge it in the tiny space over the reel glass fluorescent, be-

tween the bulb and its hood. In this way, while you are examining the contents of the hopper, the knife will be warming up. When you get back to the heated knife, you will be able to carefully bend it back to the proper shape in your hands.

If the coins have wedged beneath a metal knife, these can usually be bent back into shape as well. With metal knives, the best bet is to try to locate the exact bend and try to unbend it to its original form. Keep in mind that once metal has bent it acquires a weakness along the bend, and is likely to re-bend at the same place again.

The most important consideration in restoring either plastic or metal knives is to observe how the tip and upper edge ride on the pinwheel and shelf wheel when the hopper is in motion. Even more to the point, the determining factor on the quality of your restorative skills is how the coins will move along the restored knife. You won't be able to tell this until the knife is remounted but you usually have a pretty fair idea of what the shape will need to be. This isn't rocket science, after all.

My favorite tool for straightening metal knives is my miniature locking needle nose pliers. That tool is perhaps the most useful of all the tools I carry aside from my screwdriver. In fact, I usually carry two pairs of miniature locking pliers.

Not all repair work involves such feats of precision and skill. As I mentioned above, this knife bent for a reason and without a player, you have to find out why. Most of the time, there is junk in the hopper. Unless you remove the offending debris that caused this problem, the knife will be certain to bend again. Here's a bit of common sense that is sometimes overlooked, but is useful whether there is a customer at the machine or not. At least one of the bits of debris that caused the knife to bend is probably right there in the coin jam itself. I knew a tech who carried a pair of hemostats in his pouch and told me that those hemostats were the best tool for pulling a coin of the wrong denomination off of the pinwheel without disassembling the whole hopper.

The quickest way that I had found for going through the contents of a hopper is to remove the hopper from the game and dump all of the coins from the hopper, putting them into the coin tray if possible or into cups if there are too many coins. With the hopper empty, you can carefully examine the bottom of the hopper bowl, the pinwheel and the escalator (if the game has one) for paper shreds, washers, screws, or other debris. Take this opportunity to carefully examine the entire hopper for signs of wearing and work the moving parts like the optic lever and the pinwheel to check for free motion with no rubbing or

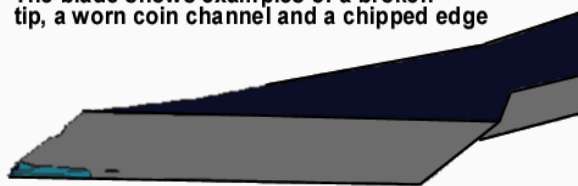
binding.

Confirm that the coin deflector is not damaged. The deflector is a small piece of sheet metal that is mounted just above the knife, and lifts the coins up off the pinwheel and directs them into the exit chute. It does this by providing a little ramp that slips under the leading edge of the coin as the coin is pushed by. Occasionally, the ramp's lower lip will separate from the pinwheel just a fraction of a millimeter, usually again because of hopper debris. That tiny gap will be enough to allow the leading edge of the coin to collide with the deflector rather than ride over it. When this happens, the deflector is bent severely and usually needs to be replaced. However, I have had really

great luck straightening out bent deflectors with a small tap hammer, a firm flat surface, and my locking needlenosed pliers. Just as with the knives, remember that once any metal part has been bent, the metal has softened along all of the creases

Knife Wear

The blade shows examples of a broken tip, a worn coin channel and a chipped edge



that the bending has caused and the likelihood of the part bending again is very high.

Before I go any further, let me pause to say this. In all of these cases, it would be bet-

ter to replace any defective parts you find with new exact replacements from the shop. If you followed the advice found in the manufacturers manuals to the letter, that's exactly what would be done. Unfortunately, the sad reality is that most slot depart-

ments can't afford the inventory of replacement parts that would be required for this practice. Beyond that, the technicians also have a tendency to replace parts that aren't

causing any problems and that adds yet more to the required inventory. In point of fact, parts shortages will demand that you exercise a bit of innovation from time to time, in order to keep the

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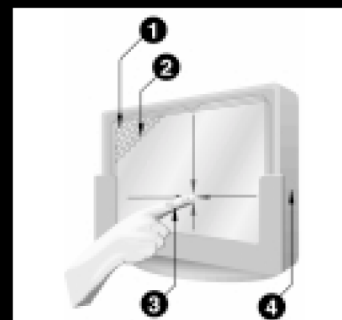
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How ClearTek Capacitive Touchscreens work



Voltage is applied to the screen (1) and the electrode pattern uniformly distributes the low-voltage field (2) over the conductive layer. When a finger touches the screen (3), it "capacitively couples" with the voltage field, drawing a minute amount of current to the point of contact. The current flow from each corner is proportional to the distance from the corner to the finger. The controller simply calculates the flow proportions to locate the touch (4).

games running. Let's focus on describing life as it really is for the slot technician. Although I recommend using the proper replacement parts at all times, sometimes, you just have to do what you have to do.

Lets get back to that empty hopper. Once the knife and deflector are confirmed to be good, it's time to exercise any moving parts to check for free motion, with no binding or looseness. If you find that anything in the hopper might need cleaning and lubrication, now is the time to get that done. Remember, if you decide that extensive disassembly will be required to complete the job, it might be better to lock the coins in the game, leave the game down and take the hopper to the shop.

When the hopper has been examined and confirmed, it's time to turn your attention to the coins. I have found that the fastest way for me to get this done is to make stacks with the coins and examine the side of the stack for different diameter coins. Then, when you throw the coins back into the hopper, try to spread them as you throw and visually scan them for any unusual colors. Be advised that your hands will probably be filthy when you get done. Coins are remarkably dirty.

Once you have examined a few stacks of coins, it's a good idea to make sure the hopper is seated correctly and that it

will complete the ten-coin pay out test. If you have followed the advice above, the knife is probably out of the game at this point, but that shouldn't matter. If the pinwheel turns on, and you mount a good knife correctly later, the hopper will probably pay out. At this point, you are simply confirming pinwheel rotation and coin motion. Then it's time to get back to the stacks of coins

If you find coins of the wrong denomination in the hopper, there are only two ways that they could have gotten there. The first is sort of unlikely, but I mention it because where I used to work, it became commonplace. That is, they can possibly come in with the hopper fill bags, from the hard-count room. The second, far more likely source of wrong-denomination coins in the hopper is a defective coin-accept device. Obvi-

ously, before you can consider this game to be fixed, it would be best to confirm the proper operation of the coin accept device. Just drop the coin of the wrong denomination that you have found into the game when you have completed the repair, to make sure the coin acceptor will reject it. HINT: place a cup in the hopper under the coin accept device before you close the door or you may be digging that bad coin out of the hopper again.

Well, I've rattled on and prattled on and I've run out of room. I've just barely begun to scratch the surface of the fundamental, yet critical process of clearing a hopper jam. I promise to rattle on a little more concerning the topic of hopper jams next time, but till then, keep 'em running!

-Frank Sutter

fsutter@slot-techs.com



Everyone reads Slot Tech Magazine! Pictured here during a very busy grand opening night at the new Pala Casino in San Diego County are slot manager Mike Burnett (left) and slot tech Chris Mason

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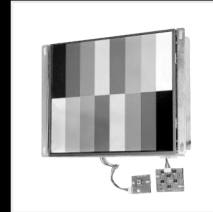
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How Monitors Work - Part II

The Seven Sections

A monitor can be broken down into seven basic sections. Armed with a general understanding of how these sections work, we can often observe the symptoms of a bad monitor and have a pretty good idea which sections are operating properly and which are not. Once we have the problem isolated down to a single section, troubleshooting is often a simple matter of testing the parts in that section with a meter.

MONITOR SECTIONS

1. Power supply
2. Video
3. Blanking
4. Sync
5. Vertical deflection
6. Horizontal deflection
7. High voltage

There is also a very close relationship between the horizontal section and the high voltage. In fact, the horizontal section is actually used to create the high voltage! Can you hear the high frequency "squeal" that comes from a standard resolution television monitor as it is operating? Some people can, others cannot. That high frequency squeal is the sound of the high voltage unit in operation, as it is being driven by the 15,750 hertz horizontal deflection circuit. If you can hear the squeal of the high voltage, the high voltage unit must be working prop-

erly. If the high voltage is okay, the horizontal section must also be working properly, since the horizontal section is used to create the high voltage! If the high voltage and horizontal sections are working normally, chances are extremely good that the power supply circuit is good as well! So just by listening to the monitor as we turn it on, we can verify that three of the seven sections of the monitor are probably working okay. Note that this only applies to standard resolution monitors, not the high resolution monitors used in today's video slots. The operating frequency of a VGA resolution monitor is 31.5 kHz, too high a frequency for us to be able to hear.

Let's take a look at some common monitor problems and see if we can determine the source of the problem just by looking at the symptom.

Where is the problem as shown in figure 1? It's cer-

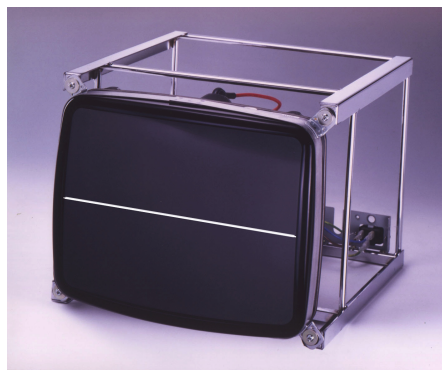


Figure 1. Loss of vertical deflection causes just a horizontal line to appear on the screen.

tainly not a high voltage problem! Generally speaking, if you see any brightness at all on the screen, your high voltage is probably okay!

It's not a horizontal problem either. We can see a horizontal line on the screen, so the horizontal deflection section must be making the beam sweep left and right. Besides that, the fact that we have any kind of display at all means that the high voltage is working and if the high voltage is working, the horizontal section must be working too! Of course, if the horizontal section is working, the power supply is working as well!

Can the video circuit be the cause of this problem? No way! In order to draw a line on the screen, the electron guns must be turning on. If you were seeing this symptom on an actual monitor connected to a game, you would see colors in the horizontal line as well.

It can't be a sync problem because the picture is not rolling or shifting. In fact, we don't really have a picture at all, just a horizontal line across the screen!

We know it's not a blanking problem because a blanking failure will reveal the zig-zag, vertical retrace lines and that's not our problem here.



Notice the curves and distortion on this monitor? This is almost always caused by bad electrolytic capacitors in the deflection circuits. It is also possible (although not likely) that this can be caused by a low-voltage condition in the monitor's B+ power supply

That only leaves the vertical deflection section as the possible cause of the symptom! You see, it's pretty logical once you know how the monitor works.

What if you are missing a color? Perhaps you have a video poker game and the blue background has become black. Naturally, this cannot be a problem in the power supply, blanking, sync, vertical deflection, horizontal deflection or high voltage. A missing color has to be a video problem. In fact, it has to be a problem in the blue video amplifier or the blue gun in the CRT itself.

So by a logical process of elimination, we have not only eliminated six out of seven sections as being the possible cause of our missing color problem, we have eliminated two-thirds of the remaining circuits as well. Neat, huh?



This monitor displays just white raster with diagonal, "vertical retrace" lines. This might be a problem in the "blanking" circuit.

What if you get to a monitor whose symptom is a screen filled with raster and vertical retrace lines but you do not see any images? Assuming that a good video signal is getting to the monitor from the computer, the problem is likely to be in the blanking section of the monitor! All of the other sections in the monitor must be working to produce raster.

What can cause the raster to shrink in both the horizontal and the vertical direction? Is there any section of the monitor that is common to both the horizontal and the vertical sections? How about the power supply? This symptom is typical of a "low voltage" power supply problem. There is enough voltage from the power supply to allow the monitor to function, but just barely!

The point is this:

ONCE YOU HAVE DETERMINED WHICH SECTION IS BAD, TURN THE MONITOR OFF AND USE YOUR METER TO CHECK ALL OF THE COMPONENTS IN THAT SECTION!

Start with the semiconductors first. The diodes and transistors are the most suspect to failure because they are the active components in the circuits. They are switching on and off, or otherwise controlling the current in the circuits.

Con't on page 27

Replacement Parts For Slot Machines

By Dennis Gambuzza



Besides knowledge and skill, what other things do you need to fix a slot or poker machine? Tools and parts! The next question is, where is the best place to buy these?

Some parts, which are proprietary, you can only buy from the manufacturer. There is nothing I can tell you about these parts. But some replacement parts are sold to OEM manufacturers by other companies and these companies also improve upon parts made by OEM manufacturers. This is where you and I have something to talk about.

We all want quality parts as inexpensive as possible and you can buy them from these companies. Lets talk about one of these companies.

HAPP CONTROLS

Happ Controls sells a full line of gaming parts and has a quality catalog in hard copy and on-line at www.happcontrols.com. You can call for a hard copy at 888-BUY-HAPP. They do sell internationally and if you're not in the USA, call

and ask for Louie Rummenigge who is the International Sales Manager.

Happ Controls is owned by Frank Happ. Happ Controls keeps millions of dollars of inventory on hand and they ship from Elk Grove, Illinois or from Las Vegas. If you need electro-mechanical parts, this is the place to shop as they carry many hard-to-find parts.

Happ Controls also performs JCM bill acceptor repair as well as monitor repair. In fact, they are an authorized Ceronix repair center. For those of you that are responsible for amusement and vending machines as well as slots, they also inventory a full line of these parts. Catalogs are available the same as gaming. See their ad in this issue of Slot Tech Magazine for a better understanding of all the parts they carry.

What makes Happ Controls exceptional is that they sell their push buttons to most manufacturers. I believe that push buttons are their showcase item. They sell to Bally, CDS, Atronic, IGT, Sigma and now Konami. Their buttons are used on all the new IGT games.

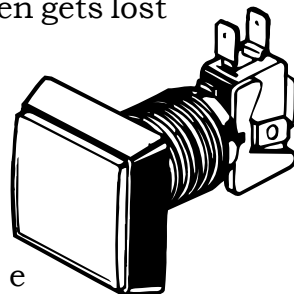
Their push buttons for gaming are broken down into two groups: pushbuttons used on reel type games and Sigma

pokers, and VLT buttons which are used on poker or videos such as IGT and Bally. You can order them individually or in kits.

Square Button Fix for IGT

Here's a problem everyone has had with the large square push button on the IGT reel games. The little feet break off the plunger and the button comes apart. The spring then gets lost

on the floor, the clear cap gets stepped on and you're

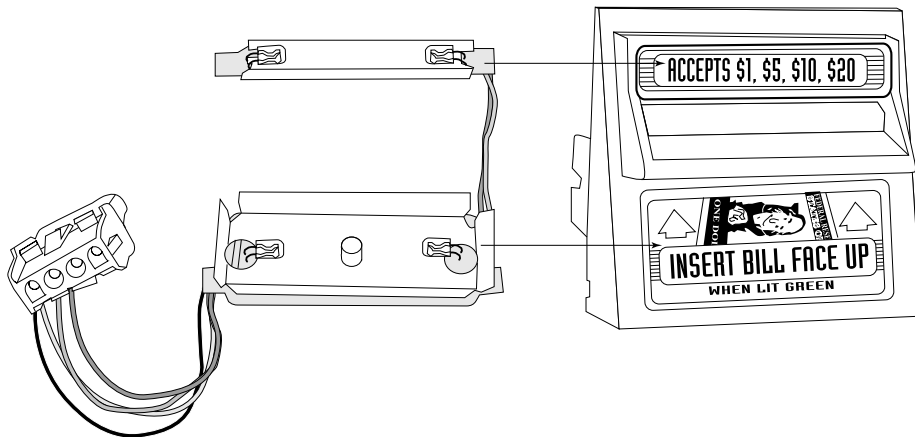


lucky to find the legend. Well I'm here to tell you that this will not happen with the Happ Controls button because they use nylon with the plastic.

Bill Acceptor Lights Fix

The Bally 5500 series has an annoying little problem. The light bulbs on the "insert bill" indicator keep burning out. You replace them and the next day one or two are out again. After three or four times, the pads come off the boards and you either buy a new board or try to hard wire them in.

Here's how to solve the problem. Happ Controls is the Exclusive Distributor in gaming for Ledtronics. Happ Controls will sell you a replace-



ment board with LED's on it for about the same price you can get an original board. PLUS they will give you a three-year guarantee.

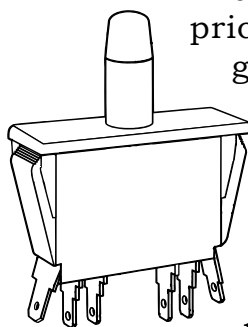
It comes in versions for Up-right (Happ no. 70-1205-00), Slant-top (Happ no. 70-1206-00) and Bar games (Happ no. 70-0076-00). This is a good one ladies and gentlemen. First, you don't have to take the boards out and then desolder the bulbs or re-solder the new bulbs in. And best of all, your boss will be happy that all these lights work. We all know how annoying working on bar games can be, right? You can get LED's for those push buttons to lower your exposure to the spilled drinks. These are a little more money but in my opinion worth the cost because you save on labor and service calls many times over.

Editor's Note: I saw this little LED board at a recent trade show. It's really amazing. What Dennis failed to mention is that these LEDs are the newest, really cool WHITE LEDs. They're expensive as heck, even for the manufacturers themselves to buy but

you'd be crazy to not to retrofit.

Happ Controls is a very large Cherry Switch distributor.

This means lower prices for very good switches.

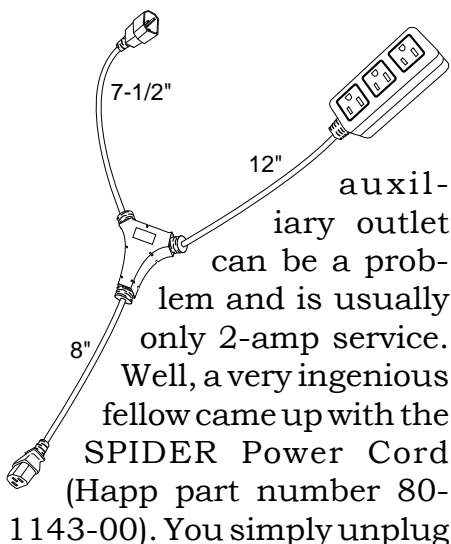


I know that the interlock switch used on drop doors gets broken a lot by the drop

teams. Happ Controls even has a switch bracket that protects this switch. (Their part number 42-8061-00)

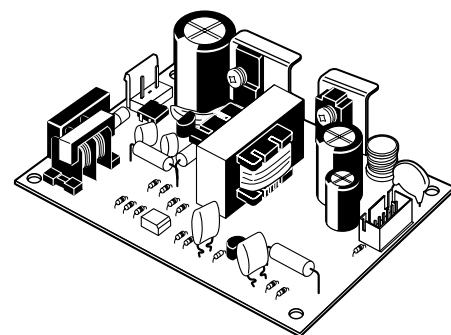
Most new games are congested inside. Getting to the

Well, a very ingenious fellow came up with the SPIDER Power Cord (Happ part number 80-1143-00). You simply unplug

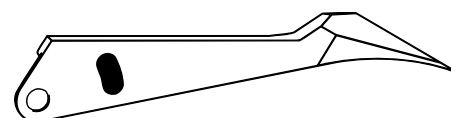


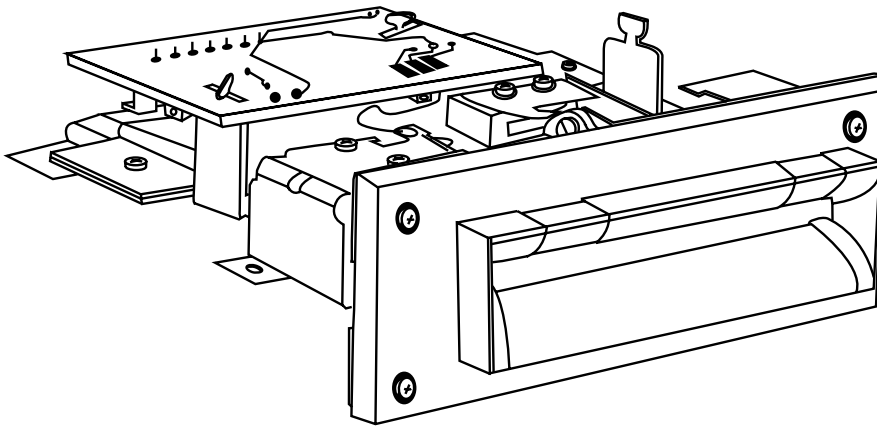
the game on the inside, plug that end of the power cord into the spider and then plug the second end of the spider into the machine. Wa-La! 4 outlets at about five amps. Good stuff.

The next trouble spots are the power supplies for the Bally 5500 (Happ # 80-0307-00) and the JCM 200 Head (Happ # 80-1146-00). Happ Controls has both at very good prices and has stock most of the time.



We know that IGT has stopped producing the S Plus and PE plus series games. All good things must come to an end. I bring this up because Happ now has the Fiber Hopper Knives (Happ # 70-0545-00 & 70-0546-00) available. They have been in the field for a while with good results, after overcoming a soft tip problem.





A lot of people have CDS Player Tracking Systems. An early weakness (now overcome) was the plastic card reader. Neuron came out with a metal reader that works quite well and is now being used by CDS. Happ Controls

has the Neuron reader for CDS (Happ no. 80-1157-00). For those of you that need hand tools, Happ Controls has them as well. Xcelite has a life time warrantee. Take a look at these.

All in all, Happ Controls is a good company that can help us techs in the field. In the Las Vegas area they give mostly same day delivery and all other areas same day shipping.

I would like to thank Rich Santercola of Happ Controls for his help with my research. I think each of you should give Happ Controls a shot. For those of you that already use Happ Controls, I hope some of the products I mentioned will help you.

Until next time, keep the games up.

Dennis Gambuzza
dgambuzza@slot-techs.com

Dennis Gambuzza has worked in the slot machine end of the casino industry for seventeen years, starting as a slot technician in Atlantic City in 1978 and working through 1981. Gambuzza was an Engineering lab Technician at Reuters R&D Department from 1981 to 1987, then moved to Las Vegas where he still resides. Gambuzza explains with confidence, "The reason I tell you this is that I believe I know my stuff, from slot tech, bench tech, lead slot tech to assistant slot manager."

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This program covers monitors in detail, from the basic theory of operation to a detailed look at monitor failures and their symptoms.

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Fill Checks in Detail

by Pete Bachran

It falls on the slot tech to check on machines that have had multiple fills in a given period of time. It varies from casino to casino but usually by the third time a game gets a hopper fill in a twenty four hour period a slot tech gets a call for a fill check.

What exactly gets checked in a fill check? A tech puts the game into a hopper test and counts out ten coins closes the door and puts a note in the log book that it was done. If there is a problem with a knife coming off a shelf wheel this method might catch that, otherwise this check was a little short of the goal.

A fill check should test or check the entire game. This can actually be done in a very short time with minimal distraction to the player. If management doesn't like players disturbed during their gambling go over anyway. Watch the machine. If they put a bill in the validator did it credit the correct number of coins? Does this customer put bills in the validator and immediately cash out the coin? Is there a steady stream of one hundred dollar bills going in? Does the guest cash out after every win? When the guest cashes out does what you hear hitting the tray match the paid out display? These are all easy quick checks that can give an idea of a ma-

chines health. Remember, these stand back, eyeball tests are not a fill check. They only hint at whether there is an emergency situation present.

If the game you're checking has a bill validator the first thing to check is the denomination. This should be checked through the machine's options tests, not through the player tracking system. The player tracking systems will only tell you how the game is supposed to be set up. The game options will show you how the game is actually set up. This option should never be set wrong but it's worth checking. Slot techs have lost their jobs because a one dollar game was optioned as a quarter game and not caught on a fill check. Check denomination first.

While checking options, check the hopper options. If the glass says that it pays out up to 400 coins is the option set for 1000? This won't make any difference to the bottom line of that machine but it will certainly have more fills.

Next check the hopper. Run the hopper test at least five times. Count the coins back into the hopper. Look at the hopper carefully. A worn hopper knife can cause overpays in older machines. Check the knife. Are the optics clean and situated properly? If the optics are loose or



cracked, this can cause problems. Take hold of the optic and wiggle it to check for movement. If bad, replace them. Is the hopper seated fully? If it isn't this can cause miscounting. Usually an IGT hopper that isn't seated fully will over count but it can cause undercounting as well. Neither is acceptable.

Using the machine's input tests, check the hopper level probe. Is it working correctly? If there is a short in the probe wire, all coins will go to the drop and the hopper will keep running empty.

In the output tests check the diverter. Is it moving fully and completely? Does the diverter snap back when released? Drop a coin from the hopper into the drop. Did the coin hit an empty bucket (diverter working) or a full bucket of coins (diverter suspect)?

It also is a good idea to take a look at the bill validator history. If the last five bills in were all hundred dollar bills

it could be that the game is being used as a change machine. If the validator on one game is not working it isn't unusual for people to use the next machine as a change machine. Most games show the number of credits issued for each bill in history. Do they match up? If the quarter machine being checked shows that a hundred dollar bill paid four hundred credits, everything is fine. However, if it's a dollar game that shows four hundred credits for a hundred dollar bill, then there is a serious problem that needs to be addressed.

Drop in a coin. Does it register correctly? Play the game until there is a win. Does it give the correct number of credits? Cash out and count the pay. Is it counting properly? If there is a customer waiting step back and let them play and just watch for a few minutes.

This brings up the question of how you do this when there is a player on the game. Most of the time it isn't a problem. First, be friendly. Smile and say hello. Explain why you are there. Usually if given a running commentary of what's going on a player will not just put up with the tech "messaging" with his/her game but will enjoy the experience and feel that they have gained some inside information. When the customer complains that you are only there because the machine is "paying to much" remember that they are serious. It's a good time to smile and try to put them at ease. Explain that there's probably nothing wrong with the machine but management gets nervous.

# _____ FILL CHECK CHECKLIST	
_____ Demonination	_____ Coin out optics
_____ Hopper settings	_____ Hopper level probe
_____ Hopper test 5X	_____ Diverter test
_____ Hopper test in play	_____ Diverter test in play
_____ Knife condition	_____ Bill History
Tech: _____ Date: _____	

Or mention during the hopper tests that when a machine is underpaying the customer is sure to notice and call for help however, if it's overpaying not everyone notices. You are doing strange things to their game, they are seeing strange numbers appearing on the meters smile,

the player needs to be reassured that you are not going to toggle the "lose" switch.

Handled properly a fill check will take about two minutes, please management and the guest will be happy to keep playing.

-Pete Bachran
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At the grand opening of the Valley View Casino in Escondido, California. Frank Shabo (left) retired from an engineering position at local defense contractor Cubic, Corporation but was tapped to join Valley View Casino as a slot tech. On the right is Mars Electronics' industry support manager Mark Martino who was there for the opening to ensure that hundreds of Mars bill validators were working properly (They were, by the way).

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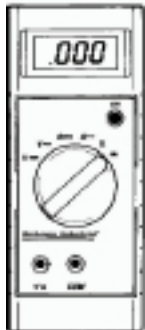
Randy Fromm's Casino School

On-Site Technician training

Randy Fromm's Casino School is a practical, no-nonsense look at how gaming machines work and how to repair them when they don't. **No previous knowledge of electronics is required** to get the most out of the school. The Casino School is geared for those who want to learn how to fix gaming devices without having to learn complex electronic theory or purchase expensive test equipment.

Be prepared for six hours of accelerated learning each day. Class begins at 9:00 am sharp each day and continues until 4:00 pm. The Casino School provides each student with reference materials and troubleshooting guides that will be valuable aids for repairing equipment on location and in the shop.

Students learn how to work with:



THE DIGITAL MULTIMETER

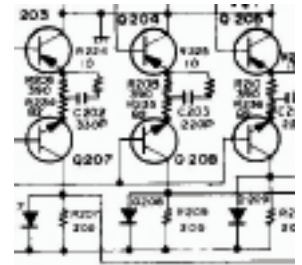
This relatively inexpensive piece of test equipment is easy to operate. Casino School students learn to use the digital multimeter to perform tests and measurements that will pinpoint the cause of a failure down to a single component.

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!





As slot techs we all have a varied day to day routine. Dont you just love those days when all is well and you've fixed everything until it's half an hour from the end of your shift and it seems that the whole floor goes wrong? Well if it hasn't yet happened, it probably will. Believe me. Below are a few Techy-Tips to guide you through your normal day so you can hopefully get a few nice satisfying jobs under your belt before the "Slot Armageddon" takes place.

CC33 Dollar comparitor accepting nickels & Quarters etc.

You get a call from the floor that there are coins other than dollar tokens in a machine. You perform a quick test and find that the machine in fact is taking what it shouldn't. AAAAGH! To get the machine back online, you replace the CC33 with a good one but then what are you to do?

Due to the difference in metallic mass between a dollar token and a nickel, this problem obviously cannot be tuned out using the accept/reject potentiometer control. Comparitors work on an inductance value between a sample coin and inserted coin. This control does not change the bandwidth enough.

Don't give up with that CC33 and pitch it! Lift the cover and remove the small pcb assembly and locate C1, the only large axial capacitor resident. Change it out and enjoy an operative CC33 once again. You may want to re-center the potentiometer as it may have already been "adjusted."

Bally Gamemaker (all models) Bills will not enter Bill Validator Unit

The radio crackles into life (well it does where I work). "Machine not accepting bills in section 26." You go to investigate thinking to yourself "this should be an easy one." The customer explains that the bill will not even enter the slot as it should, never mind being rejected. You perform the usual checks: Power is present (the unit cycles over when the 2-wire plug is removed and replaced), no obstructions etc.

Now what to do? You go into the test screen for the Bill Validator and are met with a message saying "BV protocol incorrect, communication timed out TEST FAILED." AAAAAGH! Dont panic, this is an easy one with no tools required except the prescribed Bostitch staple remover.

Remove the processor tray assembly (observing any gaming regulations regarding this area) and locate U28. This is a DUART chip type SCN68581. Using the staple remover (This now has a new industrial definition amongst tech around the world. WHAT? You dont have one yet?) Remove the DUART and replace it with a new one.

This is an available part from some of the suggested suppliers found in here in Slot Tech magazine and I would suggest you have a few on hand as this is a fairly common failure part. Replace the processor tray, power up the game and amaze your colleagues with your achievement. Please note that contrary to common belief, no loss of memory or CMOS errors will occur by replacing the DUART.

Bally Gamemaker will not come back on.

A customer asks for the machine to be turned off while they go to eat in the casino restaurant. Instead of the machine being disabled using the software selection, someone turns the whole game off. The customer returns with a full belly to continue their gaming enjoyment but Oh Oh . . . the machine will not come back on. AAAAAGH (again?). Take a look at the front of the processor tray and you should see 4 green LEDs brightly lit. If you have 4 greens then it's probable that the monitor has failed (refer to the flowchart in April's issue of Slot Tech). If the LEDs are out or pulsing, then the power supply has failed. Remove the power box from the machine and then remove the actual SMPS from the box. Replace the large radial capacitor C5 100uF@400v. It's possibly melted so that's a sure sign of death. Re-assemble everything, power up and the machine should be restored to its former glory.

**Visit the website at
slot-techs.com**

Jammin' - Cont.

IGT Touchscreen will not calibrate or calibration does not last.

Well we all dread the touchscreen part of nearly every gaming machine these days, but there is hope. You just calibrated a Game King machine but the touch tracking test reveals that it's still not following your finger. Remove the monitor chassis from the game and take out the touchscreen controller PCB from the monitor assembly. Locate C1 thru C5 (10uF@35v) and replace them all. Also, it's probable that C52 is bad too so include this in the change out. C1 through C5 control the actual touchscreen input co-ordinates from the coated glass assembly, while C52 suppresses noise in the power supply area. Re-assemble everything and re-calibrate the touchscreen. It may be a good idea while the touchscreen controller is out to re-seat the EPROMS to avert any socket contact issues.

IGT PE+ Video poker showing Coin-In Timeout on screen.

You're out walking the floor when a customer alerts you to their machine not taking coins. You immediately see the "coin In timeout" tilt parading itself on the screen. You check the coin optics for dust, paper and hung up coins but all is good. You then enter the test mode and on the input test it shows that coin optics A B & C are all showing 0. Press the test button again and see if it will take you to the next page. If it will, there are problems with the optic or with the connections/wiring. However, if you can't enter page two, check the 7v fuse located on the lower mod-

Con't on page 28

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Power Harness or Roasted Marshmallow?

By Bart Holden

Several months ago, I encountered a problem on the casino floor with an IGT S-Plus Upright slot machine. The credit meter was blank. Normally, when I find a game with this symptom, my reels are also without power. This time, my reels were operational. I immediately checked my fuses only to find that they were functioning properly.

Next, I began a visual inspection of the game. I inspected my credit meter and the harness. Again, all was well. I removed the Central Processing Unit (CPU) and checked the condition of its components. Seeing no visible defects, I reseated the CPU. The problem continued.

I then looked to the motherboard. I immediately noticed that pin 2 of the harness connecting the power supply to the motherboard at J8 was brown. I could see that the white plastic of the connector had suffered a considerable amount of heat damage. I removed the harness and motherboard to allow for further inspection.

Back in the shop, I flipped through an S-Plus wiring schematic and used a digital multimeter to verify that the motherboard had received no damage. J8 pin 2 is a chassis ground that is connected to the machine's transformer via

the eight amp fuse. It also runs to J10 pin 7 of the motherboard. All applicable test points passed the continuity test.

I returned to the game with the motherboard and a new harness. After reinstalling both, the credit meter was operational. There seemed to be no reason for the sudden meltdown of the harness and the problem did not return.

Last week, at another S-Plus Upright, I came across a game that had no illumination on the tower lamp. A patron had pointed this out to an attendant after a long wait for a hopper fill. I of course began by checking the obvious. Neither light was burned out. I checked the power at J/P201 pins 3 and 5. The multimeter read .3VAC and there was no change in voltage when I pressed the change button.

After checking at the output end of the circuit, I ventured south to the origin of my power and BAM, there it was in that same harness. However this time it wasn't brown. It looked more like a marshmallow that was roasted on the end of a coat hanger.

Again, I removed the harness and the motherboard. This time it was evident that the motherboard had not made out so well. J8 pin 2 (chassis

ground) and J8 pin 3 (7VAC) were charred. There were also other spots on the board where the runs had been burned.

I replaced the motherboard and harness. The tower light came on but was dim. The connector began to get hot again and I shut off the main power. It was apparent that there was a bigger problem in the game.

The next shift relieved me and my associate technician, Brad Denmark picked up where I had left off. He checked out the connection to the tower light and the condition of the tower light itself. He opened a neighboring game to compare the wiring and noticed no discrepancies. He reconnected the harness and the lights were bright and there was no excessive heat at the connector to the motherboard.

I asked Brad what he thought fixed the problem. He felt that there was a tarnished connection between the male and female pins at J/P201 pin 3 and J/P140 pin 2 ground.

The game now has full tower lamp operation and our patrons aren't forced to wait longer for service.

- Bart Holden
bholden@slot-techs.com

NIGA Snapshots



Sometimes, the most interesting products never actually make it to the casino floor. This is an "electric chair" but not in the usual sense. Electroluminescent panels bring this Addams Family chair to life with an animated lightning storm and flashing windows in the house. These photos cannot do justice to the effect. Unfortunately, the concept was rejected by IGT. The chair was developed by Gary Platt Manufacturing under the trade name X-Tended Play Seats.



On the show floor with Dagwood and Blondie at the Bally Gaming booth is Slot Tech Magazine publisher Randy Fromm.

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By Randy Fromm

Getting Down to Base-ic Repairs

Slot Machine Bases Need Fixing Too!

April's NIGA show in Albuquerque gave me a chance to escape the office for a couple of days and take a look at some of new products and services that the gaming industry has to offer. Naturally, I am always on the lookout for new systems and new technologies so that I can pass this information along to the readers of Slot Tech Magazine. This show boasted the usual array of exhibitors, from accounting computer systems to surveillance equipment and everything in-between.

What grabbed me the most (after the garlic-dipped buffalo meat and the cigar-mobile) was not any sort of new technology. In fact, it's not electronic at all and it doesn't even plug in to anything. It is however, a brand new concept in a long overlooked segment of casino maintenance and repair. It was a small sign that caused me to stop in my tracks and do a one-eighty in the middle of the aisle.



Replaceable panels make slot base repair a snap!

The sign read: *** SLOT BASE DAMAGE SOLUTIONS ***

In a typical slot operation, slot machine bases take an enormous amount of abuse. Replacing and/or refurbishing a damaged slot base is a time-consuming process. You have to perform a drop, empty the machine's hopper, disconnect the machine from the power and from the network, pull it off the base, replace the Formica and reverse the process to put it all back together. Multiply that by 2000 machines and you begin to see the scope of the project. No wonder you see many slot operations with wonderful machines but cracked and broken bases.

Brown Manufacturing has a solution that's both innovative and simple: Replaceable panels. What a concept. The panels are complete with cladding and T-molding. Installation takes just a few minutes. The replacement panels simply bolt on over the damaged ones. They bolt on from the inside of the stand so there are no exposed bolt heads.

When a damaged base is spotted, the slot tech can grab a bolt-in replacement panel from the shop and fix it right away, as opposed to putting it off until a "better



Greg Martin and Phil Cochran show off their slot bases and replaceable panels at the NIGA show in Albuquerque, NM

time" which, of course, never comes.

"The area we're targeting is service," commented Brown Manufacturing's Greg Martin. "We want to raise this to another level."

In my opinion, they just did.

Brown Manufacturing is an architectural casework and casino cabinetry specialist, providing slot stands, pit podiums, carousels and various other types of custom gaming furniture and cabinetry.

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Monitors - Con't

Capacitor failure is a common problem in monitors that are a couple of years old. Bad caps often cause distortion in the picture. Curved sides and squished pictures are generally caused by bad capacitors. The best procedure here is to replace any suspected capacitors (suspect all electrolytic capacitors that are two or three years old) with new ones. Testing capacitors is not always a good way to go here as handheld capacitor meters will often give bogus results if you don't know what to look for.

Resistors are the next thing



to check. Although they are passive devices, they do generate heat as they work. This heat can cause resistors to fail. When resistors fail, they will open circuit or increase markedly in resistance. Resistors will not short circuit.

By determining the section of the monitor that is bad, and then using a meter to test the parts, we do not have to know exactly how the circuits operate to be able to fix them. It's also a lot safer to troubleshoot a circuit with the power off than with the power on!

Of course, we will be taking a detailed look at each of the seven monitor sections in future issues of Slot Tech Magazine.

BROWN AD

Jammin' - Cont.

ule (there are three fuses all together). It will be blown causing loss of voltage on the processor board which runs the input circuit optocouplers. Replace fuse and all will come back to life. This fuse can fail for no apparent reason. It can also open when lamps are replaced in the candle assembly with the machine turned on.

Well fellow Techies, keep on jammin (or un-jammin) and meanwhile I will see what other slot floor horrors (AAAAAGH!) I can discover for you for the next issue.

- Chris Hunt
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Chris Hunt is an English ExPat currently living in Reno NV. His qualifications include a City & Guilds Diploma in Electronic Engineering from England (Equivalent to a B.S. in USA). He is employed as a Senior Slot Tech with the Gold Dust West Casino & Motor Lodge in Reno. He has been working in the gaming business since 1984. Previous to that, he was in the amusement business for 13

years and spent time in the Royal Air Force as a flight mechanic on Lockheed C130's. Chris has been employed with IGT in Europe and Reno and also worked for Innovative Gaming Corporation of America as a design engineer. Chris recently returned from a tour of the Caribbean where he built two major slot operations in St Maarten & Belize.

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