December, 2002

On the cover: Harrah's Rincon Casino opened this summer in San Diego, California. slot players have the opportunity to win a new BMW on a WMS Jackpot Party carousel. You didn't *really* think that Slot Tech Magazine was giving away a Beemer, did you?

Slot Tech Editorial

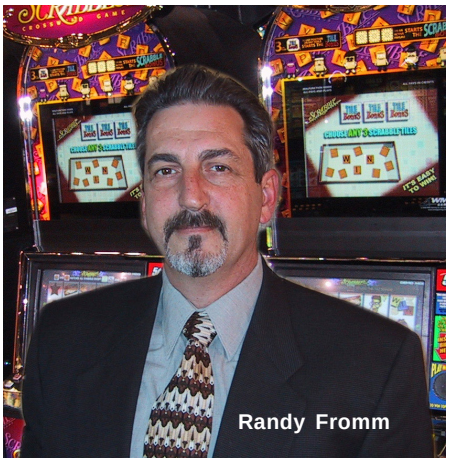
This month's Slot Tech Magazine may cause some of you to scoff and say "Fuses? Heck, we don't need to know about no stinkin' fuses."

Admittedly, the concept of a fuse is pretty basic on the surface but there is a lot to be said about fuse types and their ratings. For example, do you know where and why a slo-blo fuse is used? Do you know what a fuse's voltage rating means? Do you know what a surface-mount (SMD) fuse looks like? Herschel Peeler covers the subject in this month's contribution, starting on page eight. And no, Virginia, you cannot replace a 3 amp slo-blo with a 5 amp fast-blo fuse.

Is it love at first sight for Kevin and Konami? Contributing writer Kevin Noble takes his first look at video slot machines from Konami Gaming and gives us his opinion starting on page four.

Okay, okay . . . It's not technical but Horseshoe's John Green sent in an opinion piece about maintaining good relations between management and the worker bees. I found his opinions and suggestions to be right-on and so you'll find his contribution, "A Word to Management" in this month's issue. Leave it out where the boss can find it (accidentally, of course) starting on page 14.

TechFest 4 (at Grand Casino, Mille Lacs) was sold-out. Thanks to everyone for a great three-day event. Coverage is on page 17. TechFest 5 is scheduled for San Diego, California in February 2003. See page 35 for details.


Randy Fromm

Kortek's authorized service center, Casinotech, is now carrying a reasonably priced replacement chassis for their older, out-of-warranty PCB. Read their CN and get the details on obtaining this new chassis, starting on page 22.

Rounding up this month's offerings is an important presentation on monitors and monitor repair - the horizontal deflection circuit. The horizontal deflection circuit is the hardest-working circuit in the monitor. It's an area where we see lots of catastrophic failures as well (read "dead monitor"). The fun begins on page 31.

That's all for this month. Have a happy holiday season. I'll see you at the casino.

Randy Fromm

Randy Fromm - Publisher

Randy Fromm's
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Introduction to Konami Video Slots

By Kevin Noble

I recently was introduced along with fellow Technician Samer Geha to Larry Jones (install technician) and the Konami video slot machines. So, what is the big deal about that, you might say. Well, so far as I have heard, we are the first ones in Canada to receive these games on the gaming floor.

Currently, we are field testing these games at Windsor Racetrack Slots in Windsor, Ontario. My first chance to view and work on these games was back in Burlington, Ontario where we first prepped these games, installing Mikohn hardware such as the SMIB, PTM bracket with the card reader, key pad and display. We had to wire the top box, main door, belly glass door and the fill door in series. Everyone pretty well knows the routine by now.

This is when Larry Jones comes in. Larry has been a great help in showing us the clears and sets for the games. He also made the trip down from Burlington to Windsor to help with the installation. While he was down, I was able to pick his brain and get some tips on Konami games that I would like to pass along.

The Konami Video Slot Machine

In the small amount of time that I have had a chance to work with these games, the clear and set procedures were very easy. The machine itself has lots of room to work in and is very "technician friendly." The CPU, I/O boards, and communication board are all mounted in the top award glass in a locked box. It uses a Sigma hopper and has many of the characteristics of a Sigma reel game. The power supply is mounted under the monitor and is easily removable by undoing a thumb screw and sliding the whole unit out.

There were only two problems that we have encountered. The first problem was when we were installing the card reader in the PTM bracket; the award glass door would not close fully. The card reader PCB board was hitting the hard meters that were mounted in the top box on the right side. Paul Tran, the warehouse leading technician, quickly solved this problem by unscrewing the PCB board on the card reader, spinning the mounting brackets 180 degrees and remounting the PCB board on the back mounting holes. Larry Jones also recommended redesigning the PTM bracket to allow the card reader to sit in the center position and moving the keypad to the right side.

The second problem was when we mounted the games on the bases; the drop hole was about 4 inches more in front of our universal drop chute. We had to modify our bases to allow the games to pass the AGCO inspection. Currently we have had the same problem with the Williams video. We checked the gaming floor where they worked and found that we used single bases mounted back to back with a 4 inch spacer between the bases.

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Set / Clear Procedure

1. Remove the "KEY 1" chip and install the "KEY 0" chip (or EL chip)
2. Power up
3. Push "SPIN" button to reset when prompted, message execute appears, select type of clear you want to perform.
4. Set the time and date, and save changes
5. The message "STANDARD "and "QUICK" appears select type of clear.
   - "STANDARD – partial clear, allows you to keep options and clear meters.
   - "QUICK" – full clear, clears all meters and sets the options to default.
6. Options page appears, please set the following:
   - ATTENDANT FULL LOCK – ON
   - DENOMINATION – 5 cents
   - AUTO CASH – OFF
   - CREDIT INTERVENTION – ON
   - PARTIAL COINS – 2000 (same as hopper limit)
   - MAX CREDIT – 2000
   - ULTIMATE FULL LOCK - $100 (same as hopper lock-up in dollars)
   - MACHINE # - 00000001 (this is to communicate the game's communication chip)
7. Power down
8. Remove "KEY 0" chip
9. Install original "KEY 1" chip
10. After game loads, turn the reset key to allow game to re-enable.

Notes:

- In the "OUT OF ORDER" state, turn the reset key to get back to game mode.
- After a hopper fill is performed, you must turn the reset key to clear.
- The BV should not be removed with the game powered up
- EL CHIP error – pull the lower tab in the EL chip socket up, over time, the lower tab does not make full contact with the EL chip.
- In the options menu, the machine # should be set at 00000001. This allows communication between the game and the communication chip.
- The board in the CPU tray is as follows from left to right: I/O AB, CD ROM with MAIN CPU BOARD ASSEMBLY, I/O BB, and communication board.
- The CD in the hard drive only loads the sound and graphics to the main CPU board on start-up. It is then not used for anything else.
- When using the EL chip 0 for clearing RAM, make sure that the tag has the correct game theme. The EL chip enables you to set the denomination, percentage, and max coin.
- When turning the reset key with the door closed, this allows you to get into soft meters. If you are still in the menu and you open the door, the diagnostic and other menus appear.
- EM COUNTER ACCESS must be set to the "ON" position. This is to enable the hard meter operation.
- Last event recall goes back up to 40 games.
- Last bill recall goes back 16 bills.
- Any bonus rounds or games are included in the 1 game during last event recall.
- Insert "CANADIAN BILLS ONLY" and "MACHINE PAYS UP TO 2000 COINS' disclaimers, which must be added to the front of the game.
- The power supply is removed easily by undoing a thumb screw and sliding the unit out.

Diagnostics Mode

COIN ACCEPTOR – **enable – acts like coin lock out**
BILL VALIDATOR – **enable – enable- test bill acceptance**
COIN HOPPER – **hopper test**
IN-PORT – **test all inputs on the game**
OUT-PORT – **test all outputs on the game**
THERMOMETER – **locks game out at 158 F degrees**
SOUND – **allows the adjustment of all sound- set to 12**
SCREEN - **screen test**
COMMUNICATION INFORMATION – **check if game is communicating with the Mikohn system**
GAME TEST – **reel strip test**
EM COUNTER – **allows you to enable or disable certain hard meters**

The Field Trial

With Konami Gaming being approved in other gaming jurisdictions, we had the chance to add 8 games to the gaming floor under the condition that we monitor all problems that we encounter with the game and the Mikohn System and report it to the AGCO. Since August, when the games were first introduced on to the gaming floor, we have not experienced any major problems with the game. The only problem that we did encounter was a 480 CD ROM error. We swapped CDs with another game and the problem has not come up yet. Currently we only have two themes approved: "3 Free Wild Bee's" and "Treasures of Tulum." We are waiting for more to be approved for Ontario.

Where to find them?

Konami machines can be found at konamigaming.com on the internet. By filling out a small registration form you are able (upon approval) get customer notifications, manual information and PAR sheets.

- Kevin Noble
knoble@slot-techs.com

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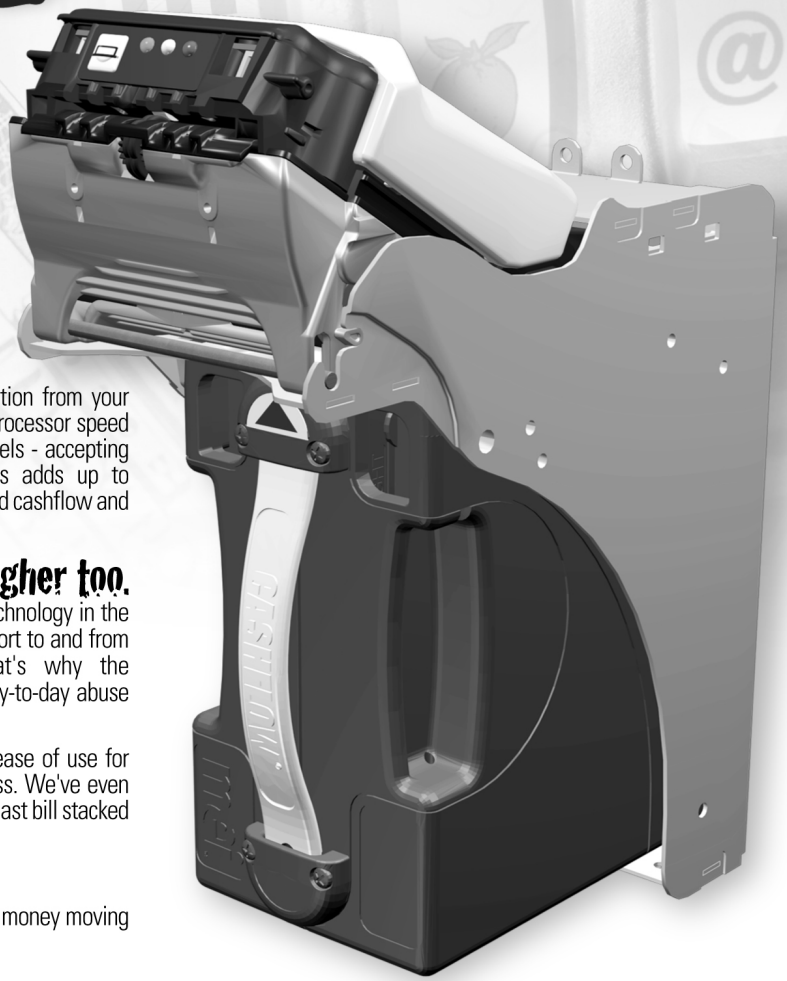

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Fuses

By Herschel Peeler

This installment is about Fuses. Those sweet little creatures that give their all to protect other circuits in the event of an over-current condition. We will spend most of our time on two major types, based on popularity. There are 1/4" x 1 1/4" size, and the smaller 5mm x 20 mm size. Both come in a variety of fashions, either Fast Blow, or Slow Blow, glass case or ceramic case. Toward the end, we will consider other current limiting safety devices.

Fast Blow fuses are used to protect semiconductor circuits where excessive current is a major indication of a serious problem. Excessive current for even a short time can do major damage to semiconductor circuits, so we want the fuse to react quickly.

Slow Blow fuses are used in circuits that we expect a surge of high current for a short period. With inductive devices (such as solenoids and motors) and fluorescent lamps, we expect to draw a high current for a short period of time before settling down.

Either type of fuse will sustain a slight over-current for a certain length of time. For fast blow fuses, this is more in the range of 25% over the rated value for tenths of a second. For slow blow fuses, this may be 100% over the rated value for a few seconds. In either design, the fuse is a metallic element that gets hot as current passes through it, and it melts. The element is usually some metal with a low melting point.

It is normally a good practice to replace a fuse with the proper type and current rating. When we get around to bench troubleshooting we may make exceptions to that policy, but not on the casino floor. In a game, always replace the fuse with the proper type.

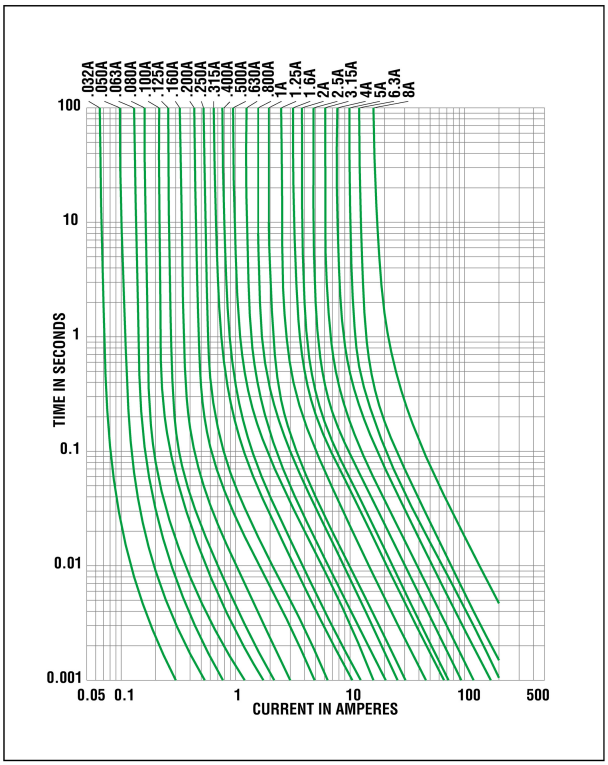
Editor's Note: Notice Herschel said "replace the fuse with the proper type" and not "replace the fuse with the same type that came out." You are not the only technician to

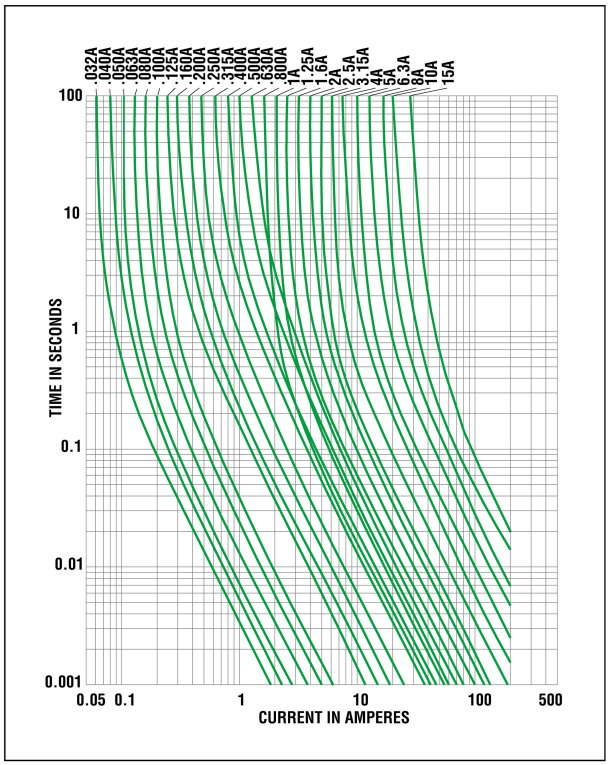
5 x 20 mm Time Lag Fuse (Slo-Blo® Type Fuse)

ELECTRICAL CHARACTERISTICS:

% of Ampere Rating	Ampere Rating	Opening Time
150%	.032–.100	60 minutes, **Min**imum
	.125–6.3	60 minutes, **Min**imum
210%	.032–.100	2 minutes, **Max**imum
	.125–6.3	2 minutes, **Max**imum
275%	.032–.100	0.2 sec., **Min.**; 10 sec. **Max.**
	.125–6.3	0.6 sec., **Min.**; 10 sec. **Max.**
400%	.032–.100	.04 sec., **Min.**; 3 sec. **Max.**
	.125–6.3	.15 sec., **Min.**; 3 sec. **Max.**
1000%	.032–.100	.01 sec., **Min.**; 0.3 sec. **Max.**
	.125–6.3	0.02 sec., **Min.**; 0.3 sec. **Max.**

Slo-Blo fuses allow a load to draw high current for short periods of time but will open circuit when time and current ratings are exceeded. Notice from this chart how a circuit might draw more than double the fuse's current rating for as long as two minutes before blowing and up to an hour at 150%!





Here is another way to look at fast-acting Vs. Slo-Blo fuses. On the left is a graph of time/current for fast-acting fuses. Compare that to the graph on the right for Slo-Blo fuses. The graphs might seem a bit confusing when you first look at them but they actually make a lot of sense. Each of the curves is for a fuse of a different current rating. Just pick one of them (say, 1 amp) and ignore the rest and you'll see how the graph shows the time it takes for the fuse to blow in the vertical direction (y axis) in comprison to the amount of current drawn across the fuse by the load in the horizontal direction (x axis).

work on a machine. If the technician before you has used too light of a fuse (one with a lower current rating) you may find yourself chasing a problem that doesn't exist. Of course, too heavy a fuse can cause damage to a host of other components or circuitry. Always consult the fuse labels or placard if you are uncertain of the fuse rating.

There is no standard part numbering system used between the various manufacturers. Major manufacturers each have their own part numbering system, even though the fuse itself may be identical. The "Standardized Parts List" available from the Bench Tech forum (Delphi forums) contains a cross-reference to find equivalent part numbers and a description of the part.

The older "American" standard part is cylindrical, and 1/4" in diameter, 1 1/4" long, with metal caps on each end. The body may be glass, or ceramic. Glass is cheaper and allows you to visually inspect the fuse. Ceramic bodies are used for higher temperature environments, usually.

The more modern body style is also cylindrical shape also, but is physically smaller, 5mm x 20 mm, and also comes in glass or ceramic body styles. This style has the advantage of taking up less board space, and more popular acceptance worldwide. There is no other engineering advantage of one over the other.

Fast blow fuses normally have a simpler internal structure than slow blow fuses. Slow blow fuses are more complicated inside and look like springs. The objective is to have a way of dissipating the heat for a few seconds before blowing.

Fuse Forensics

Problems in games that cause excessive current may be extreme or marginal. In extreme cases, like a shorted capacitor or a pinched wire, the over-current is excessive. You can see that the fuse has literally exploded. Look for something major to be wrong.

If the fuse is only open in a small point in the middle of the fuse, and sagged before finally blowing out, the problem may not be so obvious. In these cases, the over-current was marginal for an extended period of time. Such symptoms indicate problems like coils that are slowly changing in value as they go bad.

Diverter coils, for instance, if not properly adjusted when they were installed, will get hot and short out over a period of months. If the plunger in the coil does not move fully into the coil when activated, the coil will have less inductance than when properly adjusted. This means lower resistance and higher current, which cause the coil to heat up while it is activated. Over a period of months, the heat breaks down the insulation on the coil windings and the windings will short together causing more current, more heat, more damage...

As the coil slowly decays, it draws more and more current over a period of months. The fuse finally gives up its life. These bad coils can be found using an ohmmeter (with game power off, of course). Any change of 10% or more from what a good coil measures, is an indication of a problem and warrants changing the coil.

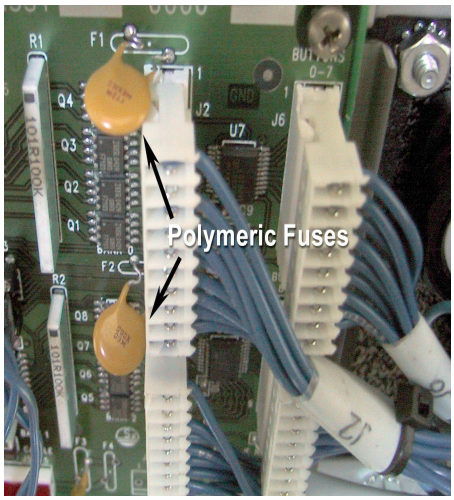
Satisfying Substitutes

Fuses are not the only option for over-current problems. Circuit breakers have an advantage in that they can be reset. The disadvantage is that they are more equal in operation to slow blow fuses. It takes a while for the thermal operation of a circuit breaker to react. This is often too long for the protection of semiconductor devices. Games that use circuit breakers will also have a separate fuse in the power supply that feeds power to the logic board.

Poly fuses work much like a self-resetting circuit breaker (see Slot Tech Magazine September 2001). These wonderful little devices look like capacitors and act like a slow blow fuse. Many I/O boards have gone to using these to protect individual components. Many have a poly fuse on each output line. IGT, to mention one, has done this. There is advantage and disadvantage to these. The advantage is that problems in one circuit (Diverter coil, for

instance) will spread no further than that circuit. The disadvantage is in troubleshooting. If the diverter coil, as mentioned above, causes the poly fuse to overheat the poly fuse opens up the circuit, as a fuse would, and the diverter stops working. The diverter stops working and the hopper overflows with coins. The Slot Attendant comes along, realizes the game has a serious problem, and turns the game off. In the morning the tech is called in to look at the game. By this time the game has had a chance to cool down, the diverter works normally, and the game appears to have no problems. The tech scratches his head and puts the game back into service. After a day of heavy play, around 2:00 am, the poly fuse heats up again and the problem comes back. This same story can happen with any output. Lamps, hard meters, you name it.

Polymeric fuses come in different packages. The PFSM is popular on IGT's small I/O cards.



Surface Mount Devices

As does just about everything these days, fuses also come in surface mount packages. Like everything surface mount, it's hard to tell one part from another. The cases vary in structure from "big enough to recognize as a fuse" to "just another small flat rectangle." The smaller ones are usually white, which makes them easier to recognize. The lettering may, or may not, indicate the current rating.

The biggest problem with the small ones is that when they go bad, it destroys the writing on the fuse and you can't tell what amp rating it was.

To makes this really interesting, some people, like IGT, may use a small value resistor (10 ohms) on the board as a fuse. The wisdom is simple. Resistors cost a penny. Fuses cost a dollar. The function is the same. When enough current passes through the resistor to exceed the wattage rating of the resistor, it burns up.

Catalog Number	Ampere Rating	Marking Code	Voltage Rating
0466.125	.125	B	125
0466.200	.2	C	125
0466.250	.25	D	125
0466.375	.375	E	125
0466.500	.5	F	63
0466.750	.75	G	63
0466 001.	1	H	63
0466 1.25	1.25	J	63
0466 01.5	1.5	K	63
0466 1.75	1.75	L	63
0466 002.	2	N	32
0466 02.5	2.5	O	32
0466 003.	3	P	24
0466 004.	4	S	24
0466 005.	5	T	24
0466 007.	7	U	24

Cracking the Code: Here is Littlefuse's code for their SMD type 466 very-fast-acting fuses. As you can see by the letter N, we are looking at a mess of itty-bitty, 2 amp fuses on the left.

Troubleshooting Boards With "Bad Fuse" Problems.

As mentioned earlier, always replace a fuse with one of the same type, unless...

Well, here's the exception. Given the example of a bad Door I/O card on an IGT 960 series game. The "fuse" (a 10-ohm surface mount resistor) has gone up in smoke. Suspected problem is a shorted cap or smoked IC. No visual damage other than the "fuse" is obvious. The fuse has done its job and given up its existence to protect the board. The obvious thing is to throw the board away and buy another.

BUT NO!!! We have to be technicians and fix this puppy. We replace the "fuse" with a small piece of wire and apply power again, keeping our finger on the power switch. Not having the safety net of the fuse the shorted capacitor now overheats, turns brown, and gets real hot. We quickly turn power off and replace the bad capacitor and the fuse. For $0.10 worth of parts and ten minutes of work, we repaired a $100 board. I think that is worth it.

As with any "break the rules" remedy, we stand the chance of doing damage to the board. Such extreme current required to smoke a bad filter cap or IC can destroy the circuit board as well. Tiny clad runs that make up the circuit are easily destroyed. But the board is already considered bad and is written off. We are talking about ten minutes of time and a few pennies worth of parts in an attempt to avoid a $100 loss. I have about a 90% success rate finding bad filter caps with this method.

Happy troubleshooting

- Herschel Peeler
hpeeler@slot-techs.com

Fuses come in ceramic as well as glass. No, it's not just to make your life more difficult. These are high-current, high-voltage, "non-explosive" types.

Money Controls Announces Website

Money Controls has recently announced a complete revamp of their website at **www.moneycontrols.com**

"No other site takes the customers step by step through the complex world of notes in, coins in, coins out, tickets in, tickets out making trouble-free one-stop-shopping a virtual reality," according to a Money Controls press release. "It is vital that customers understand what each product is capable of and which are most suitable for their needs. Therefore the easy-to-navigate pages begin with a simple home page."

The Product Solutions section is clearly broken down into each of the market segments. Money Controls product options are illustrated with images, explanations and downloadable brochures, making the entire product specifying process as easy as it can possibly get.

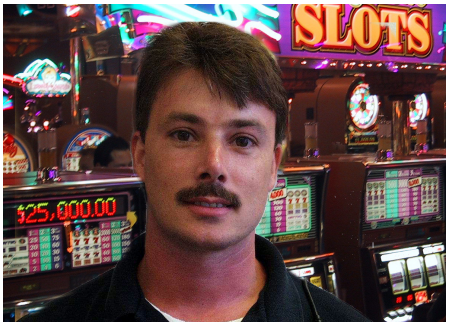
This is no mean feat considering the fact that the Money Controls range of acceptors and hoppers is the largest in the world. However, the website, like its products, is designed to provide customers with comprehensive solutions, tailored to meet their exact needs. Problems can be solved on-line with 24-hour technical support, or by downloading technical manuals, and customers can even request training.

In addition to product information, this site provides a wealth of information for the gaming industry. Visitors can check out coin specs, find out answers to technical FAQs and read technical bulletins on the site. It even has an industry portal, detailing the latest trade news, exhibition dates and updates in legalization.

And for anyone wanting to look further afield, the Money Controls website provides contacts and links to the entire distribution network.

The company's credentials are also clearly outlined on the website. Check out the "About Us" section for an international company overview, an outline of Money Controls' dedication to quality – and for a true expert opinion, the MD's View.

A word to Management



By John Green

It never fails. You find an excellent employee, hire them, train them and then they quit. It has happened to every business at one time or another. You can always expect some quantity of turnover in your staff, but there are ways to help retain your good employees. Some job markets are tough and finding a good, solid candidate for a slot tech position can be frustrating.

When you finally have a good crew, it's like a well-oiled machine. Sure, there will be a few squeaky parts now and then but normally, a little maintenance and your problem is fixed.

A good employee is a company employee; they are not just working to pick up a check. Of course, everyone needs a check but it's more than that. A good employee actually doesn't mind coming to work every day. A good employee cares about the company and will accept responsibility, even when they're "in trouble."

When good employees come to you with a problem, drop anything you're doing and make them important. Make them your priority. It doesn't cost you anything to listen and it may not cost your casino a dime to remedy a complaint that he or she has or to implement an idea that would make everyone's job easier.

Obviously, not all problems can be fixed. This may be due to jurisdictional or other policies. If that is the case, make certain that you explain the reason so your employee doesn't feel like they are getting the brush off or that you are giving them the cold shoulder. Why not make them feel important for a minute? Try to get an understanding of what their day is like and what makes a day on your casino floor challenging.

Another problem that happens is promoting a tech to supervisor just because they are a good tech. Two things potentially wrong with this: One is that you lose a good tech, another is that you may have gained a bad supervisor. It is always a good idea to promote by merit and leadership, not by job knowledge. One way to run off techs is to have a bad supervisor. A good supervisor will always take up for his / her techs and even cover their butts when necessary. When you have a good crew and a good supervisor, they will compliment each other, and it always rolls uphill. If you have the opposite, everything always rolls downhill and it's usually not a very pleasant work place.

I am not a believer in buying performance, however, I think you should reward your good techs. I read once that there are two things people want more than sex and money: Praise and recognition (at least at work). These are things that will not cost your casino a penny to use. A little recognition for a job well done goes a long way toward making your employees feel important (as long as it's not given too often). Too many will take away the power of an attaboy.

Invite one of your big bosses to come in and tell your crew "good job" when they finish a project early or discuss letters from a customer that commends a tech. I'm talking about the Vice President of your department or Senior Vice President of your property. If your crew is given five weeks to install a new player tracking system and it's finished in three weeks, have that VP come in and tell your crew how much they kick ass and that the casino would have to close the doors without them. Make sure they do it face to face or in a shop meeting and not in a note or letter as this will make it more personal. Of course, a little something extra in your paycheck never hurts. It's always good to discuss upcoming projects with your techs. Talk

about ideas that you may have or plans that are in the works. You will get plenty of feedback and it will build trust with your team.

It has been said, "Knowledge is power." Most HR type seminars will preach empowerment. I have faith in that plan. If you allow your techs to make more decisions while dealing with customers or machine problems right when it happens, the less-severe problems can be eliminated on the spot. Your techs will have more confidence. Job quality will increase while customer down time will decrease. A good crew, combined with empowerment, will run on autopilot.

There is no better feeling than being able to give a project to a technician without going over all the fine details (micro management) and not having to worry if it gets done. To me, empowerment builds confidence. Confidence, in turn, allows a tech to see a problem and fix it without having to second guess themselves or call a supervisor.

Confidence also flows over to customer relations. When a customer is in need, technicians that are empowered and confident in their abilities can answer questions or assist in ways a micro managed tech can't even imagine.

Techs shouldn't be afraid of jumping in and doing any kind of task. It's just a casino. This isn't a nuclear power plant or bomb factory where people can get hurt if a mistake is made. Say it with me, "It's just a casino." The world will not end tomorrow if all the machines don't get tested or converted this instant. It may piss off a few bosses, but hey, you can survive that.

Cut your better techs a little slack. Most likely, they are going to make more mistakes than your slacker techs, regardless of the fact that they have the same job.

It sounds odd but let me explain: A good tech will answer more calls and touch more machines than a slacker, so the opportunity for making a mistake is greater. It's not that they don't know or don't care, it's the fact they are busting butt to do the job and just made a mistake. It happens. This is where a good supervisor steps up and makes it right. When the manager throws his fit, the supervisor has to stand behind his good techs and smooth things over. A slacker tech that never does much of anything, never has a chance to make mistakes.

Why not let some of your good techs sit in on a few job interviews? Once the interviews are complete, ask them for their advice on whom they liked and disliked and why. Find out if the new hire candidates are people that they want to work with everyday. We have used this system in the past and it works well. I believe the technical term for this is "peer hiring." Once again, it makes your techs feel more involved; they feel more important. Even though they don't have the final say in the hiring, at least they are involved in the process.

Do the same for in-shop policies. Allow your people to have some kind of involvement. For example, we once had a shop meeting with all the techs. One of the topics of the meeting was about what color T-shirt everyone had to wear under their tech shirt. It seems trivial, but some techs wore white, some black and some brown. Instead of the manager picking the color, saying "that's final" and having a lot of bellyaching in the background, he let the techs decide with a majority vote. He didn't care about the outcome, just pick one and let him know. Everyone was involved with the decision.

There is one rule that everyone should follow that I feel is very important. Don't hire out of desperation! Don't give in to hiring with the assumption that you can change a person. You can't. Forget it. If you interview and can't find a good slot tech candidate, wait for more applications. If you hire a tech with good qualifications but one that has an attitude problem, when you're not around, that person will cause grief among all your techs and maybe even across departments. The only thing a bad employee will make is more bad employees. It's like marriage. You can't change a person no matter how good the intentions. You may live together for a while, but if you constantly try to change your partner, your relationship will eventually crash and burn. A good crew will weed out a bad tech with great efficiency. Your only option when you can't find a candidate with good tech skills is to hire by personality and train the slot tech part. This can actually be a good approach. They have a fresh look at everything and haven't established any bad habits.

This is off topic and more of a rant, but why are most memos posted on the bulletin board often written in a negative way? "If you do this, your fired", "If you do that, your fired", "If I catch you doing this, this and that, youuuuur FIRED". Drives me crazy. Although our company doesn't do this to an extent, I have worked places where this is the norm. When writing a memo or such, just explain the problem, the solution and maybe even an explanation. It's just plain easy. This is your workplace and you can set the mood any direction you want. Why fill it up with negative things. A simple reminder of a policy can be as easy as "We need to pay closer attention to this" and then copy and paste the policy to the memo.

I don't know, maybe I live in a fantasy world. I have worked for people that were total asses, but in their defense they were consistent, no surprises. Bosses that try to play both sides are the ones that will bite you when you don't expect it. You get away with something one day and then a week later your get written up for doing the same thing. Scary stuff. Be consistent, whatever your style may be. Stick to your guns when things get a little out of control, don't second guess your decisions, empower your people, stand behind your team in good and bad times, keep everyone informed and "in the know." If you can do these things, your people will follow your leadership without doubt and even defend their department and the actions taken within the department.

Convert those so-so employees into company employees. For example, look at Ken Locke. He said in one of his articles in Slot Tech Magazine that he gets a lot of crap because he works for IGT, mostly things that are not in his control. He said he digs his job and the things that people rant about don't bother him. If he didn't dig his job, when others complain about IGT, he would join in or even add some things to make himself fit in. To me, this is a company employee and the people that dig their jobs are the people you should want working for you. I guess the moral to all this is to make a work environment where people can dig their jobs.

Thanks for listening!

- John Green
jgreen@slot-techs.com

TechFest 4 Sold-Out in Minnesota

Slot Tech Event

75 slot techs from across the northern United States and as far away as the United Kingdom joined together at TechFest 4 to learn from the gaming industry's most experienced technical instructors. The TechFest was held at Grand Casino Mille Lacs in Onamia, MN . This was the world's largest gathering of slot machine technicians.

Left: SuperTech Brian Carty of Advanced Electronics Systems (see their website at http://gamingstuff.com) gave an excellent presentation on the Seiko printer on the first day of TechFest 4 and another on MEI bill validators on day two. Below Left: Brian was inundated with questions during break.

Right: Tom Talbot of JCM presented a detailed discussion of their WBA bill validator, including cleaning and troubleshooting procedures. He also brought along a hundred pounds of coveted items such as pocket screwdrivers, flashlights, flip charts and, of course, "nerd-packs" (AKA pocket protectors).

Right: Michael Harris of Coin Mechanisms, Inc. cracks up the class during his presentation on Coin Comparators.

Also presenting at TechFest 4 were Don Seagle of Asahi Seiko (coin hoppers) and Gary Moranville from Sencore (test equipment).

Below: Presenting the world's largest gathering of slot machine technicians at TechFest 4.

Anticipation & Expectation

ATRONIC at EELEX 2002

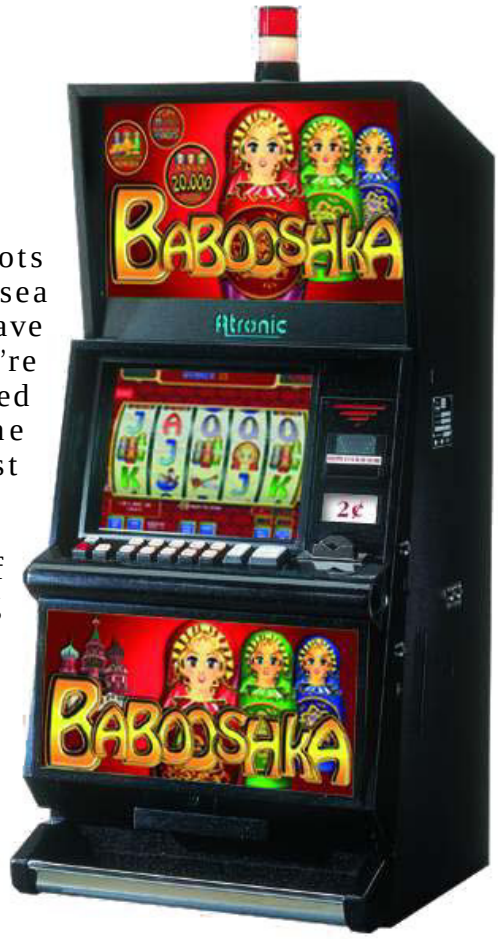
The success and elation felt within the Russian market for Atronic in the past years has created great anticipation and excitement in wake of the most popular Gaming Show for Eastern Europe, EELEX. Opening its doors from 14th-16th December in the Expocentre, Moscow, Atronic will be exhibiting a thrilling fusion of new game designs and products in a show that is destined to create a high level of attraction, enthusiasm and curiosity.

Atronic, located on the Unicum booth will display many of its most thriving games including Sphinx II and Babooshka as well as unveiling a wide range of new games within the popular Cashline Series including the mystery of the enchanting water world of Atlantica. It is here that the beautiful mermaid will guide you through the land where you can enter the mermaid bonus and try to reach the valuable treasure of Atlantis!

Other new games within the successful Cashline Series will include the comical capers of the circus in Clowning Around, the mystical world of horoscopes in The Sign of the Zodiac, and the wonderful theme of dreams and wishes in Dream Maker. Spend a day at the seaside with Beach Patrol, play the cool and collected IC CASH, sweep the board with the top prize winning Jumping Jackpots and catch some sun, sea and success with Wave Watchers - and if you're brave enough be prepared to be spooked in the haunted house of Ghost Hunter!

The fascination of Atronic's first stunning progressive tower box game Sphinx Magic, which is based on the globally successful theme of Sphinx is also sure to create great excitement through its high hit frequency, unique multi-level progressive and the interactive Magic Bonus Card feature. Featuring an elegant, Las Vegas style tower box package with 3 meters and Atronic´s unique bonus flip card bonus, Sphinx Magic is sure to attract a high level of play and attention.

Atronic has enjoyed huge success in Russia, which has been boosted through the collaboration and representation of the distributor Unicum. Levels of interest and sales have proved to be fascinating and are continuing to grow. Unicum's contacts, knowledge and experience have turned Russia into one of Atronic's most important markets, with Russian operators embracing the new slot technology, high quality graphics and bonus features of Atronic´s GREAT GAMES.



Partnership of Quality for Atronic Technical Support

An advanced and specialized form of technical support is currently underway due to the new collaboration of Atronic and service partner Reel Games. The joint venture will exclusively serve Atronic customers in Curacao, Aruba, St. Maarten, Barbados and the Dominican Republic.

This relationship will ensure faster reaction times and minimized lead times for spare parts within the Caribbean region for Atronic customers. It also guarantees valuable customer feedback to further improve Atronic's technical service that is committed to create a form of support dedicated to constant re-evaluation, development

and enhancement.

Reel Games, which is well-established in the Caribbean region, will add to the "Great People" technical team at Atronic.

Meanwhile - In the USA . . .

Atronic Approved for Tokenization in Nevada

Tokenization has arrived! Atronic is now approved to enable the tokenization software in their games for the Nevada market.

Tokenization has been a highly sought technology option for slot directors. Tokenization provides players with more game denomination options and less hopper fills, which leads to a more pleasurable gaming experience. Through tokenization, games can be offered in multiple denominations, including the increasingly popular 1 and 2 cent games. With this new technology, a player can cash out, and instead of receiving a bucket of coins, they may only receive a handful. On the operator side, tokenization helps with reduced coin handling which means a faster turn around time for payouts and a lower overhead.

All of Atronic's games are tokenization ready, but until now, Nevada operators were unable to utilize this beneficial feature. "Atronic has had great success with tokenization in the Midwest and Eastern jurisdictions and now Atronic will be able to provide one more option to the casino operator and player," commented Joe Bailo, Chief Sales Officer of Atronic.

Atronic Plans to Launch 'Arizona Magic(R)' Wide Area Progressive for Arizona

Atronic plans to launch a Wide Area Progressive (WAP) link called Arizona Magic(R). Atronic will operate Arizona Magic(R), which is the first WAP developed exclusively for the Arizona market.

Arizona Magic(R) is the first WAP link developed for Arizona, where Atronic American is headquartered, so carries the slogan "Arizona Jackpots for Arizona Players." Arizona Magic(R) is Atronic's first WAP within its WAP strategy. "We are proud to be an Arizona company offering a unique experience for local players. Arizona Magic(R) features exciting and interactive games and a multi-level jackpot designed to hit frequently. And the money stays on Arizonian ground, which is important to both our casinos and players. Further, our close relationship to our tribal partners is being confirmed by our progressive structure, while our close relationship to the Arizonian players is ensured through the close network of our Arizona Magic(R) internet-site," said Joe Bailo, Chief Sales Officer of Atronic Americas. Atronic plans to launch the Arizona Magic (R) link in November.

The first game on the Arizona Magic(R) link will be Sphinx Magic. Sphinx Magic was designed for success in Arizona casinos, and features a stunning display, a unique multi-level progressive and interactive Magic Bonus Card feature, supplemented by the globally successful Sphinx brand.

Arizona Magic(R) may be found at casinos throughout Arizona, including Desert Diamond, Casino Arizona, Hon-Dah, Apache Gold, Mazatal, Ft. McDowell, Gila River Casino and Harrah's.

To find out more information about Atronic, please visit the Web site at www.atronic.com or call 800-864-7670.

London's International Casino Exhibition Set to Rewrite Record Books

- 138 exhibitors from 28 nations
- Net space to approach 7,000 sqm. (75,000 sq.

London's 2003 International Casino Exhibition (Jan 21-23) is set to consolidate its status as one of the industry's key events, according to the latest figures released by show organisers.

As of the beginning of October, a total of 138 companies from 28 nations had confirmed their presence. With just under three months remaining before the doors open, net booth space is expected to reach close to 7,000 square metres (75,000 sq.ft.), a record high for the event, which was launched 14 years ago.

Of the 138 exhibitors to have confirmed their attendance, 47, just over one third, are from the domestic UK market. The USA is represented by 12 companies, followed by Spain (10), Netherlands (8) and France (6). The remainder is made up of exhibitors from Austria, Belgium, Canada and Slovenia (5 each); Australia, Germany, Italy and Japan (4 each); Israel, Russia, South Africa and Sweden (2 each); and Antigua, Argentina, Brazil, Bulgaria, Finland, Ireland, Malta, Norway, Slovakia, Switzerland and Taiwan (1 each).

The largest booth has been reserved by Austrian Gaming Industries' Novomatic, whose showcase will cover an area of 807 sqm. (8,683 sq.ft.). A total of 19 companies will have stands in excess of 100 sqm. (1,076 sq.ft.), with a further 19 occupying stands of between 50 sqm. (538 sq.ft) and 100 sqm. (1,076 sq.ft.).

"This January's show will offer visitors the widest range of new products and services ever seen at the London show." **- Karen Cooke**

Whilst organisers are reluctant to predict visitor figures, the strength of the exhibitor base, together with the program of gaming deregulation being explored by the UK government, augur well for the London-based International Casino Exhibition. In 2002 the independently verified ABC (Audit Bureau of Circulations) visitor attendance for ICE stood at 4,905. This excluded the estimated 5,000 crossover visitors from the co-located ATEI exhibition, which covers a broad spectrum of electronic leisure entertainment from coin-operated amusements to soft gaming to online tournament games.

Exhibitors vote to keep ICE opening hours

An overwhelming majority of exhibitors at ICE 2003 have elected to keep the opening hours of the London show unchanged.

More than 72 per cent of those who responded to a survey conducted by show organisers opted to keep the current times. 16 per cent were in favour of the show remaining open for an additional hour on the first day (Tuesday 21 January), whilst just over 11 per cent preferred the option of doors opening an hour earlier on all three days.

The opening hours for ICE 2003, which takes place at London's Earls Court Exhibition Centre, will be as follows:

Tuesday 21 January
11.00 - 18.00 hours
Wednesday 22 January
11.00 - 18.00 hours
Thursday 23 January
11.00 - 16.00 hours

More than a quarter of new companies at ICE 2003

No fewer than 37 companies from 18 countries will be making their first ever appearance at the International Casino Exhibition. The figure represents more than a quarter (26.8 per cent) of the total number of exhibitors (138) to have confirmed their stand space at ICE 2003 by the beginning of November.

Heading the list of nations featuring débutants at ICE 2003 is the domestic (UK) market, with 15 brand new exhibiting companies. Four of the ICE newcomers are US-based, whilst Australia, Netherlands and Spain provide two each, with the remainder coming from Bulgaria, France, Germany, Italy, Japan, Malta, Norway, Russia, Slovenia, Sweden, Switzerland and Taiwan.

The largest booth has been reserved by Austrian Gaming Industries' Novomatic, whose showcase will cover an area of 807 sqm. (8,683 sq.ft.).

Karen Cooke, sales manager responsible for ICE, commented: "With over a quarter of all the companies at ICE exhibiting there for the first time, this January's show will offer visitors the widest range of new products and services ever seen at the London show. Everything is now set for the best show on record, it will be a event that no operator in the gaming business can afford to miss."

For more information on ICE 2003, including online registration for free entry badges, visit www.ice-london.co.uk

Kortek Replacement Chassis Offered

In the not-so-dim-and-distant-past, Kortek produced a 17" Slantop monitor that was distributed by Telco under the Telcovision brand name and sold to IGT for use in their 17" Slantop video games. IGT's part numbers for this monitor were 69918900 and 69921000. The manufacturer's model number was the KT1703VA series with a Phillips CRT, and was manufactured around 1999.

This monitor had a problem of blacking out as the result of too much heat caused by improper ventilation. The timeframe under which it blacks out could be anywhere from six months to a few years depending on the location. Kortek's service center, Casinotech, still gets calls on these monitors.

The nature of this overheating problem is such that over time, it has shortened the life of many of the key components, mainly the electrolytic capacitors. The problem often shows up when the games are turned off and moved around. The caps, even though defective in one way or another, have settled into a certain mode of operation. When that mode is disrupted (by cooling off when the game is turned off) they will quickly fail or blow when the game is turned back on. This is the pattern that has been reported by casinos.

The monitor is long out of warranty, and Kortek does not offer this model anymore. However, Kortek has worked with their service center, Casinotech, to develop a replacement board based on its current board design. They have taken their current board, which is proven in the field, and redesigned the neckboard to accommodate the mini-neck Phillips CRT, as well as some key driving components on the main board for the CRT's deflection yoke. This new board is called KT1703NP and is currently offered by Casinotech, Kortek's authorized service center in Las Vegas.

Because the board in this monitor has been subjected to high-heat for such a long time, it has created many potential problems. You may

KORTEK CORPORATION

Technical Notice

1.	**Kortek Part# Affected:**	Kortek# KT1703V (AXXXXXXX); Any Kortek 17" with Phillips CRT
2.	**Kortek SN Affected:**	All
3.	**IGT Part # Affected:**	IGT# 69918900, 69921000
4.	**Problem Symptoms:**	Monitor shut down or black out. Problem found after 1.5 – 2 years of use
5.		Problem due to critical heat condition inside monitor as result of inadequate
6.		cabinet ventilation; internal heat beyond rated spec of monitor
7.	**General Solution:**	Varied. Best to replace entire 3pc board set
8.		Can try replacement of select electrolytic caps which have dried up as result of
9.		High heat over extended period of time.
10.	**Details of Solution:**	Replace board set by contacting Kortek authorized service center.
11.		
12.		Repair may be possible by replacing the following components:
13.		- C107, 100uF 25V cap
14.		- C108, 47uF 50V cap
15.		- C123 470uF 25V cap
16.		- C126 100uF 25V cap
17.		
18.		Generally, any large value electrolytic in power supply, horizontal and vertical driver
19.		circuits or Xray detection circuits. Note that any of these caps whose value drops more
20.		than 15% may cause problems; some of these caps dropped over 50%.
21.		
22.		Faulty C418 and C419 caps will cause horizontal hold problem. Replace.
23.		
24.		
25.		
26.	**Handling Procedures:**	Replace board set by contacting Kortek authorized service center.
27.		
28.		Replace components stated above with commonly available substitutes. You may
29.		exceed the voltage and temp spec.
30.		
31.	**Accounting Procedures:**	None.
32.		
33.		
34.		
35.		

Kortek Authorization: Richard Landry **Date:** 11/15/00

Form#TN03, 12/98

want to forget about replacing all the bad components and simply replace the entire chassis. The repair pattern on this monitor is to repair it and bring up, but soon after, it returns to the shop. It is then fixed again, but soon returns. After four or five times, the tech gives up and replaces it with a new monitor. Although it is the policy of Slot Tech Magazine to support component-level repair whenever possible, in this case, it might be better to replace the board set on the first go around.

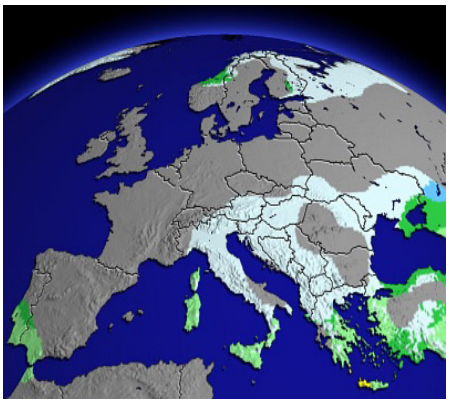
The price of the KT703N board is $150.00 The price of the KT903N board is $160.00

For further information, contact:
Casinotech
2470 Chandler Ave., #7
Las Vegas NV 89120
Tel: 702-736-8472,
Fax: (702)920-8678,
Email: Casinotech@lvcm.com

- Slot Tech Magazine

International View

By Martin Dempsey



Two New Arrivals At Maygay

Lee Gregory, Games Design Director for the Maygay Group, is delighted to announce the appointment of Neil Spence as Games Development Manager. Neil, who is based in the Wolverhampton software department, takes day-to-day responsibility for the design and development of all reel-based UK and Export games with immediate effect. Commenting upon this key appointment, Lee Gregory said: "Neil comes to Maygay with over a dozen years of frontline industry experience and a fantastic record of achievement success. Our entire team is looking forward to working with him, and to making this appointment the success we know it can be." For further information, please contact Nick Hardy, Maygay Group Marketing Manager.
Tel: +44 1902 792 320.
E-mail: nick@maygay.com

Good News From 30th Enada 2002

Excellent results have been recorded during the 30th Enada, in spite of the difficult time the Italian industry is living through since the law 388/2000 (banning AWPs) was issued. Last year's records have been surpassed: 3 pavilions in the Rome Exhibition Centre were occupied by around 120 exhibitors. Visitors were around 5,300, including international guests. There were cultural initiatives devoted to youth, such as guided visits of students from some schools located near Rome and Naples. All the initiatives were a great success, particularly the Gala Dinner, during what the Genio & I Pierrot show orchestra and the Roman singer Giorgio Onorato entertained the guests. Special guest star was the Italian showgirl Barbara Chiappini, popular because she looks like Sofia Loren. For further information email: cristina@sapar.it

Vivid Launch New Website

Vivid Gaming is delighted to announce the launch of their brand new website for players and customers, which went live on the 28th of October. The new site has a brand new look and is simple to navigate, with easily accessible company and product information. The team at Vivid is committed to keeping the website up to date with the very latest news and information on visitor's favourite games. For further information please contact Sam Drakeford / Clare McMillan @ MediaWorks.
Tel: + 44 (0)113 234 5600.
Fax: + 44 (0)113 234 5601.
Email: pr@mediaworksccl.com
www.vivid-gaming.co.uk

Atronic Sun Sparkles On Opening Night Of Casino Cosmopol

In a collaboration of Swedish tradition and majestic sea views Casino Cosmopol celebrated their opening in Gothenburg Sweden on Friday 30th September. A host of celebrities and invited guests entered the VIP Party to discover the delights of the new venue and the game mix on offer. Atronic was pleased to be selected as a major supplier for the four Casino Cosmopol locations in Sweden, and took great pleasure in installing and presenting their newly released Cashline games Sphinx II, Babooshka, Typhoon Lagoon, Beetles Unplugged and IC Cash. Atronic staff were present for the installation and helped to make sure that everything went smoothly for the grand opening. The casino was pleased with the good co-operation between their service partner EssCom and the Atronic team. For further information email MSegui@atronic.com

Hare Raiser!

Global has once again penetrated the mainline AWP sector with its latest release "Who Wants To Be A Millionhare?" Following a detailed test period and excellent results the product has seen approvals being awarded from a majority of the retail pub and LBO sector, and more are expected soon. "Millionhare" features two trails - one hi lo gamble and one with movement via

the top reel. Jackpots can be found on the reels, from a cumulative shot-box or from the top of any of the seeded pots. The stunning, clear graphics with a Rich Rabbit theme and fun, humourous sounds are appealing to players in all market sectors. "Who Wants To Be A Millionhare?" will also switch to £5 to enable maximum opportunity in all market sectors and is available with note acceptor compatibility. This game is available from your usual distributor or from the team at Global on + 44 (0)1992 466481 or email Mark@global-games.co.uk or go to http://www.global-games.co.uk for more information

Maygay Poised To Unleash 'The Power'

Following on from the success of their first non-Q&A SWP concept, Subbuteo, where levels of player skill are determined by manual dexterity, Maygay are on the verge of introducing their next ground breaking game to players of itBox and GamesNet. If Subbuteo moved the goal posts in SWP, then Phil Taylor's World Championship Darts is heading straight for the bullseye! Developed in partnership with Matchroom Sports, and featuring both footage of the ten-times World Champion and genuine playing statistics against which players actually compete, Phil Taylor's World Championship Darts has been described by no lesser experts than promoter Barry Hearn and 'the voice of darts' Sid Waddell himself, as "the best electronic darts game ever made." For further information, please contact Nick Hardy, Maygay Group Marketing Manager. Tel: +44 1902 792 320.
E-mail: nick@maygay.com

STELLA International With "Always Joker" At Forbes 2002 In Prague

At the Forbes exhibition in Prague during the 17th and 18th of October 2002 STELLA INTERNATIONAL and its Czech partners LEKRAM and HORNET HOLESOV launched the latest STELLA AWP game for the Czech Republic, ALWAYS JOKER. ALWAYS JOKER is a high-speed 3 reel game, easy to understand, with gripping features! The basic game plays with 5 winlines and 2 different stakes (2 or 5 credits). The thrilling club game offers 12 different stakes from 5+5 up to a maximum stake of 5+95! See the Joker everywhere: To find out more information about Stella International, please visit the website at http://www.stella-international.de or contact Susanne Wesemann, STELLA INTERNATIONAL. Phone: +49-5741-273 515. Email: swesemann@stella-international.de

A Happ-ening Preview 2003

Growth in the last year for Happ controls Europe plus a number of new products have seen business increase in a way that seemed to buck the trend. As a result of this Happ took the decision to have a larger stand at this years London Preview in the knowledge that its market share is still on the increase. Over the last year new products have meant new interest but not many chances to show since ATE. Preview is the ideal opportunity for this and the visitor numbers justified the presence. Managing Director Ray Hazelton said, "While we have seen some areas of the industry suffer a decline our business has increased because of our policy of quality product at sensible prices" To see how you can benefit from using this range for your engineers contact Ray Hazelton or Geoff Spencer at Happ Controls Europe on + 44 (0)1843 871100 or fax + 44 (0)1843 871122. Alternatively e-mail on europe@happcontrols.com

Classic With A Twist!

Barcrest Games is very excited about its brand new Superstreak three-player machine. This new three-player game is based on the known and loved, classic single player Superstreak and is available for both bingo and arcade markets via a switchable option. Barcrest Games has added significant enhancements to the arcade version following research carried out with arcade players. Thanks to the enhanced Nudge Preview and Super Hold features on the arcade version of Superstreak, players can strategically anticipate reel spins, adding a new dimension to game play. For further information please contact Sam Drakeford / Clare McMillan@MediaWorks. Tel: + 44 (0)113 234 5600. Fax: + 44 (0)113 234 5601. Email: sam.drakeford@mediaworksccl.com

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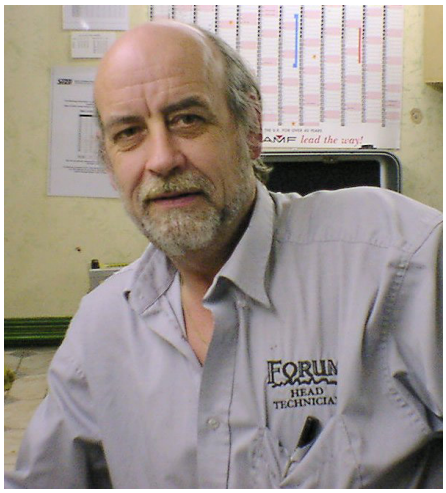
A Plumber's Guide to Fruit Machines - Part 9

By Gordon Lowe



Section 6a.
MPU (Microprocessor Unit)

The MPU is the nerve centre of the machine, the "brain" that deals with all the inputs from coin validator, buttons, door switches, opto devices fitted to reel sensors, coin level sensors, etc. This information is processed within the MPU and outputs dealt with accordingly, e.g. reel motors, payout coils and feature lamps.

At the heart of the MPU is the "EPROM" or Erasable Programmable Read Only Memory. This is the "chip" or chips that have been programmed with the required information that decides how and when the host machine operates. Because the memory size of the EPROM has increased over recent years this information can usually be stored in a single device, whereas in older machines you will find 2, 3 or even 4 EPROMs used, necessary because of the lower memory capabilities available at the time.

Section 6b.
Erasable & Programmable?

Erasable because the information that is written into the chip can be erased by exposure to ultraviolet light. This is why the "window" (the clear square in the centre) will be found covered by the identification label. Should this label be removed, it is possible for the EPROM to lose its memory when exposed to light over a period of time.

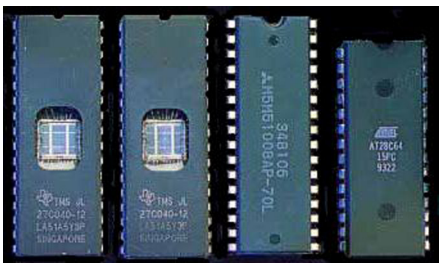
Programmable because with the right equipment, you can program or copy this data onto another chip yourself. Copying is one thing; editing or writing a program is a specialised area.

Read Only? Because the device can only be "read" (information taken out of) when installed in the MPU board, and cannot take data into itself.

Take care when removing an EPROM from its socket. The pins are easily bent out of position and once they are, you will find great difficulty in reinserting the device back into the socket. I have always found that the simplest method of removing an EPROM is to slide a small terminal screwdriver under one end, raising it no more than an eighth of an inch, then do the same at the other end raising it slightly more, return to the end you started and you should be able to remove the device from the socket without any damage.

Section 6c.
Bulletin Boards & Programming

It is possible with a PC (personal computer) fitted with a modem to communicate directly over the telephone lines with all of the main AWP manufacturers, on what is known as a "bulletin board." For those who are familiar with computers, this is similar to the way of logging onto the Internet.



Information on the bulletin board comprises the latest update on programs available and much more. By far the biggest advantage of the bulletin board is being able to access all the different programs each manufacturer has developed for all their machines. What you will require if you wish to program EPROMs with the data you have downloaded is an EPROM programmer connected to the PC and a blank EPROM of the type required. The whole process is fairly straightforward and can be completed within 15 - 30 minutes. Further information can be obtained from the various AWP manufacturers direct, just ask to speak to whoever is dealing with the bulletin board.

Often found mounted close by the EPROM you will find a 14/16 pin IC known as a 'characteriser chip' or 'GAL' fitted to protect the manufacturers program being copied without their approval. If you are exchanging the program because of an update from the manufacturer then usually there is no problem. If however, you wish to fit a program that may be considered a conversion, i.e. £4 jackpot to £10 jackpot, then you might find that a new characteriser would have to be purchased. Be warned, this may be expensive.

Always disconnect the power from the host machine when removing or replacing the EPROM. Serious damage can occur if you fail to do so. Also,

pay particular attention that you insert the device the correct way round, identified by a notch at the end.

Section 6d.
The Lamp Matrix

Data programmed into the EPROM controls all the interface sections of the main board and it is in these sections with their associated components where faults are likely to arise.

For example: Feature Lighting. Should a short on one of the lamp holders occur (and this does happen) the lamp fuse on the power supply should blow, protecting the MPU from damage. What often happens is that the associated transistor driving that particular lamp circuit will blow before, or in addition to the fuse.

The correct way to sort out the fault on the MPU is to trace the faulty lighting circuit back to the associated pin on associated connector. Then, using the circuit diagram for the type of MPU fitted (if you have one, that is. These are difficult, if not impossible to obtain from some of the manufacturers) follow the diagram to locate the defective component. This may be the correct way, but it's the hard way!

Easier: Remove the housing (if it has one) of the MPU. Using a multimeter set on ohms or diode test, go through all the transistors on the lighting bank (commonly next to the lamp drive's connector) and look for a component that gives a different reading on the meter to the others. Ninety-five percent of the time, this will locate your fault. A faulty transistor will cost around 20p, cheaper than sending the board away for repair costing between £25 and £50. Have a go; it's the only way to learn.

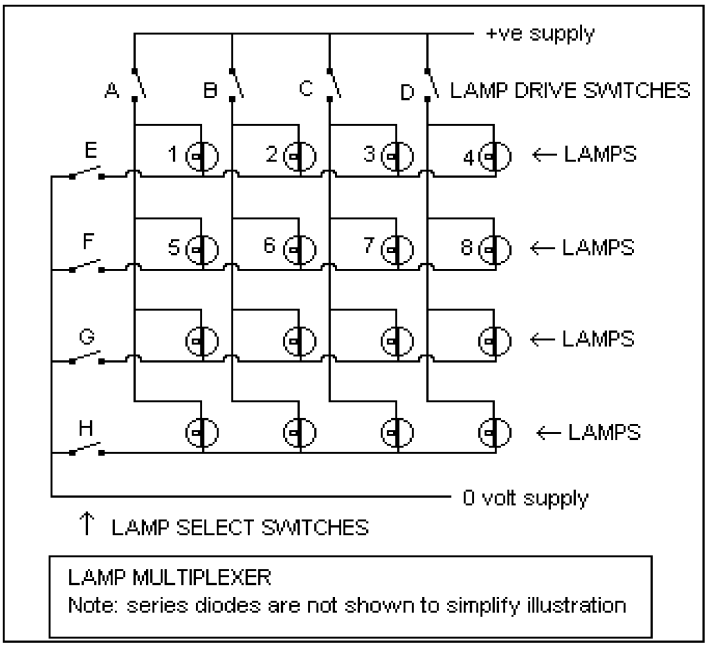
While we are on the subject of lighting, let's look at the lighting matrix. Operating at between 34 and 48 volts at its start, it must be able to drive large numbers of feature lamps (designed to work at 12 volts) without having dozens of transistors for each individual lamp.

This is achieved by configuring the lamp drive circuit in a matrix or array. For the purpose of attempting to explain this, I will substitute the transistors with switches (which is basically what the transistor is in this particular case). Shown here is a simple lamp matrix of the type we are looking at. It can be seen that by the use of 8 switches (or transistors) we can switch 16 lamps on or off. To put any one lamp on it will require 2 of the switches in the 'on' state. For example, if we want lamp 6 on then switches B and F will have to be "on" to complete the circuit.

Switches A, B, C & D are classed as lamp drives, switching the positive voltage; while switches E, F, G & H are known as lamp selects and drive the negative voltage.

Now if we take this same example and increase the switches to 16, this will give us an 8 x 8 matrix, in other words 64 lamps. So by simply doubling the amount of transistors used we have multiplied the amount of lamps by 4.

Here I would note that not all MPU boards operate this way,



but where large amounts of feature lamps are required, this is the normal practice. One example that does not incorporate a matrix is the MPU manufactured by Electrocoin for the 'Super Bar X & Super Big 7' range of machines. It does not require dozens of lamps, so each individual lamp is driven by its own transistor, in this case, four transistors are encapsulated in a single IC known as a 'Quad Darlington Transistor Array' or ULN2003, so one IC will drive up to 4 lamps.

Why the high voltage used from the power supply to attain 12 volt as the end result?

The lamps are actually pulsed at a rate of around 2 micro seconds out of every 16, as a result of the higher voltage the outcome is that the lamps are of a brightness similar to being supplied directly with 12 volts. If the voltage is measured with a standard voltmeter then it would appear to be only around 4 volts. This is due to the 34 volt supply being pulsed at one eighth of the time. Of important note is the diode across each individual lamp where fitted. The diodes are there to stop current feeding back into other parts of the lighting circuit that we do not require lit. For this reason, it is critical that when replacing the lamp holder that wires are reconnected in the same order they where removed, taking note of the band (cathode) on the diode.

Section 6e
Inputs & Outputs

As discussed in Section 2 on triac control of payouts, often found as part of the circuit on the MPU, as is the case with the Barcrest MPU4 and Maygay M1A. Unlike the lamp matrix, one triac will control one payout coil. The current load required of these triacs is high and failure is not uncommon. Test as you did the transistors, looking for a discrepancy between the components.

The repair of the MPU can be a very specialised job, requiring an engineer who is skilled in this area. However, there are many repairs that anyone with a little patience and the ability to use a meter and a soldering iron can sort out without resorting to returning faulty units to repair centres. These are the vast majority of faults that occur.

The majority of inputs and outputs from the board are controlled by transistors or triacs and these are the first components in line to fail. More involved faults like failure of the MPU to reset the machine or a reel drive failure (although once again these are often driven by transistors or transistor arrays in an IC package) are sometimes better left to the experts! At the risk of repeating myself, have a go. (So long as this is not the only MPU of its type you have, with no spares on the shelf, a complete replacement MPU can be a very expensive item.)

The microprocessor unit is a very sophisticated piece of equipment and can be classed as a computer in its own right. All too often it is not handled or treated with care and attention due. As stated before, a new replacement unit can be extremely expensive, although repaired exchange units can usually be obtained at a more reasonable charge.

Section 6f.
System frozen?

One problem that is inherent with all computers, and the MPU is no exception, is the lock up situation where no matter what you do the whole system is frozen or is doing things it shouldn't be without apparent reason.

Firstly, remove power to the machine, count to 10 and re-power up. This will clear the problem 90% of the time. Secondly, refer to the instruction manual and go to the section regarding "Test Routines." See if there is a RAM clearance (Random Access Memory). Not all programs have them built in. In some cases, this will be found as a DIL Direct In Line) or DIP (Dual, In-Line Package) switch on the main MPU. In others, you will be required to follow a set sequence of actions. Barcrest do a RAM clearance program that can be fitted permanently to a spare program card that can be then just plugged in as required.

Thirdly and finally if all else fails, there is no RAM clearance switch, and no section in the program, there is one last resort. Remove power to the machine and use a short piece of wire to short out the battery. Count to 5, remove the short and re-power the machine.

Section 6g.
Batteries

Whilst on the subject of batteries, they may be re-chargeable but they do not last forever. A 2-3 year working life is what can be expected, but not taken for granted. The most reliable way of checking out the workable state of the battery is to put a credit onto the host machine at the end of the working day and switch off the machine. If the credit is still there the following morning when the machine is powered up, then the battery is OK. If the credit has gone, then change it. Simple enough job and batteries are readily available. Make sure the replacement is of the same type. Two types commonly in use, 2.4 volts and 3.6 volts.

Failure of the battery will effect the machine takings, and any settings that are programmed in at the time of siting will be lost. Notably on older machines, the payout percentage is set via the test routines. These will be lost if the battery fails or if you fit a new one, and you will have to reset these in this event.

Do not put aside the importance of the state of the battery. A regular routine for coin checking to verify the state of the battery as shown above is recommended.

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Horizontal Deflection

Most video slot monitor failures are pretty straightforward. A quick glance at the screen will often point you to the general area of the problem. A missing color will lead you to the video amplifier circuits. A thin, horizontal line will point to a loss of vertical deflection.

But a failure in the horizontal deflection circuit can be a bit more difficult to figure out because the monitor will appear to be completely dead. There will be no picture or brightness of any kind on the screen. That's because the horizontal deflection circuit is used to drive the high voltage unit (the "flyback" transformer). Naturally, without high voltage, there can be no raster at all on the face of the CRT.

The Horizontal Deflection Circuit

The horizontal deflection circuit is similar in most monitors; in fact, it is almost identical in just about every video monitor in use today. Inside an IC on the monitor's printed circuit board, a circuit known as the "horizontal oscillator" is used to generate an alternating current signal. The frequency of the oscillator depends on the resolution of the monitor. For example, in a standard resolution monitor (NTSC or CGA) the horizontal frequency will be approximately 15, 750 Hz. You can often hear this high-pitched squeal while the monitor or television is in operation.

The higher the resolution of the monitor, the higher the frequency will be for the horizontal oscillator. A monitor operating at VGA resolution (640 X 480) will have a horizontal frequency of approximately 31.5 kHz while SVGA resolution (800 X 600) will send the horizontal frequency soaring as high as 48 kHz. Unlike a standard resolution monitor, you cannot hear the horizontal frequency in these monitors as it exceeds the upper range of human hearing.

The horizontal oscillator IC will have a host of support components such as resistors and capacitors. Most notably among them is the horizontal frequency potentiometer. The horizontal frequency potentiometer (also known as the "horizontal hold" potentiometer) is used to set the "free-

running" frequency of the horizontal oscillator. When the monitor receives a horizontal sync pulse from the video source (the game's CPU, a test pattern generator or other source) the frequency and "phase" of the monitor's horizontal oscillator is corrected ever so slightly such that the monitor remains in lock step with the video signal. Without the presence of the horizontal sync signal, the monitor's horizontal oscillator runs at its own, free-running frequency as determined by the horizontal hold potentiometer.

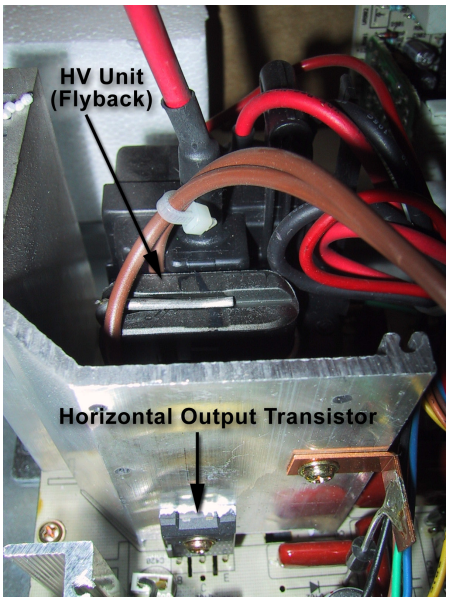
Although the output of the horizontal oscillator IC will eventually be used to drive the horizontal deflection coil in the yoke (as well as the high voltage unit) it is still very weak at this point (only about 1.5 VAC); it has to be amplified.

The output of the horizontal oscillator is connected to the base (the controlling input) of the horizontal drive transistor. This is a typical, common-emitter amplifier configuration, with a grounded emitter. The low-voltage input at the base is amplified by horizontal drive transistor to obtain an output of around 100 VAC.

A small transformer (appropriately called the horizontal drive transformer) is used to change this output into a high current AC signal. This transformation accomplishes a couple of things for us: One is that this signal is used to drive the horizontal output transistor. The horizontal output transistor is the hardest working transistor in the entire monitor. All of the yoke current for the horizontal deflection passes through this transistor. The horizontal output also drives the flyback transformer in the high voltage unit. Because of the high current flow in this circuit, the horizontal output transistor (which is a low gain transistor) requires a lot of base current to drive it. At the same time that it lowers the horizontal drive voltage from around 100 volts to around one volt, the horizontal drive transistor also gooses up the output current such that it is sufficient to drive the horizontal output transistor.

There is another benefit to using the horizontal drive transformer here. Remember that a transformer is strictly an AC device and that if you put uninterrupted DC on the primary winding (the input) of a transformer, you will get absolutely nothing out of the secondary winding. Because of this, any type of failure in the oscillator or drive circuit that might cause a DC output (as opposed to the normal, high frequency AC output) will not cause the horizontal output transistor to turn on and stay on, a condition that would be instantly disastrous to the health of the horizontal output transistor.

The horizontal output transistor is generally a special type of transistor in that it usually has an internal protection diode known as a "damper diode." When you replace a defective horizontal output transistor that contains an internal damper diode, you must be certain that the replacement component also has the diode. Replacing a horizontal output transistor that has the internal diode with one that does not will give you about 15-30 seconds of joy before it blows, leaving you to wonder just what the heck is going on.



It's easy to identify the horizontal output transistor. It's always the largest transistor mounted closest to the flyback transformer.

In addition to the internal damper diode, the horizontal output transistor may also contain an internal resistor between the base and the emitter. This will cause the transistor to appear to be bad when tested by normal means such as using a digital multimeter, even when it's perfectly fine. A typical value for this internal resistor is around 50 ohms. Later in this article, you'll see how to test the horizontal output transistor. It takes about five seconds.

Like the horizontal drive transistor, the horizontal output transistor is an NPN transistor in a common emitter configuration, in other words, the emitter is grounded. This configuration is also known as a "ground switch."

The base drive for the horizontal output transistor comes from the secondary winding of the horizontal drive transformer. The collector load consists of the primary winding of the flyback transformer as well as the horizontal deflection coils in the deflection yoke.

Troubleshooting Horizontal Failures

If the monitor's switched mode power supply (SMPS) is making a quiet ticking or chirping sound, chances are excellent that the horizontal output transistor has shorted. You can check it with your digital multimeter. Set the meter to the diode test setting. If your meter does not have a diode test, use a low resistance scale. Remove the power to the monitor. Ground the black meter lead to the chassis and touch the red meter lead to the collector of the horizontal output transistor. If the meter displays a low resistance or short circuit, you've likely found the culprit.

Another way to make this test is to simply test between the emitter and collector of the horizontal output transistor with your digital multimeter set to the diode test setting. For Ceronix monitors, using the chassis doesn't work as a ground connection.

A bad high voltage unit also may cause ticking or chirping. In some cases, the horizontal output transistor and high voltage unit will fail together (the bad high voltage unit having caused the transistor to fail).

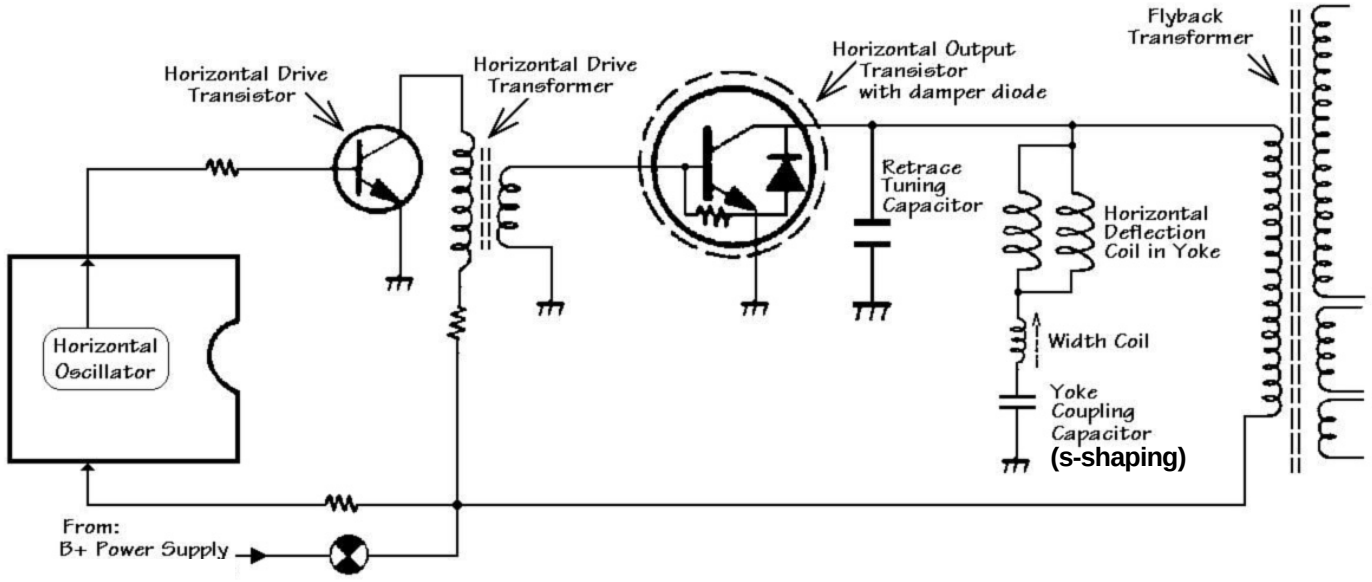
Horizontal deflection problems that do not blow the fuse are somewhat more difficult to troubleshoot. There are a few things that can cause the horizontal deflection to become inoperative. One may have nothing to do with a horizontal failure at all!

Most monitors include a circuit known as an "X-ray protector" or "high voltage shutdown." The purpose of this circuit is to shut down the high voltage if it becomes excessively high in voltage. It does this by killing the horizontal oscillator circuit. This prevents the monitor from emitting excessive X-rays.

Before you start digging into the monitor, you need to figure out if the horizontal deflection circuit is really defective or if the X-ray protector has shut it down. Generally, this is pretty easy if you're in a quiet room. When you first fire-up the monitor, listen carefully for the crackling sound of the static electricity build-up on the CRT. If you hear the static come on for just a split second but then shut right down again, your horizontal deflection circuit is being shut down by the x-ray protector. In this case, your horizontal deflection circuit is likely to be perfectly okay. You likely have a problem with the SMPS going over-voltage. We've covered this topic in great detail in past issues of Slot Tech Magazine.

The momentary presence and subsequent loss of EHT can be verified by using an NE-2 neon lamp (available at just about any electronics store, including Radio Shack). Hold the lamp against the ferrite core of the flyback transformer. If it glows continuously, you have continuous EHT and your horizontal deflection circuit is working. If the lamp flashes momentarily at the moment power is applied (hold the lamp against the core first, then apply power) you have all but confirmed that x-ray protection is taking place, shutting down the horizontal deflection circuit. Of course, if the lamp does nothing at all (and you have already verified that your B+ power supply is good - again, covered in detail in past issues) it's time to start looking at the horizontal deflection circuit.

Another way to figure out if the horizontal deflection circuit is



really defective or if the X-ray protector has shut it down is to start your troubleshooting by disabling the shutdown circuit. The principal is more-or-less the same in most monitors: lift one end of the zener diode that is used to detect the over-voltage condition. If you don't understand this, don't sweat it. X-ray protection will be covered in detail in a future issue of Slot Tech Magazine.

With the shutdown circuit disabled, apply power to the monitor. If the monitor now gives you a picture, the horizontal circuit is working. Your problem lies elsewhere (probably in the SMPS circuit.).

If the monitor is still dead, you need to make a few more tests. Measure the voltage at the collector of the horizontal output transistor. It should be the same as the B+. WARNING: NEVER TEST THE VOLTAGE AT THE COLLECTOR OF THE HORIZONTAL OUTPUT TRANSISTOR IF THE HORIZONTAL DEFLECTION CIRCUIT IS WORKING PROPERLY! This test should only be performed if the monitor is dead. If you hear the high pitched squeal or if a neon lamp glows when held against the core of the flyback transformer, measuring the collector voltage can damage your meter.

If the collector voltage is missing, there are only a few things that can be wrong. The most likely is a crack in the printed circuit board. Also, examine the solder joints around the high voltage unit. You may find some cracks or fractured solder joints. There is a highly remote possibility that the high voltage unit may be bad.

If the collector voltage of the horizontal output transistor is good, test the voltage at the collector of the horizontal drive transistor. If this voltage is missing, the primary winding of the horizontal drive transformer or the resistor that is in series with it may be open. The resistor will generally be 2-5 watts at 2.2K to 3.8K ohms. Check these with the power turned off. Naturally, you want to check for bad solder joints here as well.

Use a Neon lamp to determine the presence of EHT

If the collector voltage measures at around 50 VDC, switch your meter to read AC volts and measure it again. If you read approximately 50 VAC, the horizontal drive circuit is probably working properly. Your problem is most likely an open secondary winding in the horizontal drive transformer or broken traces and/or bad solder joints between the output of the horizontal drive transformer and the base of the horizontal output transistor. There is a remote possibility that the horizontal output transistor is bad but this is highly unlikely. The best test here is substitution with a known good component.

If the collector voltage of the horizontal drive transistor the same as the B+, turn off the monitor and test the horizontal drive transistor. You must unsolder and remove the transistor from the printed circuit board in order to test it properly. Horizontal drive transistor failure is not common, so don't be too hopeful.

If the drive transistor tests good, re-install it, apply power to the monitor and measure the voltage at the base of the horizontal drive transistor. It should measure at around .4 VDC and 1 VAC. If you have performed all the previous tests and still haven't found the problem, it probably won't. You probably will measure 0 VAC. This means that you do not have an output from the horizontal oscillator in the integrated circuit. Before you declare the IC to be defective, you should test to make sure that the IC has power (Vcc) to it. Most of the time this will be around 12 VDC.

If the input voltage to the integrated circuit is okay, the IC itself may be defective. This is not a very common problem but at this point the IC should be replaced as you have all but eliminated everything else. If the Vcc power input to the integrated circuit is missing, trace the circuit back to see where it comes from. In general, the Vcc power for the IC comes from a 3.9K to 7.5K, 3-watt resistor that is connected to the B+ power supply. If this resistor opens, it will cut off the power to the IC.

- Slot Tech Magazine

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Schedule of Events

Events subject to change

Tuesday, February 4th, 2003

9:00 am - 12:00pm
How Monitors Work - Part 1
Theory of Operation - Beginning level

12:00pm - 1:15pm Luncheon

1:15pm - 3:15pm
MEI - BV troubleshooting and repair

3:15pm - 3:30pm
Afternoon Coffee Break

3:30pm - 5:30pm
Seiko Printers

Wednesday, February 5th, 2003

9:00 am - 12:00pm
How Monitors Work - Part 2
Narrow Down the Problem - Intermediate Level

12:00pm - 1:15 pm Luncheon

1:15pm - 3:15pm
Asahi Seiko - Hopper troubleshooting and repair

3:15pm - 3:30pm
Afternoon Coffee Break

3:30pm - 5:30pm
Coin Mechanisms, Inc. - Coin Comparitor technology and repair.

Thursday, February 6th, 2003

9:00 am - 12:00pm
How Monitors Work - Part 3
Circuit Analysis and Component Level Troubleshooting - Advanced Level

12:00pm - 1:15 pm Luncheon

1:15pm - 3:15pm
Sencore - Monitor Troubleshooting and Repair - Using sophisticated test equipment.

3:15pm - 3:30pm
Afternoon Coffee Break

3:30pm - 5:30pm
JCM Bill Validators -
BV troubleshooting and repair

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