September 2005

Slot Tech Magazine

Slot Machine Technology for the International Gaming Industry

Slot Machine Mathematics
Slot Machine Levels of Verification
Quick & Simple Repairs For Slot Machines
Troubleshooting JCM's WBA Bill Acceptor
TOVIS - An Introduction to Digital Monitors

The Future of Slot Machine Graphic Design

from ALS Group, Saint Petersburg

Slot Tech Magazine

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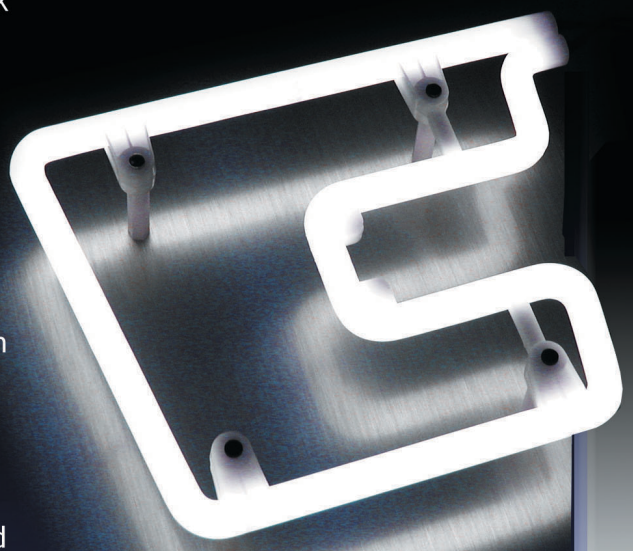

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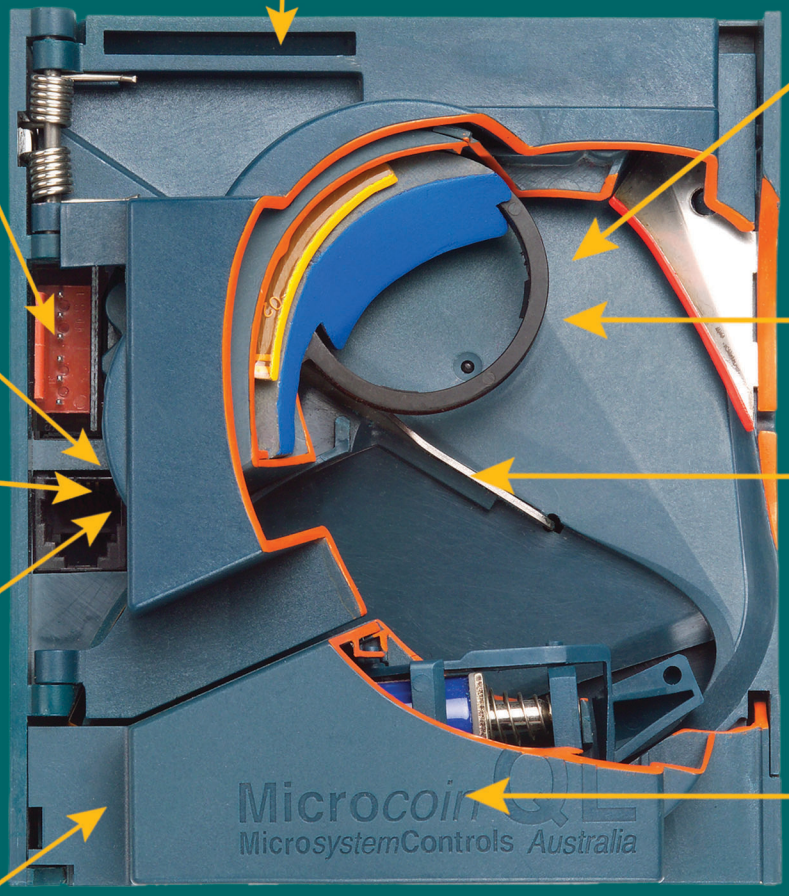

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Slot Tech Editorial

There is so much about the gaming industry to celebrate and September is the month to do it as the gaming world converges in Las Vegas, Nevada this month for the fifth annual Global Gaming Expo. It's an event that showcases the best and newest that the industry has to offer. Gaming manufacturers and suppliers from around the world exhibit everything from . . . well, everything! Everything you can imagine (and some things that you can't, such as a tic-tac-toe playing chicken) that has anything to do with casinos and, especially, slot machines, will be there.

TechFest 12 will be held at Robinson Rancheria in Nice, California October 11-13 2005

Randy Fromm's
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Graphics play an important role in slot machine design. This month, Slot Tech Magazine continues its Eye on Russia series with an introduction to ALS Group, Saint Petersburg. ALS is a Computer Graphics (CG) specialist company, and is responsible for some of the rich and detailed 3D graphics you see in today's slot machines. Their extraordinary vision in graphic design is reflected in this month's cover, a concept piece entitled "The Slot Machine of the Future" created especially for Slot Tech Magazine. Graphic Proof begins on page 49.

If you have been following our series on digital monitors, you know that we have covered a lot of ground in our section by section look at each of the circuits in the Tovis digital monitor. We've looked at power factor correction and the power supply, the video circuit, the vertical deflection circuit and the microcontroller. This month, it's time to take a detailed look at the most complex circuit in the monitor, the horizontal deflection circuit. This amazing piece of electronic engineering is a really interesting combination of shaped waveforms and boost circuits, all operating under the guidance of the microcontroller. I've never had so much fun analyzing a circuit. The detailed circuit analysis (part seven of the series) begins on page 16.

Herschel Peeler loves technical training. Whether he is the one doing the teaching (as is usually the case) or he is attending a presentation being given by someone else, sharing the knowledge is one of Herschel's passions. Herschel was impressed with a recent presentation from JCM in Fresno, California. JCM's tech trainer Dan Peterson did the honors. Herschel gathered up all of the information and packaged it neatly for us in his contribution, Troubleshooting JCM's WBA Bill Acceptor, beginning on page 26. You'll find JCM's associated Powerpoint presentation on the Slot Tech Magazine ftp server, in the JCM sub-dir, naturally.

The Slot Mathemagician continues this month with part two of our look at slot mathematics for video reel slots. This month, we're going to start to build our video reel slot

and get a better handle (no pun intended) on the difference between video reels and real reels. The Slot Mathemagician, John Wilson, picks up where he left off on page 36, followed by the sixth installment of Pat Porath's invaluable Quick & Simple Repairs on page 44.

This month's lead-off story presents a new paradigm in slot machine verification with Kobetron's tiered system for verification levels. The new levels of verification serve to provide ancillary methods of verifying CRC checksums in addition the level 1 "pop the chip out and Kobetron it" currently in use by casinos worldwide. The happy result of these new verification levels is the ability to test the integrity of a slot machine with much greater speed and safety, without sacrificing the 100% accuracy required by gaming regulators.

Don't forget that TechFest 12 is just around the corner, October 11-13, 2005 at the Robinson Rancheria Casino and Resort in Nice, California. Download an enrollment form from the website at slot-techs.com or call the magazine at 619.593.6131 to enroll. Enrollment is limited and most TechFests are sold-out events so if you're interested in learning a lot about slot machine repair, including monitor repair, bill acceptors, ticket printers, touchscreens, test equipment and more, I'll see you at TechFest 12.

Randy Fromm

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Kobetron Introduces

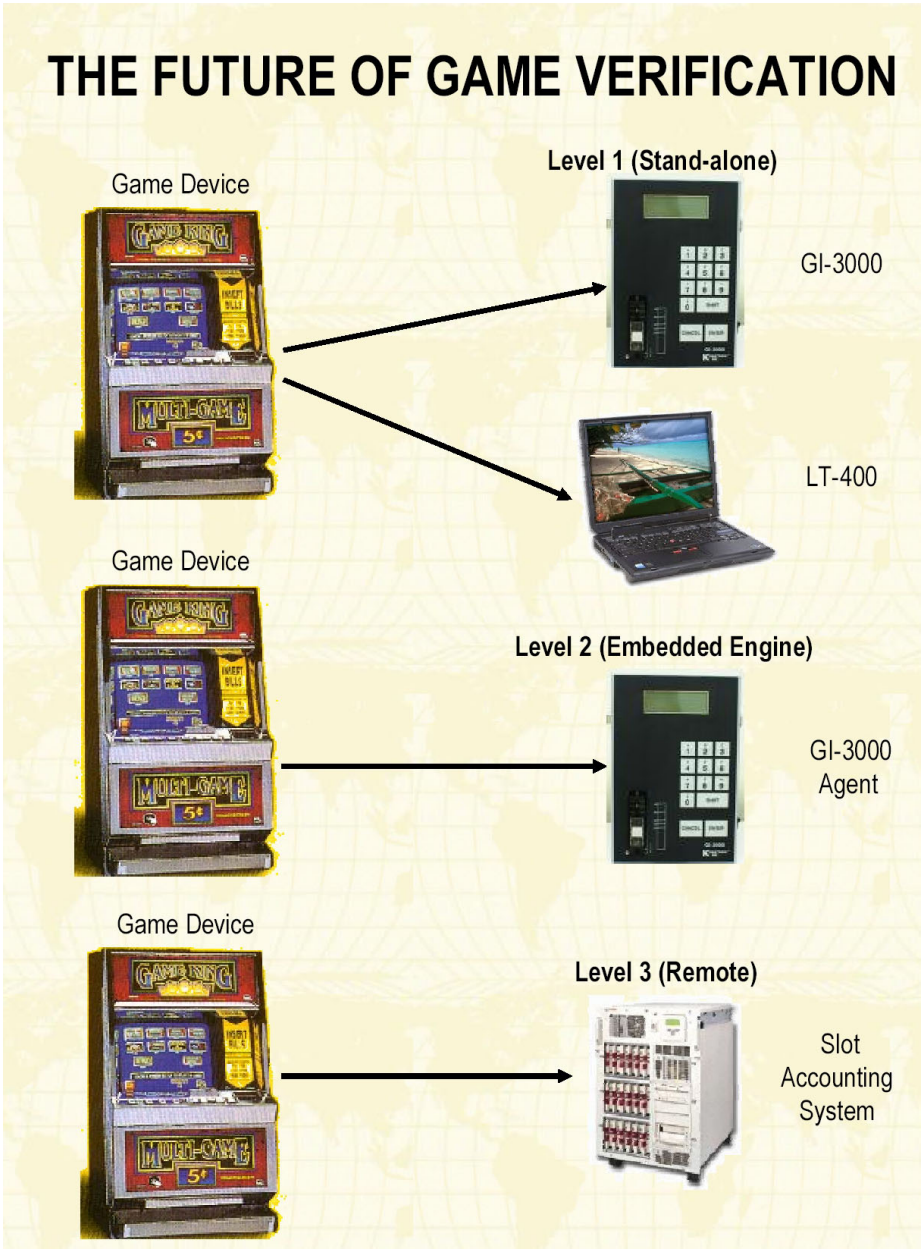
Levels of Verification

Over the last 5 years, the process of data verification has become extremely dynamic due to the industry's ever changing technology. Some of these changes have required Kobetron to take a new approach to verification, while others have enabled Kobetron to use this same technology positively by incorporating new faster, easier, and better methods of verification. After years of research and numerous customer surveys, Kobetron has developed two new levels of verification. In addition to the standard Level 1 verification, Kobetron can now offer expanded Level 2 and Level 3 verification with the help of gaming manufacturers, regulators and operators. These new levels of verification will not only enhance the current process but they will revolutionize the industry as we know it today.

Level 1

Level 1 verification is what the industry has been utilizing for the last 15 to 20 years. This method of verification is accomplished by extracting the device you want to test from the gaming machine and inserting it into a Kobetron GI-3000 Gaming Investigator for signature verification. Level 1 verification has been, and always will be, the most secure method of verification available.

However, this level of verification does have some disadvantages, especially when the user has a large number of gaming machines to test. This method of testing requires the user to power down the gam-



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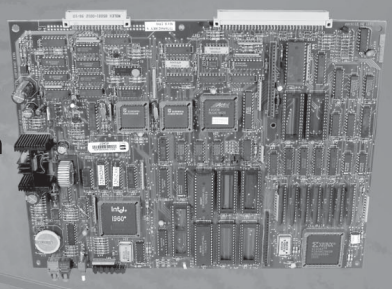

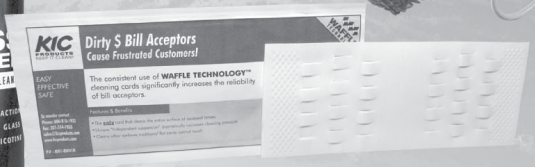

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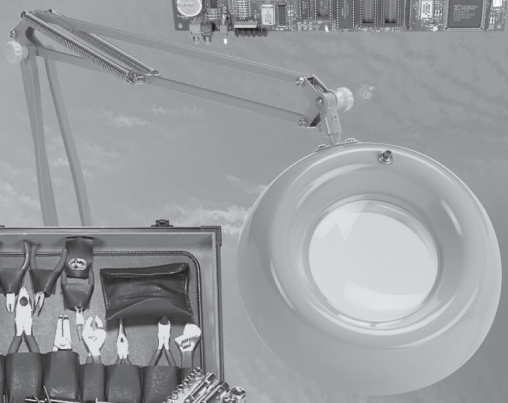

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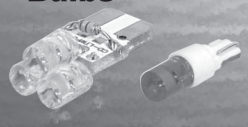

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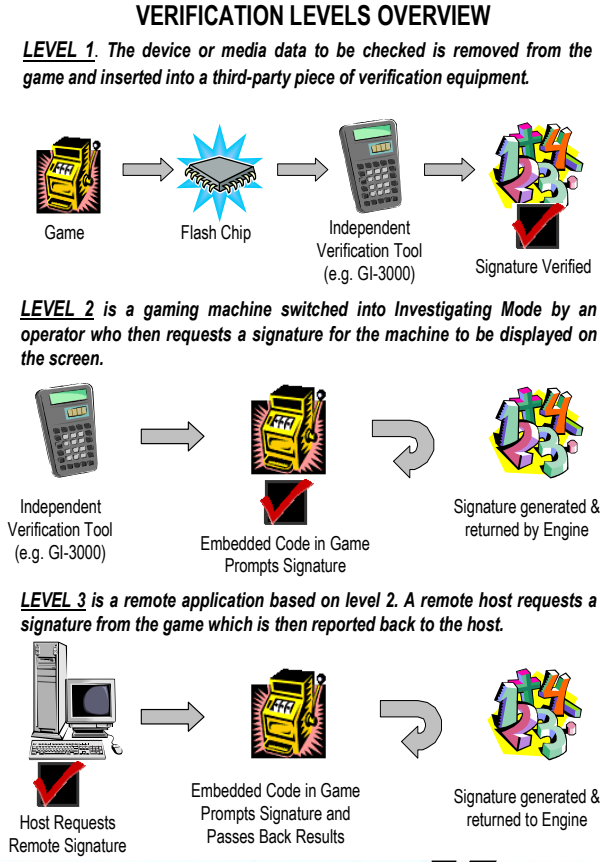
The Kobetron Embedded Engine as featured in this screenshot from a Summit machine.

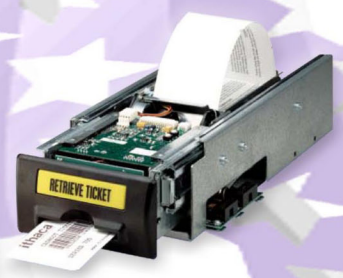
ing machine. In most cases it then requires CPU boards to be pulled-out and device seals to be broken. The device to be tested must then be extracted using a chip removal tool. Extreme caution must be used not to bend or break the pins which would render the device useless. After the device has been fully tested and verified, it must then be re-inserted in its original socket on the board. The seals must then be replaced, boards reconnected and the gaming machines powered back-up. If extreme caution is not used during this time-consuming process, damage to the device and/or gaming machine can occur. If you have several hundred machines to test using this method alone, it is very labor intensive and time consuming. Is there an alternative?

Level 2

Now imagine performing Level 1 verification on a designated sample rate of those machines and Level 2 on the remaining machines. Level 2 verification is accomplished using the Kobetron 3rd Party Embedded Engine. This level of verification requires the gaming machine Manufacturer to incorporate our 3rd Party Engine into their machine. Once the engine has been embedded in the manufacturer's gaming machine, the verification process becomes very simple. To perform a Level 2 verification using the Kobetron 3rd Party Engine, the user simply needs to place the gaming machine in maintenance mode. Once the machine is in maintenance mode, the user selects the Kobetron menu and then selects the desired device to test (see Figure.1). The Kobetron Embedded Engine will only produce and display a Kobetron signature for the selected device when it senses there is a Kobetron Agent (GI-3000 Agent) connected to an external port (i.e. RS-232, USB, etc.) on the gaming machine. Any attempt to perform a device verification without the GI-3000 Agent connected to the external port of the gaming machine will be restricted. This added security feature ensures that only authorized requests are processed. It also serves to maintain total 3rd Party integrity in the verification process. The Level 2 verification process should be used as a building block to enhance existing Level 1 process. Level 2 verification has many advantages. It can easily be performed on demand, is non invasive and does not require devices to be removed from the gaming machine; it can be performed more frequently without increasing the potential for equipment damage. This



Each level of verification augments the security options available to regulators, operators and maufacturers.



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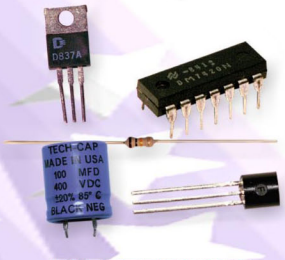

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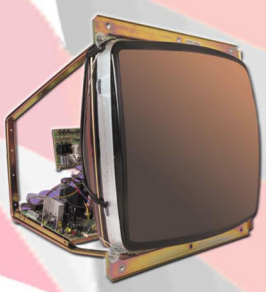

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process also minimizes the testing time due to the elimination of board and seal removal and replacement. Please keep in mind that Level 2 verification does not replace Level 1, it just offers the user another method of verification to select from and provides additional options based on the verification procedures adopted by the Industry.

Level 3

Level 3 verification is also accomplished using the Kobetron 3rd Party Embedded Engine and, as in Level 2 verification, requires the Manufacturer's gaming machine to incorporate our Embedded Engine. The only difference between Level 2 and Level 3 verification is where the request for signature originates and where the GI-3000 Agent is connected. In Level 2 verification, the request for signature originates locally (from the gaming machine's console) and the GI-3000 Agent is connected locally (to the gaming machine's external port). With Level 3 verification, the request for signature can originate from the back office system or any other networked location (i.e. slot, accounting, or corporate offices using LAN or WAN networks tied to the back office system). The GI-3000 Agent can be connected to the external port of whatever system you are using to originate the signature request (i.e. back office system or any other networked system as stated above). This level of verification allows the user to remotely verify any gaming machine device without being physically located at the gaming machine console. Level 3 verification can be accomplished using any of the standard protocols currently used by gaming manufacturers.

Implementation

Implementation of the Kobetron Embedded Engine has already begun in machines being produced by three industry OEMs, with regulatory approval pending. Integration requires only a minimal effort (generally seven to ten days of engineering time) in order to knit the Embedded Engine into the OEM's application. Once the engine has been embedded and tested, the engineering work is done and all similar machines can easily be retrofitted with the Kobetron Embedded Engine. The benefits of having Levels 2 and 3 available to everyone can greatly outweigh the investment of incorporating them.

Industry Group Benefits of Verification Levels

Industry:
- Utilizes a building block approach for all verification needs
- Can ultimately verify both H/W and S/W in gaming machine
- Minimizes the need for additional verification equipment

Manufacturers:
- Value added selling feature for new game sales
- Streamlines new game approvals and implementations
- Reduces the verification time on new installs
- Reduces the need for additional verification equipment
- Minimizes the pre-testing of devices prior to installation

Regulators:
- Reduces amount of time required to verify gaming machines
- Allows for more frequent spot checking of gaming machines
- Allows them to remotely check any gaming machines

Casino Operators:
- Reduces amount of time required to verify gaming machines
- Randomly verify the performance of any Gaming Machine based on the Manufacturer's Specifications
- Remotely check gaming machines in multiple properties
- Enables surveillance to record jackpot or other verification of internal gaming devices

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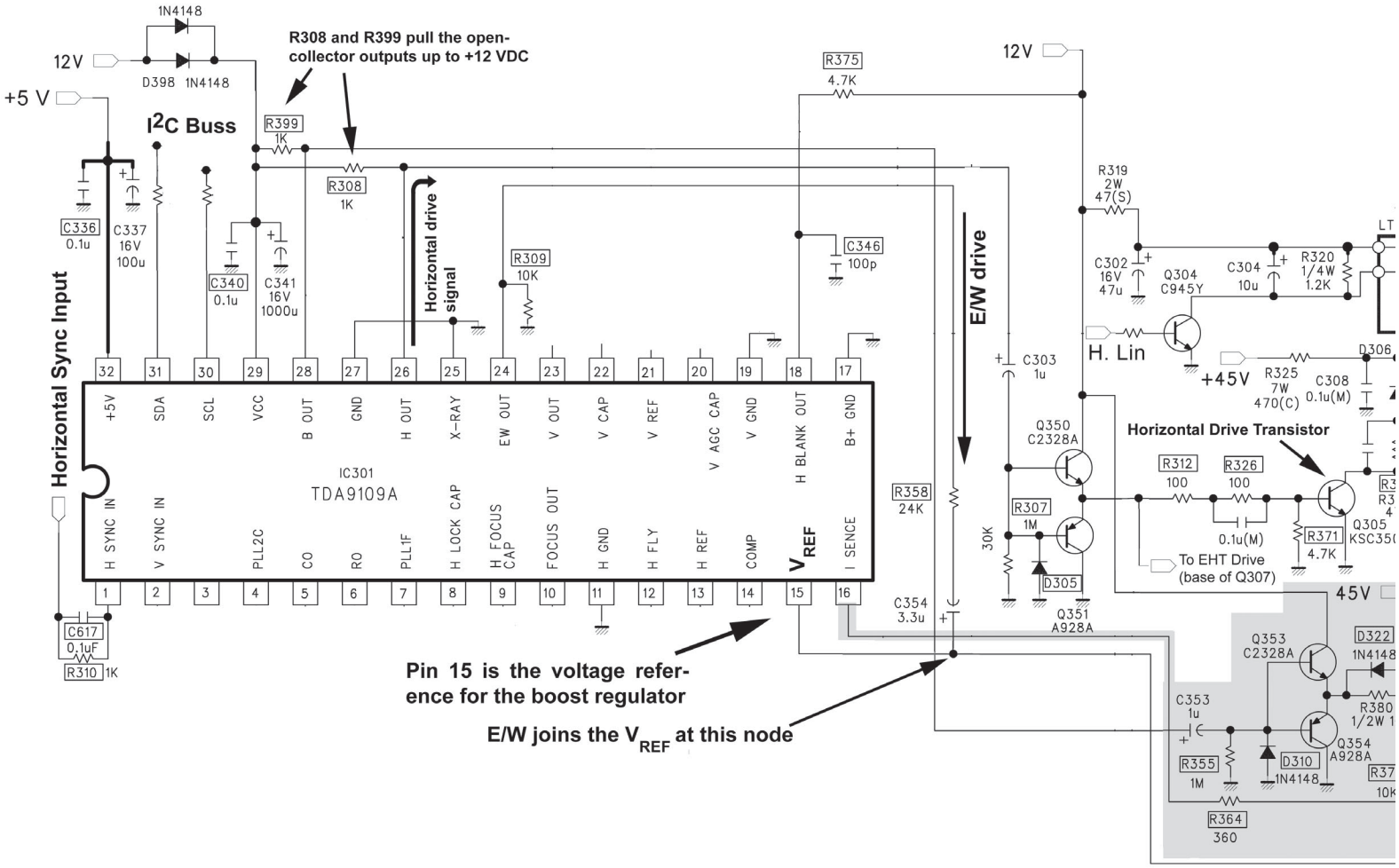
TOVIS

Part 7 - Horizontal Deflection

An Introduction to Digital Monitors

Of all the sections that make up a monitor, the horizontal deflection circuit is, without a doubt, the most complex and the most challenging to understand. The operating theory is difficult to comprehend, in part because it involves the physics of energy storage (in the form of both electrical charges and magnetic fields) and in part because of the complex geometry correction that is required to produce a linear display using magnetic deflection. To add to the complexity, you can throw in a flat (rather than spherical) CRT and, just to make things REALLY interesting, make the whole thing a multi-sync monitor that is capable of producing a perfect display at a wide range of operating frequencies (different "resolutions") and you begin to see the challenges faced by the engineers at Tovis when they designed the horizontal deflection circuit in this monitor.

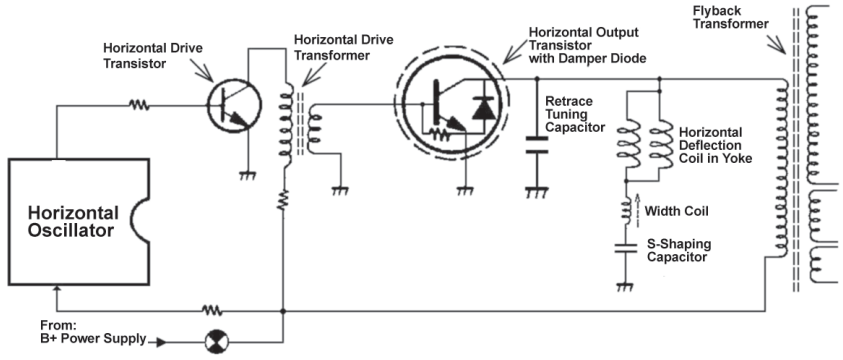


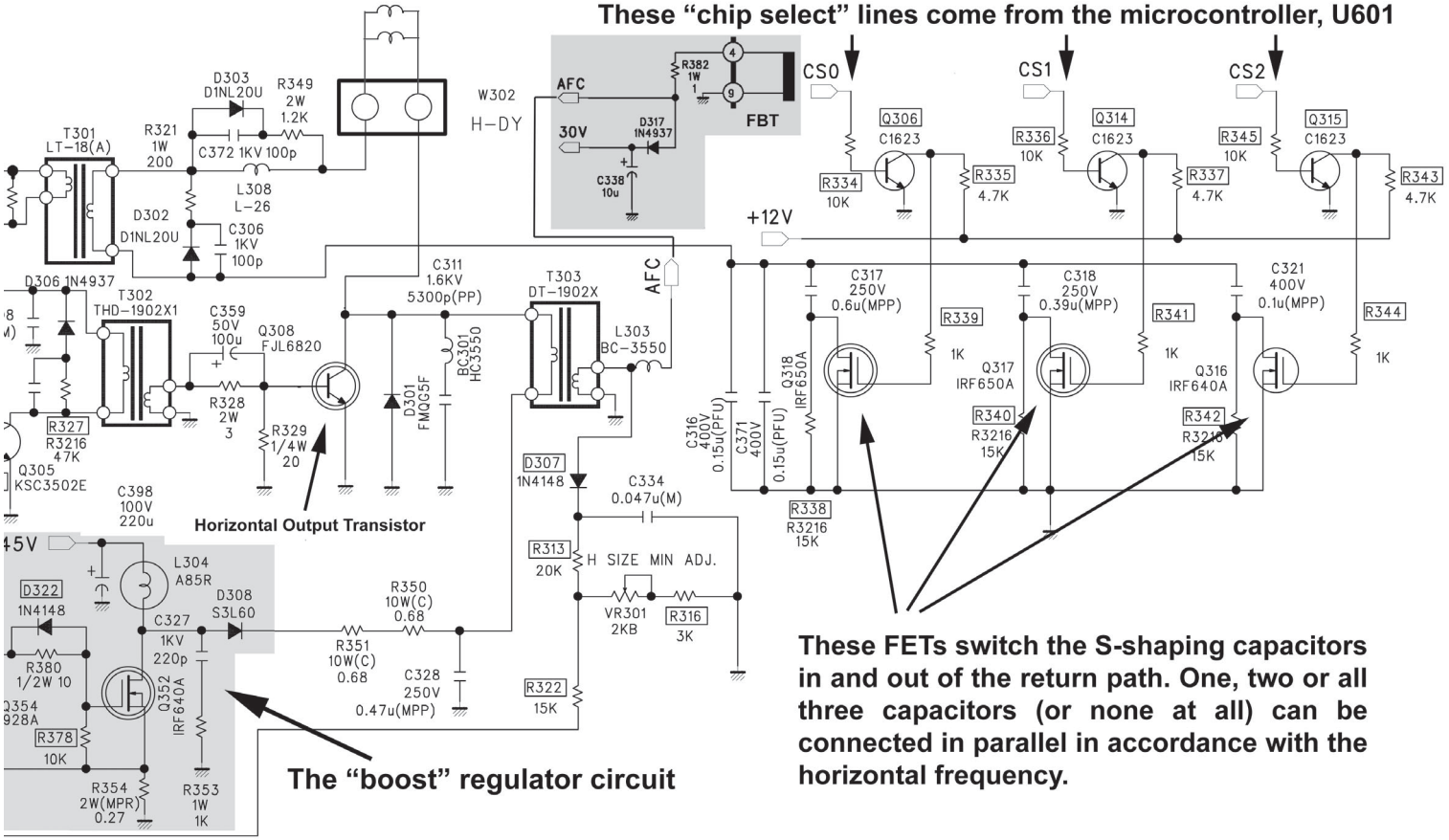
Compare the (somewhat simplified) schematic diagram of a typical horizontal deflection circuit of monitors past (above, right) with the schematic diagram of the horizontal

The subject of horizontal deflection has been covered previously in Slot Tech Magazine (December 2002). Compare the (somewhat simplified) schematic diagram of a typical horizontal deflection circuit of monitors past with the schematic diagram of the horizontal deflection circuit in the Tovis monitor. There is certainly a lot more "stuff" in this section but we'll look at it one sub-section at a time and see how it all fits together to produce a perfect raster on the screen.

Regardless of the additional circuitry, there is one thing that is absent from the Tovis' horizontal deflection circuit. Can you figure out what's missing? Where is the flyback transformer primary winding? In almost every monitor on the planet, the flyback transformer's primary winding is an integral part of the horizontal output circuit. The same horizontal output that drives the horizontal deflection coil in the yoke also drives the primary winding of the flyback transformer.

In the Tovis digital monitor, that is not the case. That is not to say that the horizontal deflection circuit doesn't have something to do with the





deflection in the Tovis monitor. There is certainly a lot more "stuff" in this section but we'll look at it one sub-section at a time and see how it all fits together to produce raster.

flyback transformer and the generation of EHT. It does. But they are not tied together at the output. As will be presented in a future discussion, the EHT circuit is connected to the horizontal drive but that's where the connection ends. The rest of the EHT has its own drive and output circuitry. For this reason, the flyback transformer primary is not part of this discussion.

So what's left? Plenty, that's for sure. Let's start at pin 26, the horizontal output of the TDA9109. This output is actually just a simple, open-collector output. Inside the IC, this pin is connected to the collector of an NPN transistor that has a grounded emitter. The IC isn't really "putting out" anything at all. The internal transistor is simply turning on at off at the horizontal frequency (31.5 kHz, 35 kHz, etc.). We turn this into our horizontal drive signal by "pulling up" the output to +12 VDC through a 1k ohm resistor, R308. This gives us a robust horizontal drive signal with a nice, 12 volt swing and the ability to both source and sink as much current as we need to drive the stage that follows.

This signal is capacitively coupled through C303 to the following stage, which is made of two transistors, Q350 and Q351. You can think of this circuit as the "front end" of a sort of distribution amplifier, a distribution amplifier that will now split the horizontal drive signal, sending it to the rest of the horizontal deflection circuitry through one path and to the EHT circuit through another.

Q350 and Q351 are in a configuration that is known as a "single-ended, complimentary push-pull" circuit. The "single-ended" part means that it works off of a single power supply (+12 VDC in this case) as opposed to a "split supply" that is both positive and negative. The "complimentary" part means that it is made of two transistors with the opposite polarity. Notice that Q350 is NPN and Q351 is PNP.

Notice that the bases are both tied together as are the two emitters. Since the emitter-to-base voltage of a transistor is what turns it on, and since the NPN transistor requires positive voltage on the base (with respect to the emitter, of course) while the PNP requires negative, clearly these two transistors will never both be on at the same time. Good thing too because there are absolutely no series resistors here. You can see that if both Q350 and Q351 were on at the same time, the +12 volt supply would have a nice path, directly through both transistors to ground, effectively shorting the +12 VDC power supply to ground or creating other "issues" such as burning up the transistors themselves.

Instead, at any point in time during nominal operation, only one or the other of these transistors will be turned on. Notice that the collector of Q350 is connected to the +12 while the collector of Q351 is connected to ground. Depending on which transistor is turned on, the output (where the two emitters are connected together) will be connected to either +12 or to ground. When Q350 is turned on, current is "pushed" into the output load. When Q351 is on, the load is connected to ground and the current is being "pulled."

This provides us with a super low-impedance drive for the two stages that are to follow, namely the base of Q305 (the actual "horizontal drive" transistor) and the base of Q307 (the "EHT drive" transistor) which is not shown because it is not actually a part of the circuit under discussion.

So, at this point, we're sort of back to normal for a while. This looks like a pretty typical horizontal drive circuit, where the horizontal drive transistor (Q305 in case you have a really short memory) is an NPN transistor configured as a "ground switch" with a grounded emitter. The collector is connected, as usual, to the bottom of the primary winding of the horizontal drive transformer (T302) while the top end of the primary is connected to some sort of source, typically through some sort of resistor. This source can be anything from the B+ itself down to the +12 VDC power supply and the resistor value (and the transformer specifications, of course) will be adjusted accordingly. Tovis has

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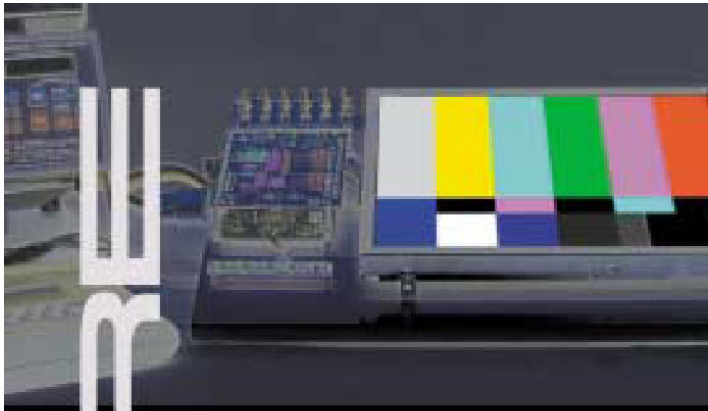

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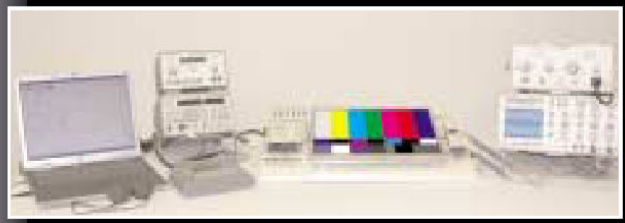

used their SMPS derived, +45 VDC power supply for the source and the resistor (R325) is 470 ohms, seven watts.

The output of T302 is connected to the base of the horizontal output transistor, Q308. Again, this is completely typical. The H.O.T. is an NPN transistor with a grounded emitter just as it always is. In this case, it's a type FJL6820, which is a 1500 volt, 20 amp transistor. This device is a bare-bones H.O.T. with neither the internal "snubber" resistor nor the damper diode and so you see a 20 ohm resistor connected externally between the base and ground (R329) and the damper diode, D301. Retrace tuning is accomplished by C311.

As usual, the collector of the horizontal output transistor is connected to one side of the horizontal deflection coil or "H-DY" for "horizontal deflection yoke." After passing through the deflection coil, the yoke current must now make its way through the S-shaping capacitor to ground but before it does, this monitor shakes up the traditional design by passing the return path through the secondary winding of a transformer (T301), the "horizontal linearity" transformer. The primary side of T301 is driven by the horizontal linearity signal that is another one of those PWM outputs from microcontroller U601 as explained previously. This is an interesting design as the horizontal linearity signal is not used to modulate the return path current of the horizontal deflection coil, as you might suspect upon first inspection. The linearity signal is actually DC, so it cannot modulate the secondary. What this DC does however, is adjust the level of the magnetic flux in the core. This changes the characteristics of the secondary winding, which is the actual linearity coil. Because this is a digital monitor, the microcontroller can precisely adjust the linearity by adjusting the DC level on the primary . If you change the horizontal linearity signal on the primary side, you can control what's happening on the secondary side. The happy result is that the horizontal linearity can now be precisely adjusted for a perfectly linear display, where capacitor and coil values used to have to be "tweaked" in order to achieve acceptable linearity.

After passing through the secondary winding of T301, the yoke current passes through the S-shaping capacitors (two capacitors in parallel, C316 & C371, both .15 µf, 400 volts) and to ground. Whew! We finally made it to ground with our deflection current, completing the current path so that we can build up a nice big magnetic field in the yoke.

Multiple Resolutions

What the heck is all that other circuitry to the right of C371? Whatever it is, it's all in parallel with the S-shaping capacitors, isn't it? This is how the monitor handles multiple resolutions.

The horizontal output circuit is a "tuned" circuit. Its combinations of coils and capacitors are all meant to work in harmony, happily humming along together and all singing the same one-note tune in the same key. The semiconductors in the circuit will always operate at the frequency of the horizontal drive signal that comes from the TDA9109. The remainder of the circuit must be tuned to match the horizontal frequency.

C317 (.6 µf), C318 (.39 µf) and C321 (.1 µf) are all connected together with the other two S-shaping capacitors on the top. By switching their return paths in and out with FETs (Q316, Q317 and Q318) we can connect one, two or all three of them in parallel (in any combination) with the rest of the S-shaping capacitors in order to "tune" the circuit for proper operation. In other words, if all of the FETs are off, the monitor is set to operate at its highest resolution with just .3 µf needed for S-shaping. As we drop the horizontal frequency, we must add capacitance to the circuit in order for it to remain tuned. To operate at its lowest resolution, all three of the FETs are energized and all three of these "ancillary" S-shaping capacitors are added to the mix. That's over 1uf when all three caps are added together. You'll notice that the three caps are not the

same value. That would really limit what we can do here. By making one cap fairly large, one medium-sized and one small, we can switch them in and out in different combinations as required. Altogether, this scheme allows the Tovis digital monitor to operate at ten different horizontal frequencies that can be anywhere from 31 kHz to 68 kHz.

Control of the FETs comes from the microcontroller in the form of three control lines, known as CS0, CS1 and CS2. That's CS for "Chip Select." It's sort of an old TTL term for these "select lines." Don't sweat it. The chip selects come from pins 39-41 of U601. They're just high or low signals, that's all. You can see the three chip select lines are connected to the bases of three more "ground switches": Q306, Q314 and Q315. The collectors are connected to the gates of the three FETs.

It is important to realize that this is set up in a "negative logic" or "active low" configuration. That is to say, when a select line is LOW, the FET is turned on and the capacitor is added to the circuit. Check it out. Let's look at CS0. When CS0 is low, transistor Q306 has no base voltage and so it is turned off. The gate voltage for the FET (Q318) is derived through resistors R339 and R335 and the FET is turned on, completing the ground connection to the S-shaping capacitor C317. When the select line goes high, Q306 is turned on, dragging the gate of the FET to ground. Robbed of its gate voltage, the FET is turned off and the ancillary S-shaping capacitor is switched out for higher operating frequencies.

Give it a Boost

So far, we have traced the horizontal deflection signal from its birth inside U301, through the drive circuit, the output circuit, the deflection yoke itself and the return path with its bank of S-shaping capacitors. We saw that the +45 VDC power supply was the source for the horizontal drive circuit but what is our source for the horizontal output circuit? Here again, the Tovis digital monitor differs from conventional monitors in that it uses a boost regulator (Q352, Q353, Q354 and associated circuitry) to take the +45 VDC power supply and double it to +90 VDC which is the actual primary voltage for the horizontal output transformer, T303 (Author's note: Purists might call T303 the "side pincushion" transformer. I can't argue against that term. I'm not entirely certain that "horizontal output transformer" is the proper term either as that implies that the yoke is connected to the secondary winding which it is not. In this case, the yoke is in series with the primary winding).

The boost circuit stores energy in the coil (L304) when the Q352 is turned on and then dumps it in series with the +45 VDC power supply when the FET is turned off. In typical PWM fashion, the longer the FET remains energized, the higher the voltage boost will be.

The boost regulator circuit is driven by the "B" output (pin 28) of U301. Internally, you can think of the B regulator of U301 as an embedded type 3842 PWM controller. The PWM "B" output at pin 28 is controlled by the reference voltage at pin 15. Pin 16 is the current sense (not "sence") input. You can see that it is monitoring the IR drop across source resistor R354 (.27 ohm, 2 watt). If there is too much current flowing (due to a shorted horizontal output transistor, for example) the voltage drop across this resistor will rise, telling U301 that an over-current condition has occurred. As usual, the IC responds by killing the B output at pin 28.

Why on Earth would we want to use a boost regulator here? We already have a perfectly good SMPS. If we needed a higher voltage for the horizontal output circuit, why didn't the Tovis engineers just throw another secondary winding on the SMPS power transformer, create a power supply and be done with it?

The answer is "control." We can modulate the output of the boost regulator circuit in order to control the horizontal size. If the boost output voltage is high, the raster will be wide. Drop the output voltage and the width will decrease. This scheme gives us control over the width of the

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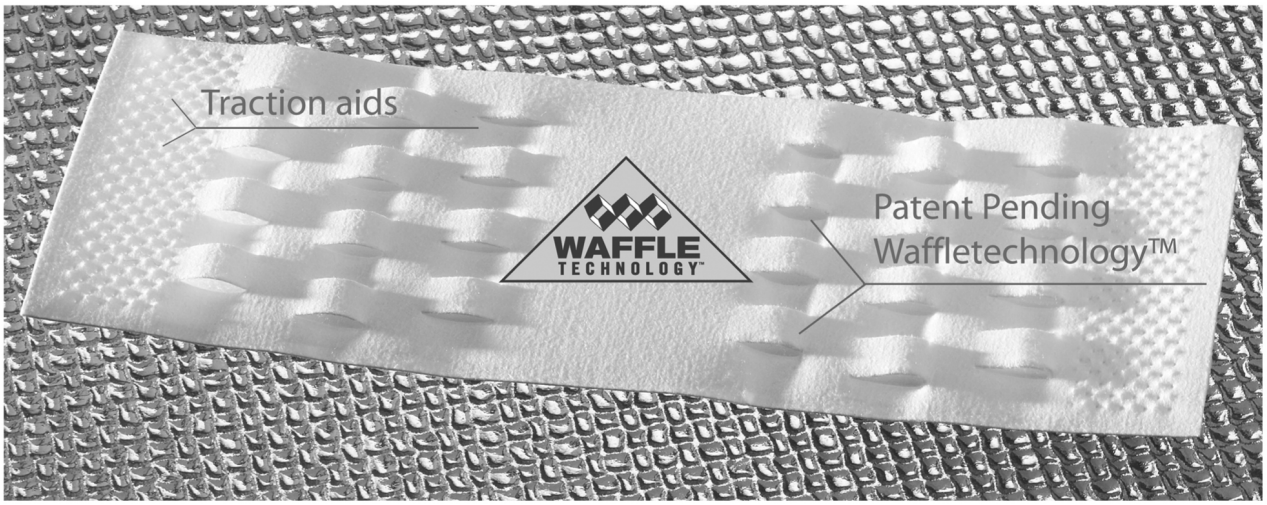

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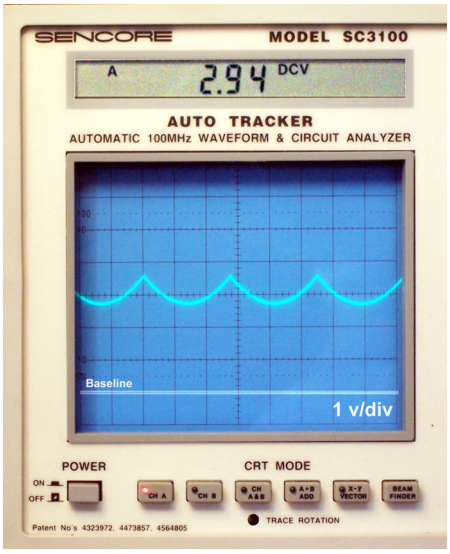
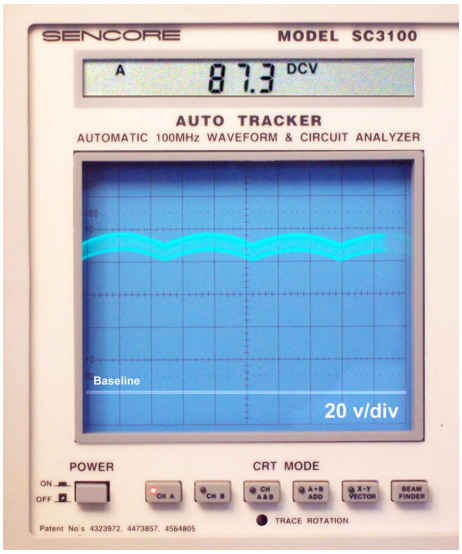
raster in ways that we never had before because the EHT is no longer tied to the horizontal output and because we can use a microcontroller to do it on a line by line basis. Sweet.

Take a look at what is happening here. Firstly, something has to generate a reference voltage for the boost circuit. U301 has to see a DC voltage on its reference input at pin 15. This reference voltage comes from the AFC (automatic frequency control) signal, which is actually a low-voltage winding on the flyback transformer (the same winding that generated the +30 VDC power supply that we have discussed previously). This pulse is rectified by diode D307 and filtered by capacitor C334. This creates a DC voltage that passes through a voltage divider and the horizontal size "minimum" potentiometer. We don't need an actual horizontal size potentiometer here because we're going to control the horizontal size with the microcontroller. We now have a nice DC voltage that is sent to the reference input. This voltage determines the basic width of the raster.





This is where the magic happens! On the left is the E/W output of the IC (pin 24). This is the parabola that is used to modulate the boost output (right) that is the source for the horizontal output circuit.

E/W Correction

But wait a second. There seems to be something else attached to this reference input. Follow the connection from pin 15 to the first node and go straight up, through capacitor C354 and resistor R358 and you'll see that the voltage reference is connected to another signal source in addition to the DC reference we derived from the AFC output of the flyback. It is also connected to an output from U301 called the "E/W Output at pin 24.

E/W correction is actually something known as "east-west correction." It refers to the correction signal that is required in order to keep the sides of the raster perfectly straight without "pincushion" distortion. Since the distance from the electron gun to the edge of the screen is different at the middle of the screen than it is at the top and bottom, without correction, the sides of the picture would be bowed in at the middle because the corners are further away (hence, bigger) than the middle. It's a phenomenon called "pincushion" because it looks like the sides of a rectangular-shaped pincushion, stuffed with cotton.

To correct for this phenomenon, we "pre-distort" the raster by modulating the current flowing through the horizontal deflection coil as it makes its way from the top of the screen to the bottom. We give the horizontal deflection coil its highest current when the beam is in the middle of the screen, but attenuate it (give it less current) when the beam is closer to the top or the bottom of the screen. In other words, as the horizontal deflection circuit creates the first raster line at the top of the screen, the horizontal deflection receives its lowest amount of current. Each successive line receives a slightly greater amount of current as the lines are drawn closer to the middle of the screen. When the monitor is drawing the center raster line (where the vertical deflection is zero) the horizontal deflection coil receives the maximum current. As successive lines are drawn closer to the bottom of the screen, each line requires less current than the previous one until we reach the bottom. The bottom line re-

ceives the exact same, minimum current as that of the top line.

But this correction signal is not "linear." That is to say, the horizontal deflection current is not decreased or increased by the exact same amount as each successive line is drawn. The correction signal we must apply is in the shape of a parabola. The E/W correction generates this parabola, which is integrated (mixed) with the "B" voltage reference after passing through DC blocking capacitor C354 (we don't want our DC reference voltage to "feed back" into the IC).

Now we have something really cool. Not only can we provide rock-solid width control by modulating our boost circuit (hence the width of the raster) but by integrating the East/West correction parabola at this point, we can completely eliminate pincushion by adjusting it away with the microcontroller. When you're in the setup menu, one of the selections allows you to adjust the pincushion. What you're really doing is changing a register value that adjusts the shape of the parabolic waveform that is being spit out by U301 at the E/W output pin. It's just like Goldilocks and the Three Bears. Too much parabola and the sides of the screen will be bowed out. If the parabola is too small, the sides of the raster will be bowed in. But if the shape of the parabola is exactly what we need to makes the sides straight, it's "just right." In other words, the parabola exactly counteracts the difference in the distance between the top, center and bottom of the screen.

Other, more subtle corrections are also accomplished by the microcontroller and the E/W output. These include the ability to tweak just the corners or make other geometric corrections such as "trapezoid" (where the top is narrower than the bottom or vice-versa) or "parallelogram" or "skew." This type of power is what really sets digital monitors apart from their predecessors. Because we can now make geometry adjustment through the microcontroller, we can compensate for changes in value as components age. Where we might have previously said to ourselves "Yeah . . . The raster's a little bit curved or distorted but there are a mess of parts that can cause that and after all, boss, it's basically working okay." and left it alone, we can now press a few buttons and make it perfect.

Next month – EHT!
Slot Tech Magazine

JCM WBA Series Bill Acceptors

By Herschel Peeler

We recently had the opportunity to attend the one-day JCM training held in Fresno, California. Expecting more sales pitch on new products than anything actually educational, I was pleasantly surprised at the value the instructor, Dan Peterson, put out in a one-day class. Very informative. We covered the (World Bill Acceptor) WBA-10, -11, -12 and -13 mostly.

The WBA-12 has 4 MB (Mega-Byte) of Flash Program Memory. WBA-13 has a 4 MB EPROM Program Memory. Operation is the same between the two CPU types. The game can not tell if it is talking to a WBA-12 or WBA-13. WBA-10 and WBA-11's are similar, but only have 1MB of Program Memory.

The program should match the type of game. The ID-xxx-xxx number is unique to different games with some games using more standard and common while others (like IGT) are unique.

The head reads the inserted bill, taking 128 readings from each sensor (the left and right sensors, labeled HPL & HPR) over the length of the bill. We'll examine these sensors in detail later on. These readings are compared to patterns stored in Program Memory for a bill inserted in each possible way, four patterns for each acceptable bill. All bills still in circulation must be supported by patterns in memory. At present, that takes up about 2.5 MB of space. WBA-10 and WBA-11 cannot accept bills in all possible directions because of this limitation.

There are also three magnetic heads that read the magnetic ink on the bill. This is a simplification. The stored pattern is not a literal reading from the sensors, but a calculated algorithm based on the readings. The specifics of what is done are a closely held secret by JCM. No surprise to me.

When a bill is inserted, the bill acceptor reads the bill, compares the sensor readings against known values and sends the game a message that it has recognized a certain type of bill. At this time, the bill is held in escrow in the carrying unit. It has not been stacked and can still be returned to the player. If the bill is not recognized, it is returned to the player. If the denomination is not one it is set to accept, it will be returned to the player.

DIP switch settings on the side of the carrying unit determine which bill denominations are acceptable. The switch being off accepts that denomination. The game then decides if it wants to accept the bill. At its option, the game can tell the bill acceptor to accept or reject the bill. If the game already has a certain number of credits, it may choose not to accept the bill at this time. A penny game may reject a $100.00 bill. A $50.00 per credit game may be set to reject $1.00 bills. If the game decides to accept the bill, it tells the bill acceptor to accept it. The bill acceptor turns on the stacker motor again and feeds the bill to the cash box.

JCM's Dan Peterson in action

This whole process is controlled by the CPU board inside the bill acceptor. There are two motors under its control, the transport motor and stacker motor. The movement of the bill (and a few other operations) is monitored by optical sensors spread throughout the bill acceptor.

Each type of bill acceptor may come in different configurations. The most popular are the WBA-xx-SS which stacks the bill in a downward direction (typical of upright games) and the WBA-xx-SU which stacks the bill in the upward direction (typical of Slant top games).

The cash box is where the bills are stored for collection. This is what is collected by the drop team and taken to the soft count Room to be opened and counted. The game, and the bill acceptor, keep track of what bills have been inserted. This information is forwarded to the Auditing Department and counted bills are compared to what should theoretically be there.

The bill acceptor keeps track of what bills have been inserted, in which direction they were inserted, how many were rejected and why, and what type of errors have been experienced. All this information can be obtained by connecting the bill acceptor to a computer. The software is downloadable from the JCM web site.

Parts

The bezel, or faceplate, is the front part that the player sees. This is not properly a part of the bill acceptor. It is an add-on that may be unique to the game vendor. It may have only a simple LED or it may be quite elaborate.

The head is the front removable unit into which the bill is first inserted, not including the bezel. All WBA-11 through -13 heads are the same. The heads are not specific to WBA-10, -11, -12, or -13, even though they may be labeled as such. Inside the head is the two (upper and lower) sensor boards, gears and a belt mechanism that is driven from a motor in the carrying unit.

The carrying unit (also referred to as the transport mechanism) is the main assembly that has the CPU and holds the bill in escrow.

Inside the carrying unit is a solenoid that activates a mechanism that prevents a bill from being pulled back out once it has been accepted for stacking.

The stacker and cash box assembly is a mechanism with gears and such to stack the bills in the same order they were inserted. The gear mechanism is driven from one of the motors in the carrying unit. The mechanism inside the cash box that pushes the bills onto the stack is called the pusher mechanism.

Cabling to the game is unique

to the game manufacturer with a few standard designs. Power is obtained from the game or an add-on power supply as an option to the game manufacturer.

Normal Game Operation

The game must be set up to talk to the type of bill acceptor attached to it. The bill acceptor must be set up to match the game type. In the bill acceptor, this is a matter of having the right type of EPROM (ID-xxx number). Some games have an adapter board. Normally the bill acceptor talks over TTL voltage level lines. Some games assume RS-232 voltage levels are present. The adapter board provides voltage level translation.

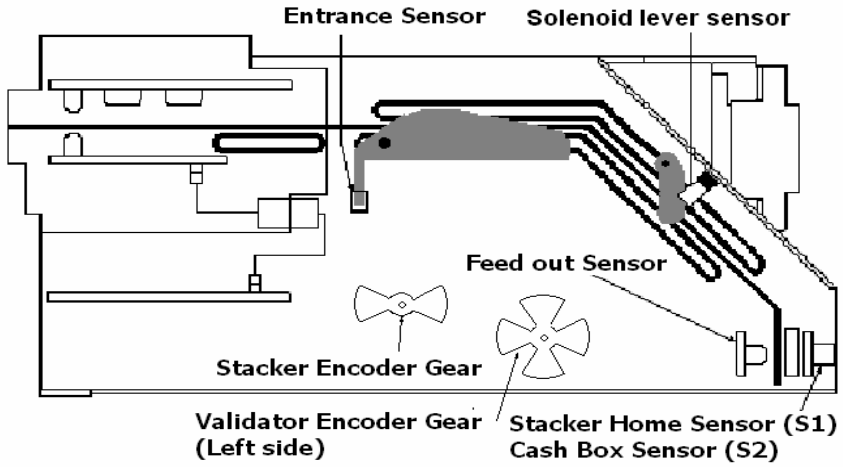
During the game's POST (Power On Self Test) it checks communication to the bill acceptor. During power up, the bill acceptor is also doing its POST. The game checks for proper operation of the bill acceptor to some degree, but it's not a total check.

POST of the bill acceptor can be noted by it doing its cycling and both LEDs on the CPU board coming on. One LED comes on at the beginning of POST. The second comes on confirming a good end of POST.

Cleaning

Clean the head and transport bill path with a soft cloth wet with a 20% solution of a mild soap. No alcohol, chlorothane, fluorothane, solvent or ammonia based cleaners should be used. A non-ammonia type window cleaner is a good example of a mild soap. Wipe it dry with a clean dry lint-free cloth.

Transport Sensor Location



Putting the transport into test mode and doing the motor test gets the workings of the bill acceptor in motion for better cleaning. Cleaning is best done at the bench, but can be done at the game if preferred.

Head Calibration

After cleaning, the calibration process should be done.

Power off Set DIP switch 1,2,3,4 off; 5,6,7,8 on Power on The two LEDs on the CPU board should light. LED1 coming on indicates the POST diagnostics are started. LED2 coming on indicates the POST completed properly. If only the first LED comes on check the EPROM (on EPROM type units). If neither come on check for a power or CPU board problem. The unit will cycle then stop. Insert reference paper 501-000032, black end first. Hold the white end close to the end of the card to avoid getting smudged by dirty fingers. Keep the white area clear of dirt or damage. The unit will read the paper in, sample the white section first, then feed the bill back out and sample the black section. It will repeat the process about five times, ejecting the calibration paper on the last sample. If the calibration went well the LED (Bezel lamp) will flash rapidly. If it failed the LED will pause, blink a number of times, and repeat the blinking (see table below)

Proper completion of calibration is noted by a rapid blinking of the LED. If a failure is encountered the LED will blink a number of times to indicate the cause of failure, pause, then repeat the blinks. A listing later in this article indicates how many blinks indicate what failure.

Test Mode

Turn Power off Set DIP switch 8 on, all others off Turn power on The LED (Bezel light)

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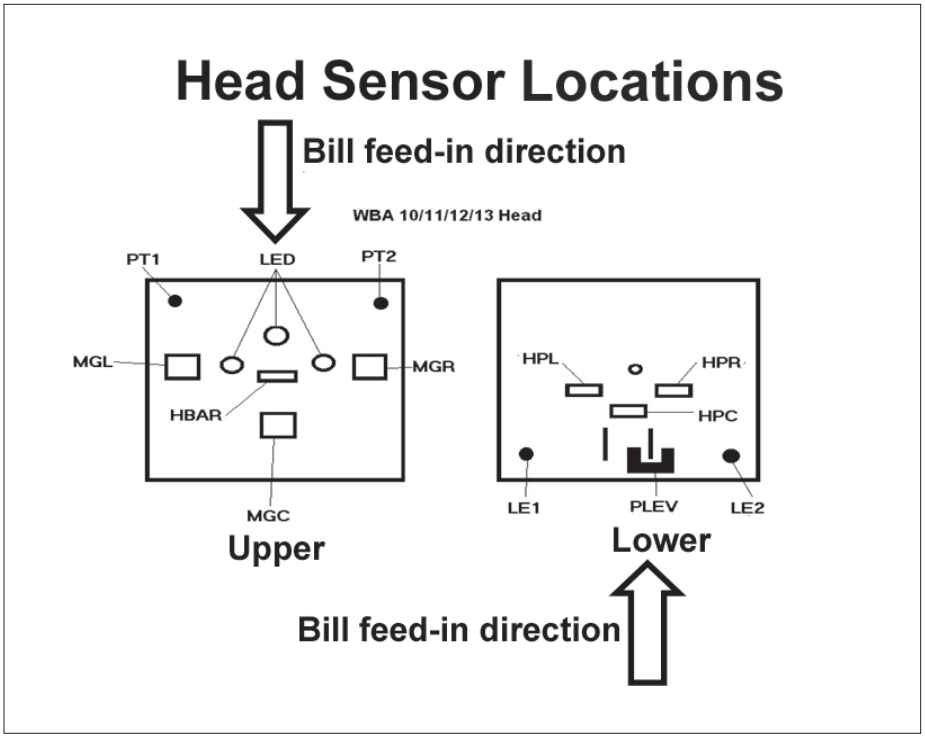
should blink at a slow steady pace. This is an indication that the CPU is in Diagnostic mode.

If the LED does not blink (steady on or off) suspect a CPU problem. Change the EPROM to a known good one, or re-flash the unit on Flash types.

Once you are in the basic diagnostics mode switch 8 is used as an Enable/Disable switch. The other sections of the DIP switch are used to select the test to be performed. Set the DIP switch to select the test. Turning switch 8 off should start that test. Turning switch 8 back on should stop the test and let you select a new test.



Sw# Test Function
1 - Transfer (transport) motor forward test.
2 - Transfer (transport) motor reverse test.
3 - Stack motor and pusher mechanism test.
4 - Acceptor Head and Stacker test.
1, 4 - Acceptor Head and Stacker test without the head.
5 - Solenoid test.
6 - Acceptor Head Sensor Test. (Multiple tests. See separate procedure.)
7 - Transport Sensor Test. (Multiple tests. See separate procedure.)
1, 2, 3 - Bill Acceptance test without cash box and frame.
1, 2, 3, 4 - Bill Acceptance test with cash box and frame.

Test 1 - Transfer motor forward test

This test runs the transport motor that drags the bill through the head and into escrow. It checks motor speed and can be used to listen for mechanical problems. If all is good, the LED should stay off. If it is too fast or too slow, the LED should come on. It takes a notable difference in speed to fail.

This is the test you can use when cleaning the head and transport bill path. It tests the validator (transport) optical encoder and associated gears.

By monitoring current draw, you can judge the condition of the motor. As it gets older, it gets weaker and draws more current. Mechanical binding in the transport will also cause slow operation and excessive current.

Test 2 - Transfer motor reverse test

Same as Test 1, but the motor goes in reverse, as if rejecting the bill.

Test 3 - Stacker motor and pusher mechanism test

Exercises the Stack and pusher. Checks the Stacker motor, optical encoder and its asso-

ERROR CODES

# Meaning	Possible cause
1 - Entrance level error	Check the PLEV/FLEV sensor. See Head Sensor Test.
2 - Solenoid Error	See Solenoid Test.
3 - Feed-In Sensor Error	See Transport Sensor Test.
4 - Transport jamming	See Transport Sensor Test
5 - Gain Error	Replace/troubleshoot upper sensor board in the head.
6 - D/A Error	Replace/troubleshoot upper sensor board in the head.
7 - Bar code sensor error	Replace/troubleshoot upper sensor board in the head.
8 - Head not in place	Check the 20-pin connector between Head and Carry Unit.
9 - Magnetic sensor error	Replace/troubleshoot upper sensor board in the head.
10 - Write-In Error	Replace/troubleshoot upper sensor board in the head.
11 - Black level error	Replace/troubleshoot upper and lower sensor board in the head.

ciated gears. Again, the LED should not come on.

Test 4 - Acceptor Head and Stacker test. This may be run with or without the head. It tests overall mechanical operation of the motors and mechanisms.

If this test fails the LED will blink a number of times indicating the cause of failure, pause, then repeat the blinking.

ERROR TABLE 1 – ABNORMAL CODES

Error No.	Description	Possible Causes	Follow-up Test
1	CASHBOX FULL	STACKER ENCODER	#3 - STACKING, #7 TRANSPORT SENSORS
2	STACKER JAM OR PUSHER UNIT TROUBLE	STACKER ENCODER OR PUSHER HOME SENSOR (S1)	#3 - STACKING, #7 TRANSPORT SENSORS
3	TRANSPORT COVER OPEN OR SOLENOID LEVER TROUBLE	TRANSPORT ENTRANCE SENSOR OR SOLENOID LEVER SENSOR	#7 TRANSPORT SENSORS
4	BLOCKED BILL PATH SENSOR	ALL HEAD AND TRANSPORT SENSORS	#6 - HEAD SENSORS, #7 TRANSPORT SENSORS
5	THE ACCEPTOR HEAD IS DETACHED, NOT CALIBRATED OR INCORRECT TYPE	CLEAN AND CALIBRATE. CHECK ALL HEAD SENSORS AND HEAD DETACHED TEST	#6 - HEAD SENSORS, #7 - ACCEPTOR HEAD DETACHED
6	TRANSPORT MOTOR TROUBLE OR THE SIGNAL IS NOT SENT FROM THE ENCODER	TRANSPORT MOTOR. TRANSPORT ENCODER	#1 TRANSPORT MOTOR, #7 VALIDATOR ENCODER SENSOR
8	SOLENOID LEVER TROUBLE	LEVER ASSY OR LEVER SENSOR	#5 - SOLENOID TEST, #7 SOLENOID LEVER SENSOR
10	CASHBOX NOT FULLY SEATED	CASHBOX SENSOR (S2)	#7 CASHBOX SENSOR

blinks Cause
2 - Solenoid lever trouble.
3 - HPL, HPR or HPC sensor are blocked, bad, or so far out of calibration they fail.
4 - One of the Bill motion sensors are blocked, dirty or defective.
5 - Cash box full or Stacker Encoder sensor is bad.
6 - Pusher trouble in the cash box, or S1 is blocked, dirty or defective.
7 - Acceptor head is detached, badly out of calibration, or the wrong type. (WBA-2x type maybe?)

Test 5 - Solenoid Test

This test exercises the solenoid in the transport.

Test 6 - Acceptor Head Sensor Test.

This test is used to check the individual optical sensors in the head. There are eight sensors to be tested. Each is selected by the DIP switch once you enter Test 6 by turning on DIP switch 6 and turning switch 8 off. Switch 6 now becomes the Enable / Disable function and the other DIP switches are used to select the specific sensor to be tested. Once selected the LED should indicate the activity on the sensor.

ERROR TABLE 2 – TEST MODE 4 ONLY

ERROR NO	DESCRIPTION	POSSIBLE CAUSES	FOLLOW-UP TEST
2	SOLENOID LEVER TROUBLE	SOLENOID SENSOR OR LEVER JAM	#5 SOLENOID TEST, #7 SOLENOID LEVER SENSOR
3	BLOCKED HEAD SENSOR	CLEAN AND CALIBRATE HEAD SENSORS	#6 - ACCEPTOR HEAD SENSORS
4	BLOCKED TRANSPORT SENSOR	TRANSPORT SENSORS	#7 - TRANSPORT SENSOR TEST
5	CASHBOX FULL	STACKER ENCODER	#3 STACKER TEST, #7 STACKER ENCODER SENSOR
6	PUSHER UNIT TROUBLE IN THE CASHBOX	STACKER ENCODER OR PUSHER HOME SENSOR (S1)	#7 STACKER ENCODER, #7 - STACKER HOME SENSOR
7	ACCEPTOR HEAD DETACHED, NOT CALIBRATED OR WRONG TYPE	CLEAN AND CALIBRATE. CHECK ALL HEAD SENSORS AND HEAD DETACHED TEST	#6 - HEAD SENSORS, #7 ACCEPTOR HEAD DETACHED

SW# Sensor
1 - PLEV
2 - (not used on WBA covered here)
3 - PT 1 (Left Entrance Sensor and LED.)
4 - PT 2 (Right Entrance Sensor and LED.)
5 - HPL (Left bill path sensor)
6 - HPR (Right bill path sensor)
7 - HPC (Center bill path sensor)

PLEV - This is the sensor on the lever close to the front that pops up once a bill has been inserted in. This discourages another bill from being inserted before the present one completed.

PT 1 and PT 2 - These sensors are used to detect that an incoming bill is present. The CPU monitors these sensors when it is ready to accept a bill. Once sensed, the CPU turns on the transport motor and drags the bill through the head. 128 readings are taken over the length of the bill by each of the HPL, HPR and HPC sensors.

The timing of each sensor reading comes from the encoder wheel on the transport motor. In this manner, reading a bill isn't tied so much to motor speed but rather to the bill's position at each of steps of the encoder. If the transport is running a little bit slow or fast, operation will still be normal. The sensors are located on the upper sensor board and the emitters are on the lower board.

HPL and HPR - These sensors are the ones that actually read the bill. Left and right are viewed from the front of the head. On these, the sensors are on the lower board and the emitters are on the upper board. These are dual LEDs that alternate between red and infrared. Timing is determined by the slots on the encoder disk on the shaft of the transport motor.

HPC - This sensor is used to read tickets. Only the bar code is read. The information is passed on to the game that ticket number so-and-so was recognized. The game then interrogates the house system for the number of credits and tells the bill acceptor to accept or reject the ticket.

Test 7 - Transport Sensor Test.

This is also a multiple function test and runs similar to the operation of Test 6. Switch 7 is used to enter this test. Once entered switch 7 becomes the Enable / Disable switch to start and stop the test and select which sensor is being tested.

Transport Entrance Sensor - As the two front sensors are blocked the LED should go

Sw#	Sensor
1	Transport Entrance Sensors.
2	Solenoid Lever sensor.
3	Feed Out Sensor.
4	Stacker Home Sensor.
5	Cash Box Present sensor.
6	Transport (Validator) Encoder sensor.
7	Stacker Encoder sensor
1, 2	Acceptor Head Detached sensor. Not actually an optic.

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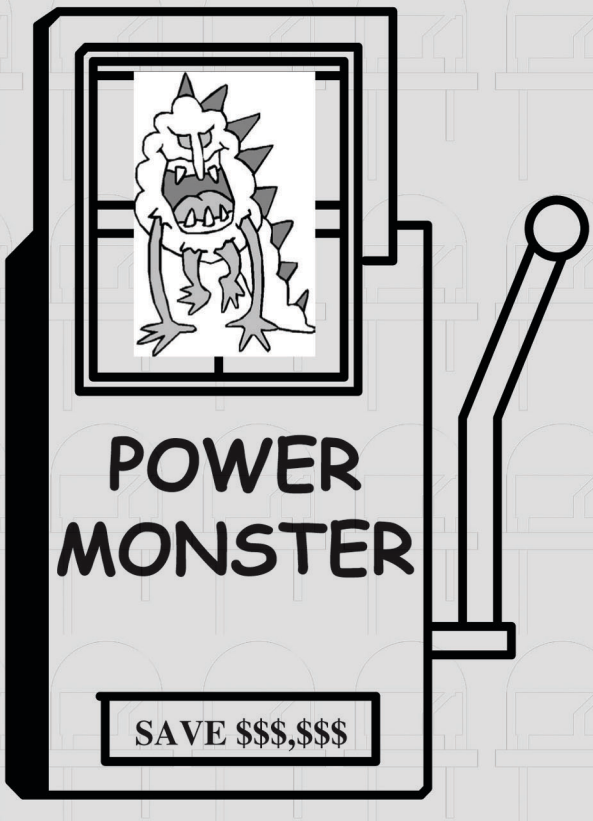

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on and off.

Solenoid Lever Sensor - As the solenoid lever moves in and out, the LED should blink. The solenoid lever has a locking mechanism on it that prevents it from being fully pressed in. To release this locking mechanism you need to insert something down next to the lever and depress the locking bar.

Feed Out Sensor - The last sensor in the bill path is the feed out sensor. This is accompanied by a prism. The emitter shines through the bill path, is reflected back through the bill path by the prism, and hits the sensor. As the bill path is interrupted, the LED should blink.

Stacker Home Sensor and Cash Box Present Sensor - In the same area as the feed out sensor, you should find two Opto Interrupters labeled S1 and S2. S1 is the stacker home sensor. S2 is the cash box present sensor. When selected, each of these should blink the LED as the sensors are blocked. The sensors monitor two flags in the frame that are activated by the condition of the cash box.

Transport (Validator) Encoder Sensor and Stacker Encoder Sensor - On the end of the shaft for each motor is a wheel with slots in it, two slots for the Stacker, four for the Validator. When selected, the LED should blink as each wheel is turned manually.

The Validator Encoder is used for timing pulses for sensor readings. A complete reading of the bill should be 128 pulses of the validator encoder or 32 revolutions. It is also monitored to judge motor speed.

The Stacker Encoder rotations are monitored to tell when the stacker is full and that the motor is running at the right speed. When the stacker is full, a friction clutch stops gear rotation.

Bill Acceptor Tests - This test can be run with, or without, the cash box and frame. As a bill is inserted it is read and stacked (if it is a good reading). The LED blinks a number of times to indicate the denomination recognized. Once for a $1.00 bill. Twice for a $2.00.

ERROR TABLE 3 - RETURN CODES

ERROR TABLE 3 RETURN CODES			
ERROR NO	DESCRIPTION	POSSIBLE CAUSES	FOLLOW-UP TEST
1	CROOKED INSERTION	ENTRANCE SENSORS	#6 - ENTRANCE SENSORS
2	MAGNETIC PATTERN ERROR CENTER	CENTER MAG SENSOR	
3	DETECTED A BILL IN THE PATHWAY AT IDLE	HPL, HPR ,HPC, OR TRANSPORT ENTRANCE SENSOR	#6 - HEAD SENSORS, #7 ENTRANCE
4	DATA AMPLITUDE ERROR	ALL IR SENSORS (POSSIBLE POWER SUPPLY)	#6 - HEAD SENSORS, #7 TRANSPORT
5	TIMING ERROR, THE BILL DID NOT REACH THE SENSORS WITHIN THE SPECIFIED PERIOD OF TIME	HPL, HPR, HPC OR TRANSPORT ENTRANCE SENSOR OR ENCODER SENSOR	#6 - HEAD SENSORS, #7 TRANSPORT ENTRANCE SENSOR, VALIDATOR ENCODER
7	ERROR IN PHOTOSENSOR	CLEAN AND CALIBRATE	#6 - HEAD SENSORS, #7 TRANSPORT SENSORS
8	LEVEL ERROR, THE BILL WAS UNUSUALLY DIRTY OR TWO OVERLAPPING BILLS	ENTRANCE SENSORS	#6 - HEAD SENSORS
9	RETURN COMMANDED BY DIPSWITCH	CHECK DIPSWITCHES	
10	RETURN COMMANDED BY THE HOST	CHECK MACHINE SETTINGS	
11	SOLENOID LEVER TROUBLE	SOLENOID LEVER OR SOLENOID SENSOR	#5 - SOLENOID TEST, #7 SOLENOID SENSOR
12	THE SENSORS DETECT MOVEMENT IN THE WRONG DIRECTION DURING TRANSFER TO THE CASHBOX	HPL, HPR, HPC, OR TRANSPORT ENTRANCE SENSOR	#6 - HEAD SENSORS, #7 TRANSPORT ENTRANCE SENSOR
13	THE BILL IS OF A LENGTH OTHER THAN SPECIFIED	HPL, HPR	#6 - HEAD SENSOR
14	COLOR PATTERN ERROR	HPL, HPR, HPC (Red Component)	#6 - HEAD SENSORS
15	MAGNETIC PATTERN ERROR LEFT OR RIGHT	LEFT OR RIGHT MAG SENSOR	

Three for a $5.00. Four for a $10.00. Five for a $20.00. Six for a $50.00. Seven for a $100.00. Eight for a Ticket.

Error Codes

Specific reasons for failure of a test are noted by the number of blinks

1 - Cash box full. Stacker Encoder may be defective.
2 - Stacker jam or cash box problem.
3 - Transport cover open or solenoid lever trouble. Transport entrance sensor or solenoid lever sensor malfunction.
4 - Block bill path sensor in the head or transport.
5 - Acceptor head is detached, or fails calibration.
6 - Transport motor encoder failure.
7 - (Not implemented in the devices covered.)
8 - Solenoid Lever trouble.
9 - (Not implemented in the devices covered.)
10 - Cash box not fully seated. S2 sensor.

JCM's website can be found at www.jcm-american.com

They have a fairly open web site with a good parts reference section but you have to know the part number of the item you want to get anything out of the system. Even on the CD they distribute, parts breakdown is not remarkable, in my opinion.

Herschel Peeler
hpeeler@slot-techs.com

Handy WBA Part Numbers

- **550-100042 - PS15-006 Power Supply**
- **400-100040 - WBA 10/11 Extension Cable**
- **400-100110- WBA 12/13 Extension Cable**
- **400-100109 - Adapter Cable WBA 10/11 to WBA 12/13**
- **501-000032 - WBA Calibration Paper**
- **TM0100 - WBA Manual**
- **960-000027 - WBA Quick Reference Manual**
- **950-100063 – Sentry Quick Reference Card**
- **960-000014 – Parts Catalog CD**

Understanding Video Reels

Part 2

By John Wolson

Last month we started on another journey into slot game design, showered with mystery, sprinkled with intrigue and rich with slot math. We started to look at virtual reels, physical reels and finally, video reels. We made a very simple slot game using three reels with 10 stops on each reel. It wasn't very difficult, but left us a little bit short on variety and nice payouts. We're going to make a video slot game and see the differences. "What?" you say. "There's no way we can do that." Fear not, dear readers. This is Slot Tech Magazine. Anything is possible....

Along Came a Technological Revolution

Now we move to a virtual stop machine. We won't bother working out all of the math and symbol combinations for the machine however. We did that earlier with our Blazing 7s game.

What does the virtual reel stop actually do for us? We know that it will permit us to pay out considerably larger amounts for a win. Why? Because we have longer to make up that win. In our 10-stop game, every 1,000 games will complete our cycle (in theory). Of course, being randomly based, we won't receive every possible combination. At 1,000 games, some will not have come up at all and some will have come up more than once. In general, however, we can say that we complete the cycle every 1,000 games.

When we have three reels with 64 stops per reel, the result is 262,144 games in our cycle. With the large base of coins in for the game we can work on what we want to pay out to the player. We could have only one winning combination paying 250,000 coins and we'll still make money. However, our hit frequency is very poor. We'll have a number of winning combinations ranging from a credit or two up to a jackpot ranging from 500 coins to 1000. In some cases, where you have a 30,000 credit payout for 3-coin play, it takes a bit more work. In that case, it might just be necessary to add some more virtual stops and expand our cycle. If we move to a 72-stop virtual game, our combinations increase to 373,248 - a total of 111,104 more coins in.

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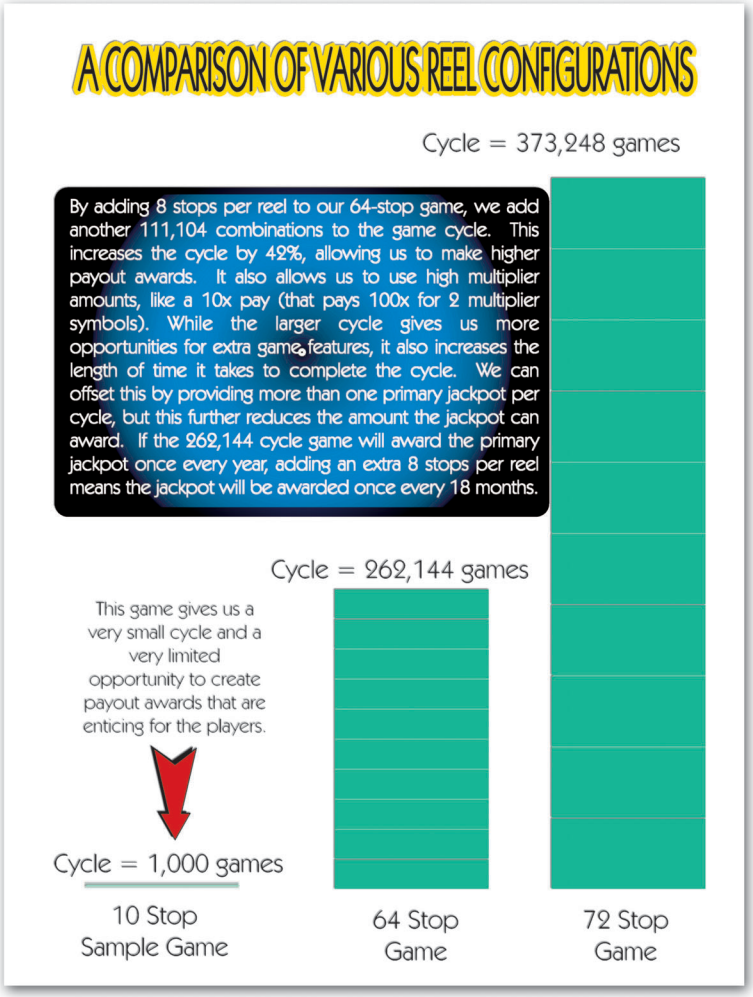
During TechFest 9, we created a 3-reel game that had a 10x multiplier. We were able to make a good payout percentage (and conversely, a good hold percentage) right from the start. The hit frequency was only around 2%, though. This was a 64-stop game and we found it necessary to increase the stops to 72. Virtual stops allow this flexibility in game design and offer an appealing game to players. Players dream of a large jackpot win that will see them going home with some money in their pockets. A 30,000 credit win for a 3-coin play is appealing. While it might be infrequent, it still happens. A life-changing multi-million dollar jackpot is even better. The players realize it won't happen very often, but also know that it will happen eventually. This creates great interest in the games.



Cycle

This brings us to the cycle itself. Suppose we have 10,000 games played on a particular slot machine during a two week period. Going back to our first 10-stop game, there will be ten cycles in this two week period. With eight combinations of 7s per cycle, we're going to see the 7s payout (the machine's jackpot of a whopping 50 coins) paid 80 times during that period. That relates to roughly once every four hours or so, assuming we are open 24 hours a day.

Using our 64-stop game, we're increasing the time between jackpot payouts. Is there only one jackpot per cycle? Then it's paid once every year. That's a significant increase in time between jackpots. However, using the virtual stops, we can have a 50-credit win paid very frequently - perhaps a few times per hour. While the biggest payout will be much less frequent, we can have smaller payouts occurring very regularly. We provide enough smaller wins to keep the players happy and can even throw in a number of 1,000 coin pays to keep them excited. If we have one jackpot in a 72-stop game, then we'll see a jackpot paid once every 18 months - approximately. By adding eight more stops per reel, we make the jackpot come up 50% less frequently. Simple changes in the number of virtual stops in a game can have a big impact on how the game plays. It might be positive (allowing for a large jackpot) or it might be negative (making the wins too infrequent).

Now, how does all of this relate to video reels? Significantly! First of all, by using five reels, we increase our cycle. A 32-stop, 5-reel game has a cycle of 33,554,432. Even with only 32 stops, the extra two reels give us a cycle of over 33 million games. For a single jackpot in this cycle, at 10,000 games in two weeks, we would pay it out every 129 years. In order to make this fair, the jackpot frequency is increased. You may have 100 combinations of the primary jackpot. That brings the frequency down to 1.29 years. Let's take a closer look at the

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Brian Rankin - Slot Technical Manager

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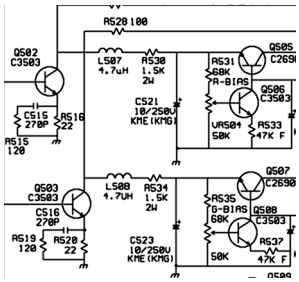
This relatively inexpensive piece of test equipment is easy to operate. Casino School students learn to use the digital multimeter to perform tests and measurements that will pinpoint the cause of a failure down to a single component.

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.

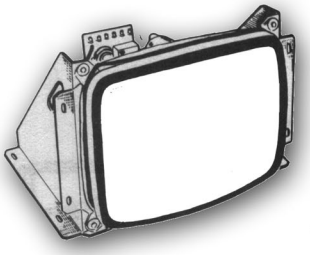
SCHEMATIC DIAGRAMS

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



POWER SUPPLIES

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



MONITOR REPAIR

The monitors used in video slots are designed for quick, easy, and safe repair. Students will learn the theory of operation of all types of monitors and how to repair monitors down to the component level. Of course, monitor safety will also be discussed.

You do not have to send your slot techs to Las Vegas or Atlantic City for training. The Casino School brings the training to you. Contact Randy Fromm's Casino School today to reserve a date for your tech school

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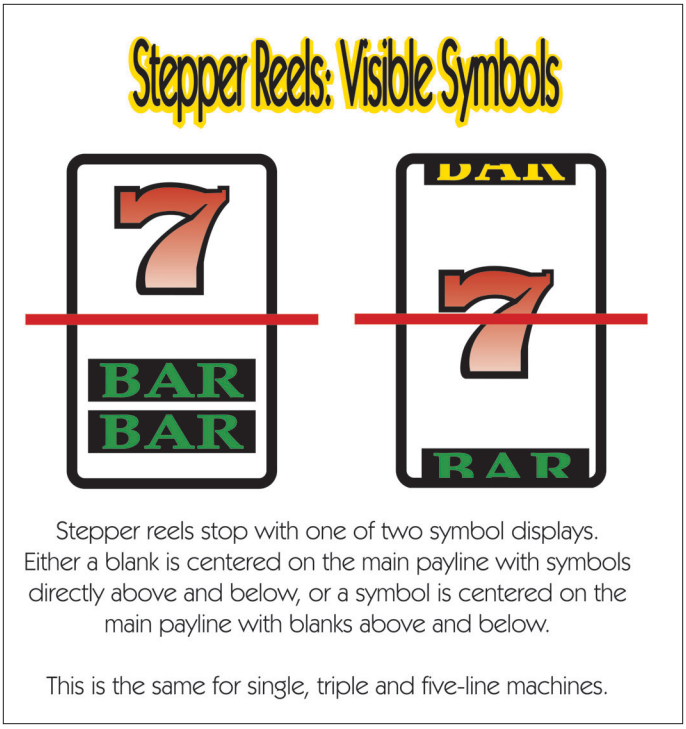


Stepper reels stop with one of two symbol displays. Either a blank is centered on the main payline with symbols directly above and below, or a symbol is centered on the main payline with blanks above and below.

This is the same for single, triple and five-line machines.

video reels and see what benefits - and pitfalls - these video reels create.

Video Cycle

First of all, our calculation for 129 years isn't exactly accurate. It assumes a single payline game. Spinning reel slots will display either one or two symbols in the visible window. Either we get a blank (where the second payline would be) a Symbol (on the center payline) and a blank (where the third payline would be) or else we get a symbol, blank, symbol. By using more paylines we can increase the frequency of the combinations.

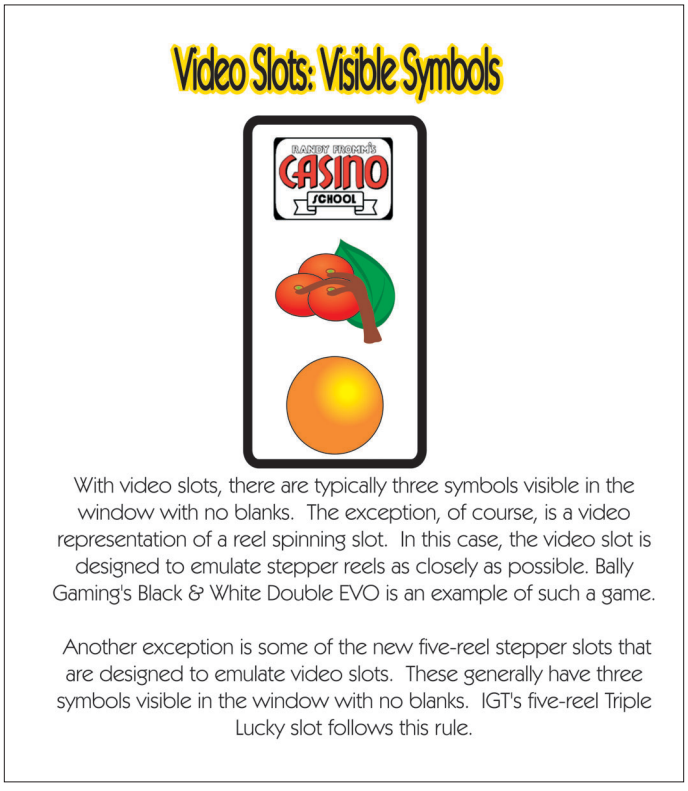
On video slots, we always see three symbols visible on each reel at all times. There are no blanks on a video reel. Also, the five reels give us an incredible array of paylines. Video games with 20 paylines are very common. We could then divide the frequency of our jackpot award by the number of paylines - it will occur 20 times more frequently! Using the example of 100 jackpot combinations resulting in 1.29 years, if we have 20 paylines we'll pay out the primary jackpot every 1.29 years / 20 = 3.3 weeks.

Virtual Video Reels (say THAT three times fast!)

Video slots don't use virtual mappings simply because they don't need to. There are no physical reel strips - they are all created inside of the slot machine - virtually. Because it is a video representation of a reel strip, the reel can be as large as we want. We could have 100 symbols on the reel strip and it doesn't take up any more physical space. We only see 3 symbols at a time. Also, video reels don't have to be the same length - you never really see the reel strips. The player (and a keen slot technician) won't be able to actually see the start and end of the reel as it spins - it's too fast. Will you notice that the first reel makes three complete revolutions in the time the fifth reel makes one? Some video slots use the same number of stops for each reel because it makes the mathematics easier.

This configuration of video symbols on the reels greatly affects our cycle as well. Let's take a hypothetical video slot machine and make up some reel strips for it. We'll start with the basics - five video reels with symbols only (no blanks). As video slots generally have different symbols from the spinning reel slots, we'll need to come up with some funky video symbols, too.

Let's keep some tradition and use a Red 7. We'll have a jackpot symbol in the form of Slot Tech Magazine's logo. In order to keep our math as simple as possible, we won't include any scatter-pay symbols, mystery payouts or bonus games. In a future series we'll exam-



With video slots, there are typically three symbols visible in the window with no blanks. The exception, of course, is a video representation of a reel spinning slot. In this case, the video slot is designed to emulate stepper reels as closely as possible. Bally Gaming's Black & White Double EVO is an example of such a game.

Another exception is some of the new five-reel stepper slots that are designed to emulate video slots. These generally have three symbols visible in the window with no blanks. IGT's five-reel Triple Lucky slot follows this rule.

Save the date—
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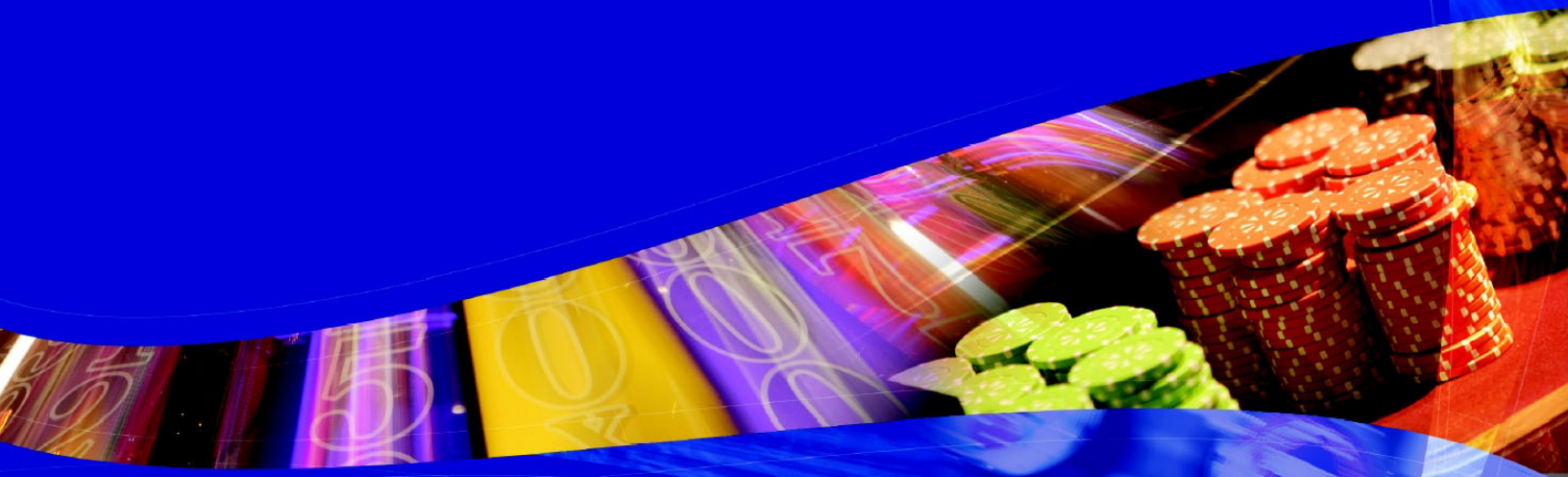

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ine video bonus rounds in detail, so we'll leave that subject for another time.

The basic slot math is the same for video slots as it is for spinning-reel slots. It is also very different. Right now, though, the line between video and spinning-reel slots is becoming blurred. Let's first examine our options.

Early video slots were simply copies of spinning-reel slots. They were made to emulate the stepper slots as closely as possible. If you have been to Mystic Lake Casino for TechFest, you'll recall that there are a number of older video slots with CGA graphics. In some cases, these slots were used because gaming regulations prevented stepper slots. Apart from the video representation of the game, they look, feel and play the same as the stepper slots. Bally has converted some of their stepper slots to video, as have other manufacturers. The Black & White Double Jackpot EVO machine basically looks and feels like a spinning-reel machine. It even shares the same SMI number.

Some newer stepper slots, however, play like a video slot. IGT's 5-reel Triple Lucky 7s game has spinning reels, but the configuration is the same as a video slot. There no blanks and there are always three symbols visible in each reel window. These games are designed as a crossover to video from stepper slots. For die-hard spinning-reel players, it gets them used to the video-feel of the games. From there it's a simple step to get them to try video. Hybrid machines, using both spinning-reels and video slots do the same thing. IGT's Double Diamond Run has a 5-line three-reel stepper base with a video screen up top that emulates the spinning reel slots. The video version follows the same protocol as the spinning reel (five paylines, blanks, either two or three symbols visible in each reel window), but gets the player used to video animation. Of course, the video bonus round further enhances the players' experience.

These crossover games mean that players can experience the best of both worlds — stepper or video slots — with the protocol found in either video or stepper versions.

Game Design

To begin with, we'll start with the basics. We'll have a five-reel game and a myriad of symbols. Let's use 16 stops per reel for a good starting point. This gives us a cycle of 16x16x16x16x16 = 1,048,576 games. We'll quite likely have to expand our stops once we get going, but it's good to start small and expand from there.

We're going to have to determine our payout and symbol table first in order to then distribute the symbols on the reels and get our first calculation of hit frequency and payout percent. We need to know how many symbols we need in order to pay something. For example, our primary jackpot will be for five Slot Tech Magazine symbols. We'll pay a lesser amount for four symbols and still less for three symbols. Do we want to pay for two or one symbols? Will we pay from right-to-left as well as left-to-right? Are these symbols wild? Do they multiply the payout? Obviously, there are a lot of decisions that we need to make.

In order to simplify it, I've come up with a basic plan and will now outline it for you. Once we get that arranged, we'll worry about the math and determine what we need to do to make the game pay properly. If the payout is too low, we can pay for fewer symbols (e.g.: pay for two symbols, not just three, four, and five) or raise the payout amount. If the payout is too high, we have to reduce the payout amount for certain wins, or try to boost up smaller-paying wins and decrease higher-paying wins. Remember, with a stepper slot we can always add more blanks to reduce the payout percentage (and, consequently, the hit frequency). If we don't have any blanks, though, it makes this more difficult. We're going to find it's quite a balancing act here in order to give high hit frequencies and a good payout percentage.

What's next?

Although we haven't progressed very far with our design of a video slot machine, we have covered a lot of information here this month. Next month we'll get into the game design and some math (yay!). We'll also discuss video cycles in more detail, looking at it from a totally new angle. The plot thickens....

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Quick & Simple Repairs #6

By Pat Porath

Game Communication - "Are We Talking?"

"Hey bill accepter, hey ticket printer, hey touchscreen . . . Are you guys there?"

SENET and Netplex. Sounds like something you'd find in Washington DC but this SENET stands for Synchronous Expansion Network. SENET refers to a dedicated communication network in IGT games for most of the simple inputs and outputs of games that are sent and received by the CPU. These are also known as I/Os, such as I/O boards and I/O cards. "I"s send information into the CPU and "O"s are sent out of the CPU. Each I/O card in a specific game can handle 16 inputs and 16 outputs. These are items such as player buttons and cherry switches as well as electronic switches like the coin-in optics but excluding the reset keyswitch and main door optics as these go directly to main processor for security reasons and are not part of the SENET.

SENET uses an IGT-designed chip on the main board of the game and can handle up to a total of 16 I/O cards. On an IGT Vision game, U67 is the SENET buffer chip and on a IGT Game King, it is U74. A typical game has two or three I/O cards in it. One is used for the main door inputs and outputs such as coin-in optics and player buttons, the coin comparator, etc. while one is for the cabinet. The one for the cabinet is used for things such as the handle, hopper, motors and the candle. Some top box bonus devices also use an I/O card but top box bonus devices could also use Netplex. Sometimes when an I/O card gets "hotslammed" (the game wasn't powered down) or it goes bad — maybe it even came loose — there can be misleading tilts. Yes . . . misleading tilts. A "coin-in jam" or "meters disconnected" may appear on the screen but if the problem isn't obvious, then it could be a SENET problem. A bad I/O card will cause the machine to display misleading tilts when it is actually the I/O card itself that is faulty. I have run into quite a few games where there is "meters disconnected" or "coin-in jam" showing on the screen and the only problem is that the door I/O card is loose. If the card is loose, POWER DOWN the game and snug it in place. More than likely, your tilts will be reset. If that doesn't work, try a door I/O card from the machine next to it. If the problem goes away, then the original is bad (I know you're saying "No kidding, Pat" but look again at the title of this column.).

This is known as "swaptronics." I really like to use swaptronics in slot machine repair. It can save a lot of time in a quick hurry. Anyway, on an IGT Vision game, a bad seven segment display will also send false tilts. If you have simple tilts that won't clear easily, it may be a bad display. If you have a spare, give it a try.

Netplex is a dedicated channel for communication and protocol used in IGT games. It is used in complex devices such as touch screens, bill acceptors, ticket printers, VFDs (vacuum florescent display) etc. Items that process information use Netplex, such as in accepting a valid bill.

Netplex can be seen on IGT Game Kings by selecting the "comm channel analyzer" channel 5. Netplex items go into two categories: Optional and mandatory. Optional items are in the software of the game and are selectable. They are in the "Auto-Config" menu of a game. The mandatory are not listed in the menu.

To "Zero Netplex" (if you have a printer, bill acceptor, and/or touch screen error that won't clear) power down the game and pull the monitor and bill acceptor. You don't have to fully remove the items, but pull them out far enough so they don't make a connection.) Power up the game with the items disconnected until the you hear the coin diverter click. It may be a minute or two. After it clicks, power down the game and re-install the monitor and bill acceptor. Power up the game and more than likely, the tilts will clear. This is called zeroing the Netplex. My manager showed me this and I was very surprised. The touchscreen failure, the bill accepter communication failure and the printer error all cleared.

LCDs

LCDs in today's reel slot machines sure have added a lot to the games. Now they have touchscreens on them as well. What will be next? First of all what is a LCD? Well, it is a color display that is very similar to the ones used in laptop computers. It stands for Liquid Crystal Display. It is

used in the top box part of an IGT game. A common size is 8.5 inches x 6.5 inches. In the IGT games, there are two slots for flash cards in it. The top slot is used for the bonus part of the game and the side slot is used for the individual casino attract modes. The connectors on it are as follows:

2 pin male connector is the audio in 4 pin male connector is the audio out 4 pin female connector isn't used 6 pin male connector, goes to J5 on the communication board in the power distribution box 10 pin male connector is for the Netplex communications

One of the problems that we ran into with them is that the display would go black. Come to find out, on the interior, a small fuse blows due to a mechanical problem. This can be seen in customer notification number 2094 at IGT.

Symptom(s): LCD stops working when the fuse blows.

Cause(s): The fuse in the LCD assembly blows during installation into the machine if pressure is applied to the metal housing of the LCD on the right-hand side of the display.

Solution: If the fuse is blown it needs to be replaced with fuse (P/N 524-040-91) and an insulator (P/N 310-118-01) must be inserted between the PCB and the sheet metal and a caution label (850-500-00) must be placed on the housing. The insulator and caution label should be put into place as a precautionary/preventive measure even if the fuse has not blown.

Parts required: 1 each: fuse IGT P/N 524-040-91, insulator IGT P/N 310-118-01 and caution label IGT P/N 850-500-00.

You may want to make sure the unit isn't under warranty. Last time I checked, they had a three or five year warranty. We recently had a LCD go out on one of our Fort Knox IGT games. I tried a spare that we had but there were software issues and had to order a new one. The new one came in; the IGT tech loaded the software in it, and the top box

Pat Porath's Website Suggestions for Slot Techs

sodak-gaming.com	**Native American gaming, IGT games, Megajackpots, etc.**
happcontrols.com	**Slot machine parts, tools, cleaning supplies, etc.**
newarkinone.com	**Tons of stuff, batteries, duart chips, com chips, fans, test equipment**
fastenal.com	**Tools, jigsaws, bolts, wire, etc**
techni-tool.com	**Multi-meters, scopes, workbenches, nutdrivers, toolboxes, etc**
digikey.com	**Tons of chips, caps, resistors, transistors, transformers, LED's, etc**
bradysignmark.com	**Labels, tags, scrolling message boards, caution tape**
quill.com	**They have a lot of office supplies, chairs, label makers, shipping supplies, markers, binders, etc.**
grainger.com	**Heavy duty things like electric motors, electrical outlets, power strips, tons of light bulbs, tools. It's a 3782 page book**
radioshack.com	**Resistors, small light bulbs, small transformers, etc**
ballygaming.com	**Tons of info on Bally games and systems**
wmsgaming.com	**Williams website, with a pile of information**
northerntool.com	**Mostly heavy duty items, steel cabinets, work benches, handcarts etc.**
slot-tech.com	**Piles and piles of information, technical videos**
eway.com	**office products, dry erase boards, copier supplies, etc**
medeco.com	**High security locks, paddles, padlocks, etc**
alliedelec.com	**Capacitors, switches, solder equipment, etc**
casinogarage.com	**Used slot machines and casino signs**
mcmelectronics.com	**Tons of items, from audio equipment, to batteries**
ceronix.com	**A monitor website, many handy things there**
jcm-american.com	**Bill acceptors and info on any new bills that are coming out**
fluke.com	**The famous Fluke equipment**
casinotech.com	**Gaming technical information**

LCD was back working again.

Simple Repairs and Handy Websites

I have worked all three shifts at our casino: Days, afternoons and graveyard. In the past, I have had trouble finding what I needed in our shop's collection of books and repair manuals. Luckily, we now have internet access. There are tons of things available on the net. Wiring diagrams, EEPROM percentages, new game information, customer information, how new progressive systems work, etc. On some of the websites, to access the good stuff there is a form that you have to fill out to make sure that you are a valid casino employee, and then they give you access. My department director asked me a while back what I was up to because IGT called asking if I was a slot tech there. I thought it was pretty funny, and told him that it was for access to the good stuff on their site. You will also find parts and part numbers, technical Q&A forums and handy tools. In the box on the left are some of the websites we use at our casino.

It is amazing what some of these websites have to offer to you. If you are in a rural area like we are, this is the only way to get what we need.

Pat Porath
pporath@slot-techs.com

Korston Group Selects FutureLogic GEN2 as Standard Gaming Printer for Russian Casinos

FutureLogic, Inc., has announced that Korston Hotel and Casino Group has selected FutureLogic's GEN2 thermal ticket printer as the standard gaming printer for the Casino de Paris and Orlyonok Casino in Moscow. The agreement will also extend into new casino projects in development throughout Russia.

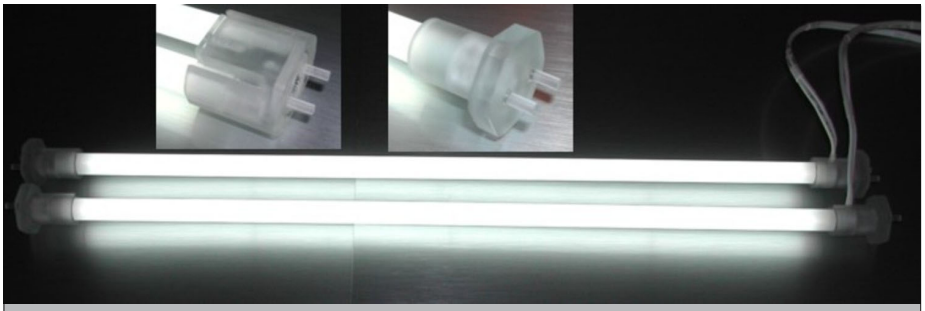
As providers of integrated hotel, entertainment and trade services for local patrons and business travelers, Korston is migrating to ticket-in/ticket-out (TITO) technology to streamline operations, improve the player experience and implement new marketing initiatives in their multi-venue complexes. According to Colin Hayes, Director of Slot Operations for Korston Hotel and Casino Group, "Obviously, we expect TITO technology to increase revenues through improved machine drop and greater customer satisfaction, but we also envision new opportunities to cross-market our broad range of services and build brand loyalty through promotional couponing."

Korston will incorporate IGT's EZ-Pay system and FutureLogic's GEN2 printer in existing and new gaming platforms. The multi-function printer enables proactive marketing functions on the casino floor by turning ordinary vouchers into colorful, eye-catching coupons. The device also satisfies Korston Group's quality and performance requirements with reliability features such as ITH (Intelligent Ticket Handling) technology to eliminate torn, smeared, or crumpled tickets; 50% more paper capacity than other printers, and provide a dedicated port for firmware upgrades.

FutureLogic's market leadership position in the gaming industry and GEN2's status as default printer for IGT worldwide were also factors in the Korston Group decision. "FutureLogic shares our long-term commitment and vision of TITO technology and promotional ticketing, making them an ideal partner for our ventures," said Hayes.

"We are pleased and honored to be selected by the Korston Hotel and Casino Group as their standard printer provider," said John Edmunds, General Manager of FutureLogic Europe Ltd. "Their vision of in-casino marketing initiatives is perfectly suited to the GEN2 feature set and functionality, and will provide an excellent showcase for FutureLogic's commitment to innovation in TITO technology throughout Europe and Russia."

For further information, contact FutureLogic Europe at +44.1628.760.083 for sales inquiries, or +44.1628.760.082 for technical service.



Graphic Proof

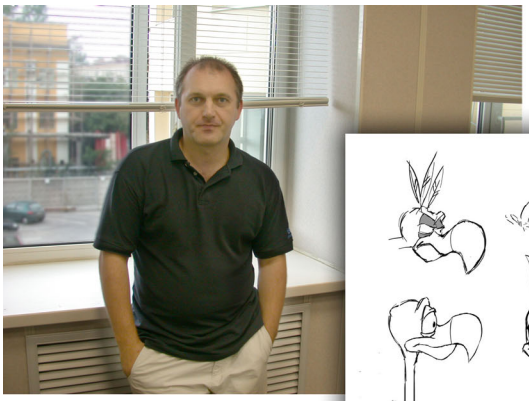
ALS Group (St. Petersburg) Provides Slot Manufacturers With Stunning, 3D Graphics

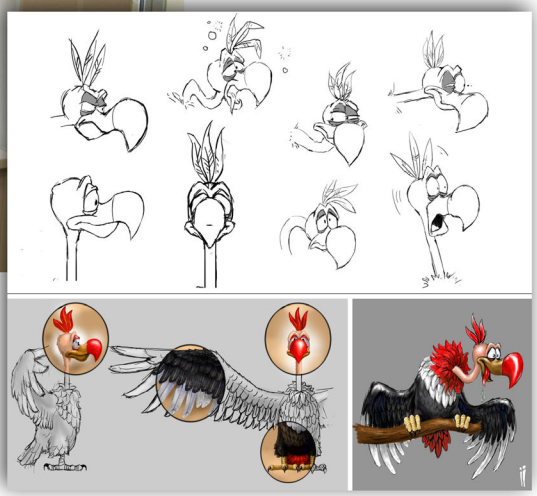
These days the eyes of all the world's largest entertainment industry equipment manufacturers are fixed on Russia. The gambling business in Russia has really gotten on its feet. It has also been developing very rapidly and has not only grown stronger but in just a few short years, already threatens to become an essential component of Russia's economics.

It is not a secret that Western capital has rushed to Russia's gambling business as it has grown. Where there is demand, there shall be supply. That's why the largest players in casino equipment manufacturing regard Russia today as a serious and growing market.

Neither it is a secret however, that Russia is a unique market in many ways. It has its own peculiarities: whims, if you wish. On one hand, the Russian gambler's mentality has much in common with players from other countries. On the other hand, Russia has a special flavor of its own and the players' tastes reflect that in all that they choose from day to day. The habits and trappings of daily life, the still wandering ghosts of the past, inevitably leave their marks on people's tastes and preferences and as such, the gaming industry must offer products and special features that are adjusted to suit the market. One of these important "cultural considerations" is in the graphics applied in gambling and in Russian casinos.

To gain an understanding of the subtle points of a Russian gambler's soul, Slot Tech Magazine has asked one of the leading Russian companies in the area of computer graphics (CG) production, the ALS Group, to assist us. The company has existed since 1999 and has been working in the CG market for the past five years. A little less than two years ago, ALS Group started producing computer graphics for the gambling industry, having started a successful and fruitful co-





Above: Marketing and Development Director of ALS Group, Mr. Anton Zailinger.

Right: Development sketches for one of the characters.

operation with Atronic Austria.

Today it has such serious projects behind itself as Dr. Cash Fever, Treasures of Africa (Atronic Austria), Tournamania (Atronic System), Mystery Million (Super Slot, incorporated with the Storm Empire holding) and many others.

We are asking questions of Marketing and Development Director of ALS Group, Mr. Anton Zailinger.

STM: Just to get started, do you consider that the Russian gambling market has grown, as compared with year 2000, when you just started? If so, what are the reasons and to what extent?

AZ: It has undoubtedly grown. It can be seen, sorry to say, with the naked eye. There are several reasons for that. However, the main reason, as it seems to us, is that as Russia's economics are being developed, people are becoming better off. There is more money at their disposal that they can afford to spend on entertainment. As you know, there is a child living in everyone in some way. Let's confess that all of us enjoy not only reading serious books and thinking about world affairs or career but also playing games! And, best of all, today we're doing it with the assistance of up-to-date technologies!

Another reason is that Western capital has come to Russia, bringing about a Western approach to business development strategies. It also applies to the entertainment industry and gambling business. It has stopped being spontaneous and chaotic. It has acquired clear structures. Development strategies have come to the surface and quite concrete objectives are being laid out, pursued and achieved. Those things could not help leading to noticeable market growth.

STM: Tell us please, what is the main difference between the graphics produced for the gaming business in Russia and those made in the West?

AZ: A popular character in a favorite Soviet movie once said, "Восток – дело тонкое!" which, loosely translated means "The East is a cobweb issue!" which may not make a lot of sense to some of your readers. What the expression refers to is the Russian attention to subtleties, little nice details or refinements. The Russians refer to this appreciation of detail as a "cobweb," making reference to the intricate detail found in the web of some spiders. Really, at a first glance you cannot notice a difference. However, if you start looking closely at it, you will understand that it is a cobweb issue, and not only metaphorically. You notice at

once, for example, that the graphics produced in Russia are developed by far in more detail, more subtlety; I would even say that more "elegant" methods of creating it are applied than graphics from the West.

STM: What is the reason for that difference?

AZ: Russia's Soviet past had not only negative sides. One of such positive aspects of that past was total, free and, I need to point out, fairly good quality (high level) general education. The program of general education included the basic level of drawing, classical music and some other arts and, as a consequence, most people have elaborated a certain feeling for good taste.

Plain, simple graphics are not regarded by the Russians as "quality" graphics. Simplified graphics are perceived, as a reflex sensation, as "cheap" by Russians. By the way, this is the reason why comics and Japanese cartoons do not enjoy any demand at all in Russia. In this country there is such a notion as "a mess" that is, "cheap, low quality work." (Editor's note: This was a difficult translation. It's a loose translation of an idiomatic Russian expression.)

The graphics that we produce are known for their high level of realism, bright colors and detailed drawing. That is, as I have said, the thing is in "cobweb."

In addition, our graphics are distinguished from their Western analogues by a high degree of creativity. That is, we strive towards inventing something new and original every time. We never repeat ourselves. We always look for new techniques and solutions so that creative staff can really enjoy themselves and get in touch with their work.

STM: How do you see Russia's gambling market developing in the next five or ten years?

AZ: It seems to us that within that period of time, Russia can become one of the world's leading players in the market, both in the sense of consuming the services in that area and in the sense of production and rendering services for the consumers of that market. Over here, strange as it may seem, Russian mentality plays the part which is by far not the last one. The Russians like entertainment and, if they are into entertainment, they do it, as it is called, to the fullest. It means that with the growth of Russians' well-being, they will spend more and more on their 'favorite toys.' As a consequence, the production and the sphere of the corresponding services will be developed more and more. It is not for nothing that one famous Russian proverb says, "if you like sledging, please get to like towing the sledge", that is, "after the feast comes the reckoning."

STM: Why did you decide to establish an office in St.Petersburg?

AZ: Oh, there are some reasons for that. We have a vision. Without vision, it is impossible to make a step forward in our business. Our activity is, first of all, creative activity. Although commercialized, it does not stop being creative activity. St.Petersburg is not only Russia's but also Europe's largest cultural and research centre! The city is rich with its traditions in the areas of science and arts. Historically,

ALS Headquarters in St. Petersburg

St. Petersburg has accumulated purposeful, creative personalities, aspiring to reach their high objectives in this life. That is why the city is just filled with a special creative atmosphere, making up its unique aura. That aura, in its turn, forms unique conditions for the organization and development of such businesses that are related to creative endeavors. Practically the entire city, as a whole, the whole history of its establishment and development, is one of the most irreplicable examples of what determined personalities having clear vision and who are not afraid of applying their hands to reach their goals, can do. Breathtaking vaults of the city's architectural chefs-d-oeuvre (masterpieces) remind us day after day and prompt us to go on with what we have accomplished.

St.Petersburg has unique geographical position just as well. The European Union is only 200 miles north of St.Petersburg and 150 miles southwest. That proximity noticeably facilitates the development and support of our contacts with our foreign partners.

STM: So, what do you actually do when you begin a project for a slot manufacturer?

AZ: Prior to starting the development of a game for slot machines, our artists look through a heap of information about the culture and ethnic traditions of the region for which they designate the game. After all the research has been completed, our artists nearly become experts in the culture and history. While developing a game targeted at the Chinese market, for example, they had to learn China's culture, architecture and fine arts. Our artists took, as a sample, a piece of a 19th-century Chinese painting and imitated the style of that print for the creation of the characters and objects for that game. It is clear that a tiger and a dragon, the country's sacred animals, as well as a peony flower, a national symbol, a flask and a little lantern with a Chinese pattern, step out as the game symbols.

This has lead to some curiously amusing incidents. For instance, creating the game on an African subject, we checked not only Africa's landscapes and the tunes of shaman's drum music but also the region's tribes, their traditions and their manner of dress and clothing. We always try to depict the combined parts, creating an amalgamation instead of a concrete person or a tribe. However, representatives of one African tribe recognized familiar details in the game character's clothing pattern, and they complained that those details were inaccurate. Now we investigate such details even more thoroughly, to avoid such incidents.

When we receive orders to develop slot games or plasma animation, it is often that approximate recommendations are given, as well as a rough description of the future product. Our job is the development and creation of characters, their styles, environment and the background. This is the hardest work to do. The characters are not just original; they need to correspond to the customer's special requirements. Over here, ingenuity is important. The same holds true for the script, the storyboard and the

For an African themed games ALS staffers checked not only Africa's landscapes and the tunes of shaman's drum music but also the region's tribes, their traditions and their manner of dress and clothing.

The artists and 3D modelers are plugged-in to their work at ALS Group, Saint Petersburg. (l) Dmitry Vorobiev creates main and minor characters for 3D movies and symbols for slot machine games.

(left) Alexey Popov is the Lead 3D Animator. He animates the characters. Right now he is working on the griffon animation for ALS' progressive jackpot system, Mystery Million.

(right) Andrey Akulov is the Lead Concept 2D artist. He develops concepts for slot machines, storyboards for 3D animations and character concepts. In the picture you can see him working on the current SlotTech cover.

animations. We usually organize a meeting of those people who will be involved in the project and do the brainstorming, resulting in interesting ideas.

After the concept and the graphic design have been done, we start 3D modeling, where 3D artists find it important to take into account any small detail, as the object can be rotated or animated in different ways. What the 3D animators do is create unusual character animation. Their work is quite valuable to us, as they are specialists at creating detailed, high class, 3D animations.

At the final step, the work is passed over to the composers who take care of rendering and special effects. It is quite a difficult phase of the project, as the rendering of a high quality movie can take some days, or even weeks. During that period of time, an entire computer park will process 3D models with animation and a final, high-quality movie is produced as the output. For the slot games themselves, the production cycle is the same but as the output, there are small micro-scripts that we see with the winning symbol combinations.

Of course, Slot Tech Magazine cannot display the samples of animation but your readers can visit our website at www.als.ru for some examples of our work.

STM: In closing, what would you like to tell our readers about ALS Group that they do not know yet?

AZ: Ah, there are so many things that I would like to tell . . .

Here at ALS, we don't shout in every corner about our company and praise all of our own works. We prove our competence and character by our deeds. Therefore I would like to tell you only one thing, come to us, please. Try working with us, creating, with our assistance, only one little project. Then you will be able to perceive and feel our full aspiration to understand your needs and help you to solve your tasks with our absolute dedication, using all of our talents and power.

Practically everyone who has tried working with us once, never parts with us!

STM: Thank you, Mr. Zailinger

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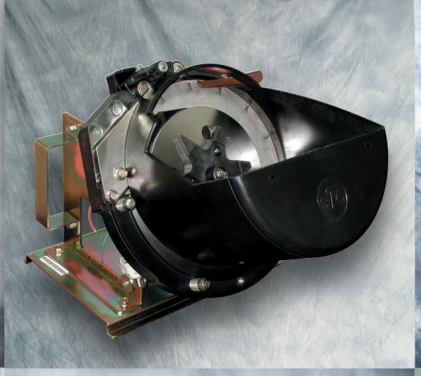


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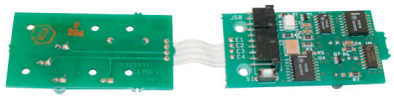

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