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On the cover: The Deer Dancer by Thomas Tapia. At right is Randy Fromm with the artist.

"I was privilaged to attend the Deer Dance at Tesuque Pueblo during the festival of San Diego," said Fromm. "Thomas Tapia is not only an artist (from an award-winning family of artists) but was a principal dancer as well. Afterwards, we all went to his mother's house for dinner. Delicious. Man, that green chili is hot!"

The flip side to this gentleman's sensitive, artistic nature is that Mr. Tapia, a former police officer, is a Gaming Commission Officer at the Camel Rock Casino in Santa Fe, New Mexico and in his spare time, he likes to ride to places like Sturgis, SD. Go figure that one!

Slot Tech Editorial

Dear Randy,

Okay, it's more of a gripe or an open letter than an article.

What gets into some vendors who want to sell us games but will not supply us with a tech manual? With the good vendors we get a tech manual with readable schematics, parts breakdowns of assemblies and parts lists. Some even supply a parts list with not only their part numbers but the original manufacturer's part numbers. From other vendors we get an operators manual, period. No parts breakdown. No parts list.

If the monitor dies due to a one dollar part they want to sell us a whole new monitor. They refuse to sell us components, and have agreements with the OEM that they will not sell the parts to us either. I can't enter a part number into our inventory system unless I have a part number. It would be real nice if the vendor and I had the same part number for the parts. We know these parts lists exist. You can't get a game through approval without a parts list.

Part of the cost of keeping a game running is the cost of repair parts. If I have to replace a $1300 monitor instead of a one dollar part, that game really generates no profit for a long time to cover the cost of that repair. If the monitor repair costs $1300 for a game with a 5% hold, we have to run $26,000 of revenue through that game before it is back to making a profit. Are those numbers really right? Why would we have such a game on our floor?

Why do we want to be in business with a vendor that considers its customers to be its adversaries? That is an ill conceived company philosophy.

Let's hear it for the good guys like IGT, Bally, Williams, and their kind who supply us with technical information about their games. You other guys ... we know who you are and you know who you are. Your problems are legendary.

Randy Fromm

This comment does not necessarily reflect the opinion of my employer. This is my personal opinion.

Herschel Peeler
Eagle Mountain Casino

Dear Herschel,

I couldn't agree with you more when it comes to the need for schematic diagrams, service manuals and parts lists. When you're handing out kudos, don't forget to include folks like Coin Mechanisms, Inc. who have for years, freely given out complete specifications and schematic diagrams for their Coin Comparitors, Kortek with their well-drawn schematic diagrams and sometimes humorous manuals written in Korenglish and Ceronix who have put together a totally complete service manual, that even includes troubleshooting techniques and flowcharts. Das Ceronix Handbuch wird auf Englisch und Deutsch geschrieben.

That's all for this month. See you at the casino.

Randy Fromm - Publisher

Randy Fromm's
Slot Tech Magazine

Editor
Randy Fromm

Technical Writers
Dion Anderson
Martin Dempsey
Bart Holden
Kevin Noble
Herschel W. Peeler
John Wilson

Advertising Manager
Dennis Sable

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1944 Falmouth Dr.
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tel.619.593.6131
fax.619.593.6132
e-mail
editor@slot-techs.com
Visit the website at
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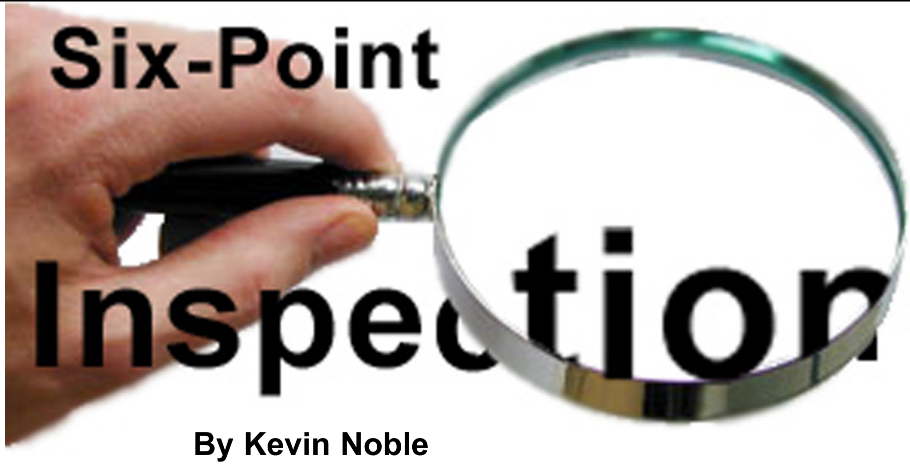


By Kevin Noble

The purpose of the six-point check is to verify that all electronic and mechanical components are in proper working order and that the physical appearance is clean and free of defects. We also perform this task prior to the Electronic Gaming Enforcement Officers (EGCO) placing their seals on the CPU boards and performing their final inspections. All this is done before the machine can go up to the public. The check is usually done in conjunction with a machine move, theme conversion, denomination conversion, and software upgrade. The six-point inspection can also apply to any work that is done to the machine's CPU or motherboard.

The "Before" Meters

The "before" meters (coin-in, coin-out, drop, games, attendant hand pays, and bill meters) must be taken on all games that will be cleared, upgraded, moved or converted. The same holds true if the CPU board or motherboard has to be removed. All essential set-up information might be (and usually is) lost during the clearing process and reconfiguration is often necessary. In case the meters are not recoverable during the removal of the CPU, motherboard, or during a machine move, we will have an accurate account of the final readings for the auditing department. The recording of any or all progressive totals for link and standalone progressives is also part of this procedure so that the figures could be reset to its original value.

The First Steps

The most important step in the six-point check procedure is recording the first set of meters because this will become a reference point for all future testing. The second most important step is the filling out of the M.E.A.L. (machine entry authorization log) book. Entering such useful data as the date, time, technician's name, and the most important information on the problem. Write down the reason that you have entered the machine and what was done (in detail). The information entered by the technician could be a handy tool in future troubleshooting of the machine. These two steps are performed first before any of the moves, conversions or upgrades have begun. After the operation is completed and the machine is firmly in place, the games has been cleared and reset, or moved we can begin the next step. The third step is the reporting, and filling out the six-point inspection sheet. By writing the correct machine information, circling the correct procedures and verifying the correct options, switch settings, EPROMS, and other gaming information (see example sheet) we can sign off and complete the inspection.

The Inspection Begins

Before the physical inspection of the game we can write out all the pre-inspection data from the game. This consists

of any machine asset numbers, locations, serial numbers, the correct decals (hopper lock-up, denomination) DID address, progressive total and EPROM's verifications to name a few. The purpose for this is to check that all the information on the game matches all the information on the paperwork that was submitted to the commission. This also allows for any steps that might have been overlooked, to be completed by another technician. We can now begin the physical inspection and coin & bill testing.

The Physical Tests

The physical testing begins with an inspection of all glass (award, reel and belly) and video monitors for any cracks or abnormalities. Check and inspect all machine locks for any loose cams, and that the three finger lock is in place holding the lock cam nut. The inspection also consists of all glass inserts such as the correct tower light color, top award pay decal, denomination insert, play max coin button insert, disclaimers and BV inserts. The inserts must be correct for the denomination of the game.

The Test Mode

In test mode, we can check all the lights, handles, buttons and switches for normal operational conditions. We can also perform the reel strip test to match the pay table and perform a 10-coin hopper test to verify the correct payouts of coins from the hopper. The checking of the IDX for the correct program information, and acceptance of coin we can check the set-up, coin path, diverter, and optics and optics block for clean or worn parts and for the correct denomination. Still in test mode, we can also check for the correct DIP switch settings for the BV and the correct version EPROM. Depending on what kind of game it is, we could even run a couple of bill through it. The setting of the options is verified to the site's configurations. We check to make sure the machine has the correct SAS address, hopper lock-ups, and that the machine options are correct.

Game Mode Tests (Coin & Bill Tests)

In game mode, we can insert and play one coin at a time. This will allow us to check and verify the reel strip alignment to the pay line, any pays won to the award glass, hopper payout, lights working, if the progressive value is incrementing, and if the meters are registering and incrementing correctly from the soft to the Mikohn.

We try to pay five coins to the hopper, open the door, short the probe and allow another five coins to fall to the drop. This ensures proper operation of the diverter and hopper probe, and that the drop meters increment properly as well.

The next procedure is to test the bill validator with one banknote of each denomination. We can also check that all Mikohn "door open" codes increment correctly. Once this is completed, we can take the second set of meters, verifying that everything has incremented correctly or, in the case of a machine move, that all the meters are exactly the same as they were in the previous location.

Cleaning and vacuuming the machine is also essential. Cleaning the reel strips, coin and hopper optics, all glass and even the bill validator allows us to keep up on the preventive maintenance on the floor. Vacuuming the coin dust out of the hopper, on the bottom of the game and even off the fans in the top box, allows for a cleaner game for the technicians and the slot attendants. This also looks appealing to the patron.

The EGCO Inspections

The slot machines must go through a final inspection from the AGCO's enforcement officers before they are allowed up to the public. The EPROMs must be verified and sealed on the CPU board before they can start on their own inspection. The AGCO has their own set of game inspections and coin tests. After the test are completed, we complete the third and

final meter readings, verify that all the meters incremented correctly and then we are allowed to bring the games up to the public. The inspection sheets are checked to make everything has been completed and the meter sheets handed in.

Overview

The six-point inspection is crucial before the Gaming Commission starts their inspection. If they find errors at any point in the process, they have the right to suspend their inspections until every game is ready for their approval. I have witnessed this on many occasions and it is not all fun and games when the Slot Operations Manager has been notified. Most of the inspections are simply to verify that everything is present or is set correctly. At the same time, if a technician has been interrupted in his/her work and cannot get back to the game for some reason, it allows the following technician to see what has been done and what still needs to be done. I am sure that you would not want to inspect the games from another shift if they had already been inspected.

This procedure is time-consuming if it done correctly but why shouldn't it be? Perception is important to a patron's choice of a game. If the BV is not accepting, lights are flickering and the reel glass is so dirty you cannot see the symbols, I am sure they will move on to another game or not even come back to your Casino. Making sure all button bulbs and insert coin lights are working also helps us technicians troubleshoot a game without opening the door, especially when max coins are already inserted.

- Kevin Noble
Knoble@slot-techs.com

Slot Tech Company Announcement

FutureLogic Appoints Nick Micalizzi as Director of Gaming

FutureLogic has announced that Nick Micalizzi has joined its senior management team as Director of Gaming. In his new position, Micalizzi will be responsible for the sales and marketing of FutureLogic's thermal printers to casinos and gaming OEMs, the company's largest market.

Micalizzi joins FutureLogic at a critical time—at the end of an exclusive agreement with Seiko for the distribution of FutureLogic's industry-leading PSA-66 line of thermal printers. With six years of experience with Seiko's Micro Printer Division selling the PSA-66 line to the gaming industry, Micalizzi is uniquely qualified for his new position.

Micalizzi is known for consistently meeting or exceeding sales, budget and margin goals, and for recruiting, motivating and training successful sales professionals. He earned Seiko's Micro Printer Division's Salesperson of the Year award in 2000 and has often been called upon to interface with engineers and product management during new product development and introduction to market. Micalizzi graduated from the State University of New York in Morrisville. He can be reached at (949) 487-4829 or nick.micalizzi@futurelogic-inc.com.

Slot Machine Volatility Index

By John Wilson

At the bottom of most PAR (Probability and Reel-Strip) sheets and SMI listings there is a Volatility Index and a chart showing payout percentages for various numbers of games. While these numbers may not make much sense at first glance, they can be a valuable tool in predicting exactly how a machine will play and pay. By learning how these values are calculated and what they mean, you gain a better insight into how each slot machine will work.

It is no surprise to any slot technician to hear that the machines are programmed to follow a precise arithmetic model and have a set payout percentage. However, the short-term payout percentage from the machine rarely matches the calculated payout due to the random number generator. The Volatility Index (VI) will help us determine what the real payout will be. For the sample machine and PAR sheet we will be using, our table would look like figure 1.

The exact payout from the machine is based upon the cycle of the machine. The cycle is the number of possible outcomes there are from every symbol and blank on each reel. For example, a 3-reel, 64-stop machine will have a cycle of 262,144 games. We determine this by taking the number of stops on each reel and raising it to the number of reels. The 3-reel, 64 stop machine then has 643 possible combinations, or 64 x 64 x 64.

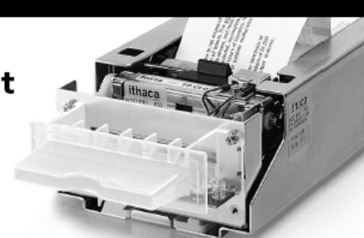
Because each spin is random, there is no precise pattern, nor does the machine select every possible outcome before selecting the same one again. One outcome may not be selected at all while a different one might be selected two or three times. If there is only one jackpot combination, then it should occur every 262,144 games. However, it might come up only 2,000 games apart. Over the long term, everything will even itself out. During the short-term, however, the machine will not pay out exactly the same as the payout percentage. There is a certain element of volatility, or unpredictability involved. Suppose that a player sits down at a $1, 3-coin multiplier machine and inserts $30.00. After 10 spins, the player could have $0 remaining, or they might win a $5,000 jackpot. Since the payout varies so much in the short-term, we need a tool in order to tell us what we can reasonably expect the machine to pay out and to hold back. Enter the Volatility Index!

Consider the example above - the $5,000 payout for $30 wagered. Let's assume that the player played 3 coins at a time, and that the only win was on the last spin. If the machine has never been

Volatility Index = 8.112		90% Confidence Level	
Games		Minimum	Maximum
1,000	25.654	70.63	121.93
10,000	8.112	88.17	104.39
100,000	2.565	93.72	93.85
1,000,000	0.811	95.47	97.09
10,000,000	0.256	98.02	98.54

Figure 1. The Volatility Index

You don't solve a player-jamming problem by jamming your printer with more motors and sensors.



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played before, both the coin-in and coin-out meters would read 0. After the games, the meters would indicate 30 for coin-in and 5000 for coin-out. That is a payout of 16,666.67%. If the machine has been played for years, however, the meters might read 10,000,000 for Coin In and 9,000,000 for Coin Out before the games were played, for a payout of 90.000%. After the games, the coin-in meter would show 10,000,030 and the coin-out meter 9,005,000. The payout percent now would be 90.0497%. As you can see, once the machine has been played for tens or hundreds-of-thousands of games, a large payout will make little change in the overall payout percentage. In the short-term, the machine payout percent increased by 16,666.67%. In the long term, however, it only increased by 0.0497%.

What is the Volatility Index?

The Volatility Index tells us how 'volatile' the machine is. It is based upon the standard deviation of the paytable, with a 90% confidence level. The technical definition sounds complicated, but a careful examination of this will show you that it really isn't very difficult to understand.

First of all, the Volatility Index is a rating of how a machine will play and pay after 10,000 games. With more games, the machine will play closer and closer to its calculated (and theoretical) payout percentage. With fewer games, the payout is going to vary even more. The value will be shown on your PAR sheets or SMI sheets showing either "Volatility Index = x.xxx" or "VI = x.xxx". Now, what does this mean? In order to understand this value, let's examine how it is calculated first, then we will have a better understanding of how we can use it.

The first thing you need is a PAR listing. I've provided a sample one in order to make our calculations quick & easy. Consider a sample game that we will use for our calculations. It is a 3-reel game with 32 stops per reel. There are only 3 symbols (not counting the blanks) - single-, double- and triple-bars. It will be a 3-coin multiplier with no bonus paid on the 3rd coin.

Let's examine the paytable, as shown in figure 2:

* This is not shown on PAR or SMI listings. We have calculated it here. The total winning combinations for this game is 4335. Subtract this number from the total combinations to get the total non-winning combinations. We will use this figure later in our calculations.

** We will discuss these figures below. The first thing to do is to calculate the 'Standard Deviation' of the paytable. As complicated as this sounds, there is a fairly easy way to determine how much the machine payout varies from the average (or median) payout. This is easily calculated from information in the PAR listing.

Look up the total number of coins paid out for the maximum coin play. Divide this number by the total number

Normal Game Percentage = 96.28%

Reel 0	Reel 1	Reel 2	Pay 1st Coin	Pay 2nd Coin	Pay 3rd Coin	Total Hits	Total Paid (for 3 coins)	Calculated Values**
Triple Bar	Triple Bar	Triple Bar	100	200	300	64	19,200	5,649,616.007
Double Bar	Double Bar	Double Bar	20	40	60	125	7,500	407,715.5894
Single Bar	Single Bar	Single Bar	10	20	30	384	11,520	282,253.0718
Any Bar	Any Bar	Any Bar	5	10	15	3,762	56,430	551,842.9055
Blank	Blank	Blank	0	0	0	* 32,768 -4,335 =28,433	0	237,226.9646
TOTAL						**32,768**	**94,650**	**7,128,654.538**

Figure 2. The paytable

of games in the cycle. In our example there are 94,650 total coins out and a cycle of 32768 games.

94,650 / 32768 = 2.88848877

This number is the average return to the player per spin. Looking at it another way, for a 96.28% payback:

3 coins played x 96.28% = 2.8884 coins returned.

Statisticians refer to this as the median.

The next step in the calculation is more involved but still quite simple to do. For each game possibility (all 32,768 spins) we have to calculate how far the payout is from the average payout. Now, a great deal of these spins will have no payout (non-winning combinations) so we simply use 0 (zero) as the payout amount in that case. We have to look at every spin in the cycle so that we have a complete analysis of how the game plays. Otherwise, we are not taking into account the number of winning games compared to the number of non-winning games and our answers will be incorrect.

Here's what we do next:

Subtract the average payout value we calculated earlier (the median) from the amount of each individual payout. Square the answer (multiply it by itself) and write down this value. Do this for every entry - all 32,768 values. If this sounds like a lot of work, don't worry. There is a shortcut to this.

Examine each entry in the

paytable and when you make your calculation, multiply the answer by the number of times this payout happens. See what we do below:

0 coins payed for non-winning spins: (0-2.88) 2 x 28,433 hits = 237,226.9646 (This number is shown in the last column of the table above) 15 coins paid for mixed bars: (15-2.888) 2x 3762 hits = 551,842.9055 30 coins paid for single bars: (30-2.88) 2x 384 hits = 282,253.0718 60 coins paid for double bars: (60-2.888) 2x 125 hits = 407,715.5894 300 coins paid for triple bars: (300-28.88) 2x 64 hits = 5,649,616.007

Now, add up all of the numbers. Your total should equal 7,128,654.538 Divide your total by the number of games per cycle: 7,128,654.538/ 32768 = 217.5492718

Next, calculate the square root of this value.

Square Root of (217.5492718) = 14.74955158 Divide your answer by the number of coins, 14.74955158 / 3 = 4.916517193

This number is the standard deviation. Therefore, the standard deviation of our paytable is 4.9165. By itself, this number means very little. When we compare it to other games it becomes meaningful. A rule of thumb is that the closer the standard deviation is to 0, the less the game will vary from the 'norm', and therefore the less 'volatile' it is. The larger the number, the more volatile the game is.

To get the Volatility Index, multiply the standard deviation by 1.65 (we'll explain why we use 1.65 a little later on). The Volatility Index for this game is 8.112253369. Ok, now that we have it, what can we do with it, and what does it tell us? Consider the following points:

1. For a complex game, these calculations are very, very tedious. Consider the paytable for the Red, White & Blue games and imagine doing these calculations for each payout.

2. The more entries there are, the more varied the payouts are, the larger the numbers you will have, and the more chance you have of making a mistake in your calculations.

3. Most SMI and PAR sheets include the Volatility Index, so you don't have to worry about calculating it for the games on your floor. All you need is a basic understanding of how it works.

The standard deviation tells us how much the payments deviate, or vary, from the average payout. When payouts range from small to very large amounts, the deviation will naturally be larger. A machine with a small range of payouts, such as the IGT's Bananas, Sizzling 7s or Bally Gaming's Blazing 7s would be expected to have a small standard deviation and therefore a small Volatility Index. The Black-Tie, with a top payout of 28,000 credits for 3 coins will have a much larger Volatility Index. Where the Blazing 7s pays 1,000 credits a 3-coin jackpot, the Black-Tie will pay 28 times that amount.

When you consider wild-card multipliers, like 2x and 3x, the Volatility Index gets even larger. Here you are taking payouts and multiplying them by up to 9x. With a 12x payout, you're looking at a factor of 144x, so you should expect a significantly larger Volatility Index. In other words, they payment is going to vary widely with the standard payout amount being multiplied by 12x and 144x.

The Volatility Index, much like the standard deviation value, doesn't mean much to us at first glance. When you see how the Volatility Index value is applied to the game, it becomes very important!

The Volatility Index is calculated on a basis of 10,000 games. This has become the industry standard. Knowing the average payout and the Volatility Index, we can determine what range of payouts we expect over 10,000 games.

Subtract the Volatility Index from the payout percentage and you will have the minimum payout percent. In our case, 96.28% - 8.112 = a lower payout of 88.17%.

Add the Volatility Index to the payout percentage to get the maximum payout. In this case, 96.28% + 8.112 = an upper payout of 104.39%

We can, therefore, reasonably expect that the machine will pay out somewhere between 88.17% and 104.39% after 10,000 games.

You might have noticed that we take the game payout percentage and that our range is

higher and lower by the amount of the Volatility Index. This means that the game payout percentage is the average payout, and we calculate how much the machine should deviate from that point.

We would expect that the payout range would be larger for fewer games and smaller for more games. We can calculate these values as well.

To get the range for fewer games, we divide the games by 10. This way, we can look at 1,000 games or even 100 or 10. The factor used to change the Volatility Index to the lesser or higher amounts is 3.16. We won't worry about how that is calculated, but it has to do with the geometric change.

Multiply the Volatility Index by 3.162111 to get smaller game values. If we want to know 1,000 games, take 8.112 and multiply by 3.162111. This gives us the number 25.652. Subtract that from your normal payout for the minimum amount, and add it to the normal payout for the maximum amount.

To get larger game amounts, divide the VI by 3.162111. Continue dividing the last value you calculate by 3.162111 as you move into higher and higher game numbers.

If the VI is not shown in the table, the values can be easily calculated. Subtract the minimum percentage from the maximum percentage for each line. Divide this answer by 2 and you have the VI for that number of games played.

Games		Minimum %	Median %	Maximum %
100				
1,000	8.112 x 3.162111 **= 25.654**	96.280 - 25.652 **= 70.626**	96.280	96.280 + 25.654 **= 121.934**
10,000	8.112	96.280 -8.112 **= 88.168**	96.280	96.280 +8.112 **= 104.392**
100,000	8.112 / 3.162111 **= 2.565**	96.280 - 2.565 **= 93.715**	96.280	96.280 + 2.565 **= 98.845**
1,000.000	2.565 / 3.16211 **= 0.811**	96.280 - 0.811 **= 95.469**	96.280	96.280 + 0.811 **= 97.091**
10,000,000	0.811 / 3.16211 **= 0.256**	96.280 - 0.256 **= 96.024**	96.280	96.280 + 0.256 **= 96.536**
100,000,000	0.256 / 3.16211 **= 0.08**	96.280 - 0.080 **= 96.200**	96.280	96.280 + 0.080 **= 96.360**
Note: If you round off any of the numbers shown, your results will vary slightly.				

E.g.: for 10,000 games. Maximum - Minimum = 104.392 - 88.168 = 16.224

6.224 / 2 = 8.112

Basically, the Volatility Index is the range in payout percent that we can expect for 10,000 games, either above or below the normal payout percent. If a game has a Volatility Index of 23.5, then you can expect payout at 10,000 games to be either 23.5%

lower or higher than the stated payout percent. Said another way, the game will range by 47% in 10,000 games. (47% = 2 x 23.5%)

We mentioned before that you take the standard deviation and multiply it by 1.65 to get the Volatility Index. There is a valid mathematical reason for this, and I would like to briefly touch on this now.

If we make a graph of game data with the payout percentage on the horizontal x-axis and the number of games on the vertical y-axis, the graph should look more or less like a bell-curve, lower at each end, and rising in the center. One game may be taller than another, one might be wider.

If we draw a line down the center, this is the median. Standard statistical formulas tell us that 68% of the data (game payouts) will fall within 1 standard deviation from the median. 95% will come within 2 standard deviations from the median, and 99% within 3 standard deviations. To get 90%, we multiply the standard deviation by 1.65

The graph below will illustrate this. It is not the machine we used in the example, but has been made to show you a perfect example of a payout with a nice bell curve. The graph of our machine is much skinnier than that of the example above.

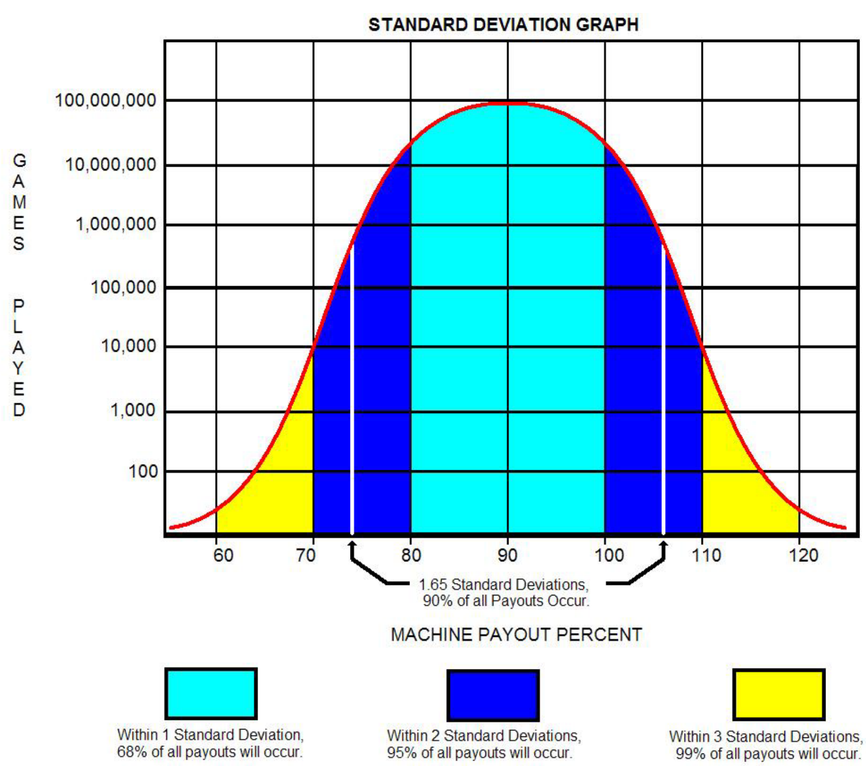
This illustrates a perfectly organized group of data. Various machines will look similar, but the size and slope of the curve will differ. Most of the payouts will be close to the median, and fewer will be further away.

The 90% confidence level tells us that 90% of all the data (paying combinations) will occur within 1.65 standard deviations from the median. What does this mean to you? You can expect that your machine will pay between the lower and upper percent range at 10,000 games about 90% of the time. In this case of the machine used in the graph, at 10,000 games the payout will range between 70% and 110%. Or, put another way, if you have a bank of 10 identical games, 9 of them will fall within this range after 10,000 games. Of course, this is in a perfect world, and some may pay more or less, but generally speaking, they will all fall into the pattern mentioned.

And finally, I'd like to mention how this can apply to your casino.

The average player will play 10 games per minute on a slot machine. To get 10,000 games, we need 1,000 minutes (10,000 games / 10 games per minute). Of course, the games aren't played all of the time. If we have a 5% occupancy rate, a game would get 72 minutes or 720 games of play per day. After 14 days, we will have 10,000 games. So, you have a pretty good idea of what a game will pay out after 2 weeks. In our example, this game should pay out between 88.17% and 104.39%. Of course, if a large jackpot is hit, this number might be higher, or if the machine isn't paying very well, it could be a little bit lower, too. But, as a general rule, your machine will likely fall somewhere within (or very close to) this range. If your occupancy is more than 5%, then it will take less time to reach 10,000 games and perhaps you'll know what it will pay out in a week.

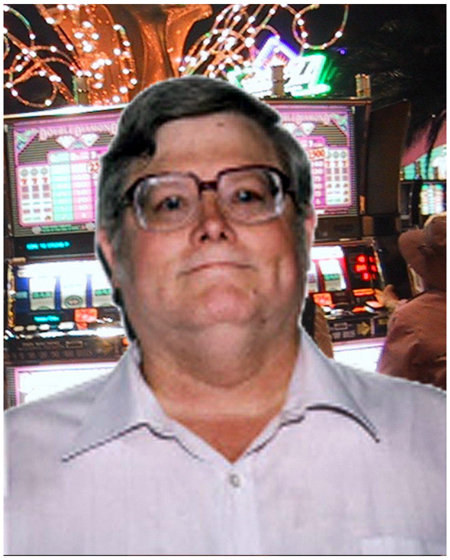
This can also apply to different numbers of games, and you will have a good idea what



the payout will be for 100 games, up to 10,000,000 games and beyond. This will help you analyze what the payout should be, and you will know how much the casino will be short (pays out more than the percentage) or how much extra it will have (pays out less than the percentage). It will also tell you how long the machine will take to play out to theory.

The next time you look at a PAR sheet, take a moment to examine the Volatility Index and its corresponding table. Hopefully you'll be able to quickly make sense of it and have an immediate feel for how the game will play.

- John Wilson
jwilson@slot-techs.com



Building and Testing Test Fixtures - PLUS - Manual SENET Emulator

By Herschel Peeler

I have had a few e-mails from different people enquiring about the test fixtures I have been talking about in previous articles and forums. This article describes the 4-bit tester with modifications for IGT assemblies. It will work for any other assemblies that use a +12 or +13 Volt interface voltages. IGT specifies +13 Volts, but seems to work fine at 12 Volts, so the fixture was built for +12 Volt operation. Many questions revolve around application as well as design and fabrication. So...

The specifics of how you build the circuits is entirely up to you. Whether you use the Radio Shack kluge boards as I do, or some other method doesn't matter. None of these circuits are sensitive to assembly method. They are all low frequency, low voltage, low current, low noise applications. Construction method doesn't matter.

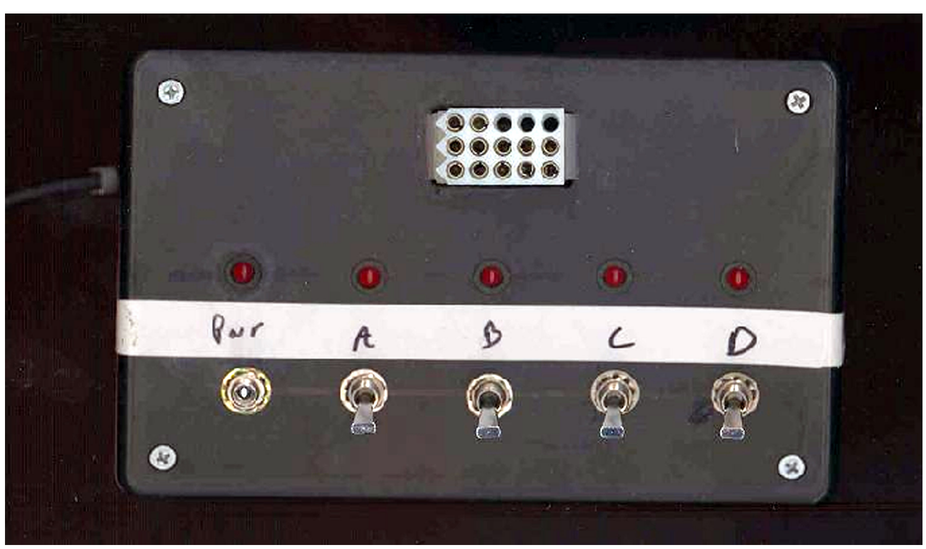
If you have never built anything at all before you may not want to start with this as your first. I do assume you have built electronic circuits and can work from a schematic.

Depending on the complexity of the test fixture I prefer to build the test fixture in sections and test that section for proper operation before starting the next section. If the test fixture includes the power supply, that is a good place to start. After building the power supply section, and rechecking everything visually, apply power and see that it comes up with the right voltages. Preferably bring it up under a load of about 50% of its rated current value. Check the output with a meter as well as an oscilloscope to check for ripple and oscillations.

Assembly of following sections can assume that previously built and tested sections work, so troubleshooting a problem can be limited to the last stage assembled. Plan ahead as far as where all the parts are going to go on the board. Place all the parts on the board without soldering first, just to see if they all fit okay. I put all ICs on sockets. This is a test fixture and we can assume that we are going to connect boards to it with problems that are likely to destroy the test fixture. Design it to be repairable.

4-bit Universal Tester

The basic design described is a 4-bit tester. This requires only one cheap IC, and can be built in a medium size box. (4" x 6" x 2 or 3 inches



high). It has four outputs (to drive up to four assembly-under-test inputs), and four inputs (to sense up to four assembly-under-test outputs). Inputs are active low. A low is sensed as an active signal. Inputs not pulled low are assumed to be a non-active signal. Outputs are active low. A low out is intended to be an active signal. If not pulled low the output will float to a high (+12 V) level. The test fixture provides +5 V, +12 V (+13 V), and +24 V (+25 V) with current capability as described a little later. This design allows us to test most basic assemblies found on an IGT game of any era since the 8032, and 80960 type games. (IGT S+, Player's Edge, S-2000, i-Games, SS+, Game King and GK Plus, Vision, and others of this era. Following is a basic description of this test fixture used as a SENET Emulator, for instance.

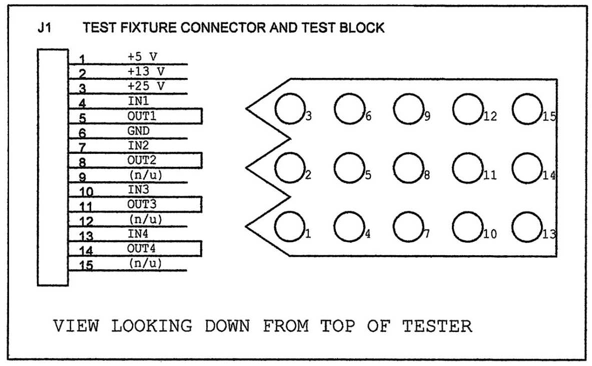
The Manual SENET Emulator

This circuit may be broken down into sections for assembly and testing. I built it in three sections; the LED Drivers (Input) section, the Switch-to-U1 section, and the U-1-to Output Drivers section. (Reference LED drivers picture.)

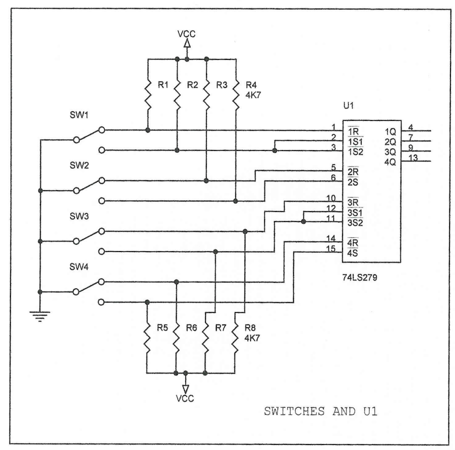
Once the Power Supply section was built and tested I could rely on it to power other parts of the circuit to test them. The LED Driver circuit was built next. To check it I put a jumper from the inputs (INx lines) to ground. The LED should light as the input is brought to ground.

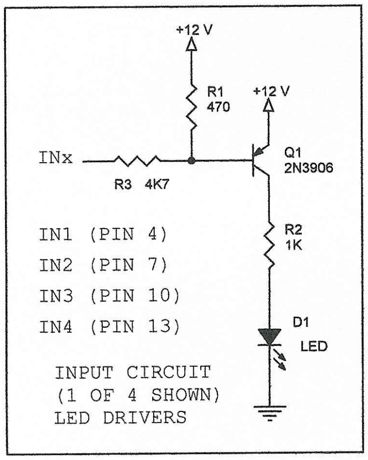
Next the circuit from the switches to U1 was built and tested. (See picture of Switch and U1 circuit.) U1 was put on a socket allowing me to check that the switch circuit was wired and functioning correctly before installing U1. As the switches are toggles the inputs to U1 should go from ground to +5 V. Once these were confirmed I installed U1, and checked that the output of U1 toggled as the switch was toggled. U1 was then removed again while assembling the Output Drivers.

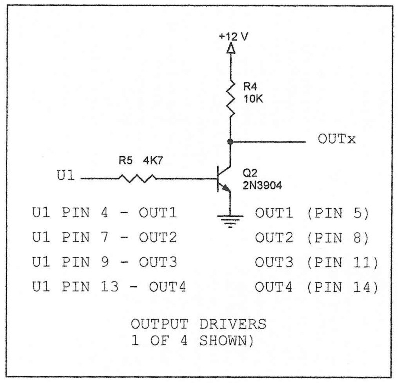
(See picture of Output Drivers.)After assembling and visually checking the Output Drivers over, I tested the output drivers by putting a jumper between +5V and the outputs of what would be U1. As these lines go high, the output should go low. The output should return to +13V when the jumper is removed. Now that all sections are assembled and tested I installed U1 again and built a jumper block that connects the four Outputs back to the four inputs, giving me a test jumper to confirm the operation of the box as a whole unit. (see picture of the Jumper Block.)



The box shown, and almost all the parts, are available from Radio Shack, or many other distributors of electronics parts (Allied, Newark, Mouser... see the list at the







end of the article.) The example shown is only one method of assembly. Needless to say esthetics was not a determining factor. Mine was designed considering parts I could easily obtain, not as a production-ready assembly. Also shown is the Test Block that jumpers the Inputs to Outputs to let us Test the Tester. (See picture of the Test Block.)

How the Circuits Work

The LED drivers (INx) get their inputs from pins 4, 7, 10 and 13 of the 15-pin main connector on the tester. These are designed to turn on the LED when the input is low. If the input is left to float high (+12 to +13 Volts in) the LED should be off. This is typical for most assemblies on IGT games. Many other games are similar, not all.

The switches provide input signals for U1. U1 is a Quad (meaning there are four) S-R Latch. Each latch is independent of the others except for power. Each latch has a Set input, a Reset input, and a Q output. When Set goes low the Q output associated with it goes high (TTL high, +3.5 to +5 Volts). When reset goes low, Q goes low. The S and R inputs are connected to a SPDT switch. As the switch is toggled the output should toggle. What we accomplish is to de-glitch the noisy switch contacts and get a clean output at Q.

Of the four latches, two of them have a second Set Input. Pulling either S input low will set the Latch (Q high). Since we didn't need the second S input we did the simplest thing and tied the two S inputs together.

The Output Drivers take the TTL outputs of U1 and convert them to an open-collector active-low signal, with a passive pull-up resistor on the output. This is a simulation of a typical IGT output signal. These outputs feed pins 5, 8, 11 and 14 of the 15-pin connector.

To provide power to the assembly being tested the 15-pin connector also has +5 Volt, +12 Volt, and +24 Volt outputs. These supplies are limited to only a few hundred milliamps. If you are going to test an assembly (like a hopper) that may draw more current I suggest you use an external power supply, and connect the grounds between the Test Fixture and the Power Supply. In the games these power supplies may use separate grounds. For test purposes this has been omitted. It does not change the function of the boards being tested.

Assemblies that can be tested with this unit:
(See individual notes concerning each assembly)

751158xx, 751186xx, 196461xx751325xx – Bill Acceptor Bezel lamp assemblies
75117700 and 75117800 VFD displays as one test fixture. (A Netplex device!)

Coin-In optics assemblies

Most SENET assemblies and boards.
Door I/O
Cabinet I/O
751179xx - 7-segment Display...

Payline Display Boards
751183xx
751184xx

75430100 – Communications Board (with some difficulty)

76602110 – Power Distribution board
754298xx – Hard meter board
754265xx – Hopper Control Board, or by testing the complete hopper
759225xx – Hopper Control Board, Secure, or by testing the complete hopper

IGT Hoppers (Secure or Regular)

Bill Acceptor Bezel lamp assemblies

751158xx, 751186xx, and others. It is suggested that you use LED replacements for the incandescent lamps. It's such a pain to troubleshoot a board problem and find out that it was a burned out lamp all along. This also keeps the current down to a safe level.

196461xx, 751325xx – (Same connector and cable for testing 751158xx and its friends.

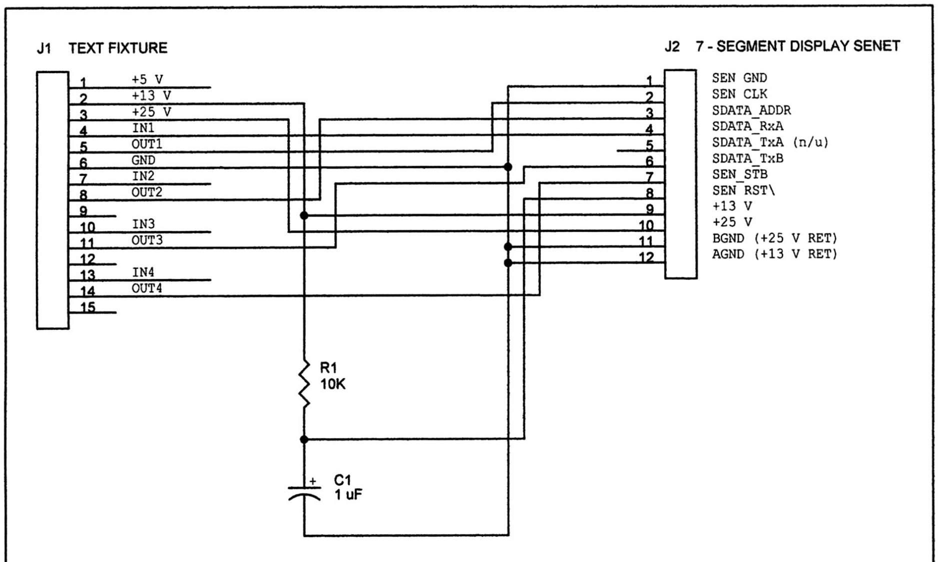
(see schematic of the cable)

VFD Display 75117700 and 75117800 VFD displays tested as one assembly.

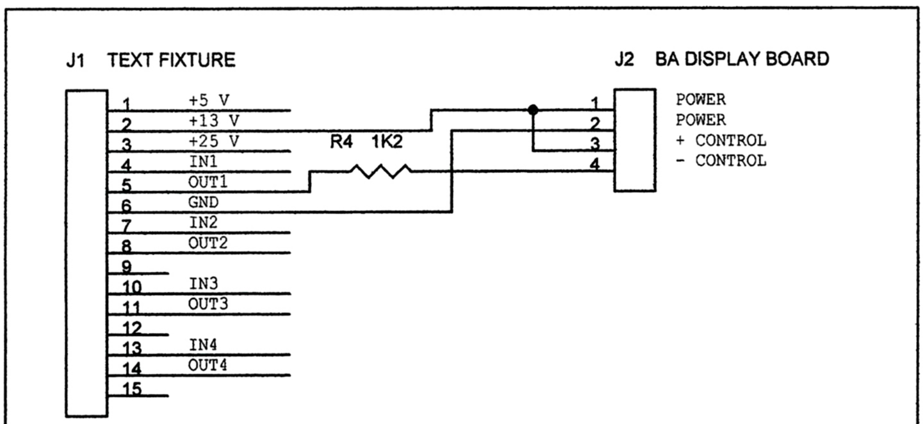
While this is a Netplex device, we can still give it a limited functional test. Most of the popular problems can be troubleshot. Most of the time the problem on the VFD Controller is capacitor C3, or its circuitry. Most of the problem with the VFD Display itself is bad solder joints between the display and the board itself. This is typically on the board toward the connector end. As the connector is pulled out the board flexes and loosens the first few solder joints of the display.

Coin-In Optics Assemblies

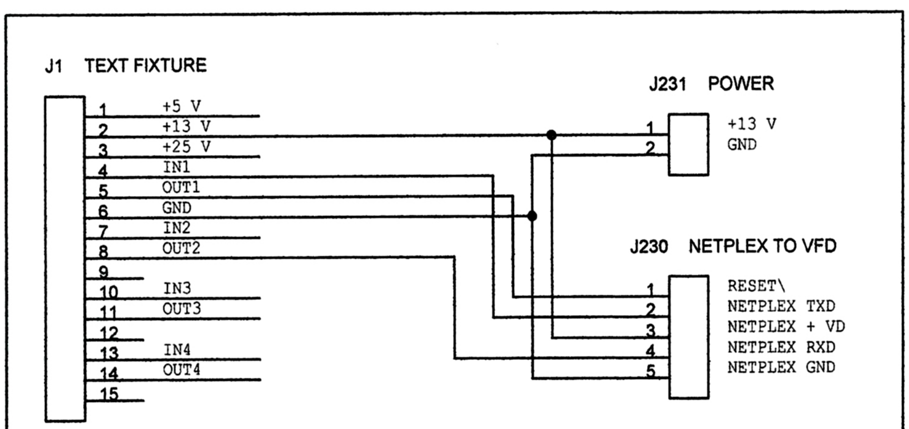
We can test the simpler Coin-In optics (without the electronics) with no problems. Weak LEDs and bad Phototransistors can be identified easily. The Coin-



7 - SEGMENT DISPLAY TEST CABLE (IGT)



BILL ACCEPTOR BEZEL DISPLAY BOARDS, IGT



IGT VFD DISPLAY AND CONTROLLER TEST FIXTURE

In assemblies with electronics (8032 era) can be tested and troubleshot with some degree of difficulty. Not having any games with the old type Coin-In assemblies, I have not yet attacked this one yet.

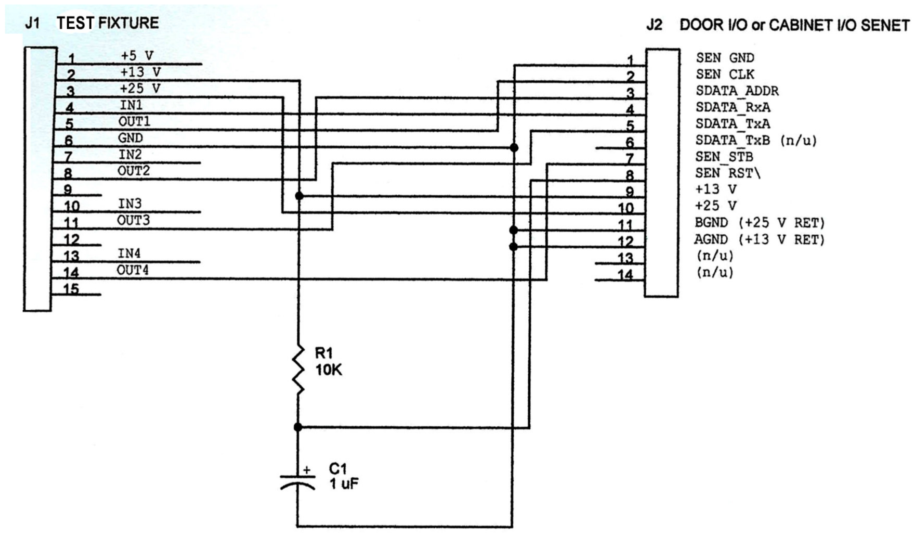
Schematics and Procedures

SENET Assemblies

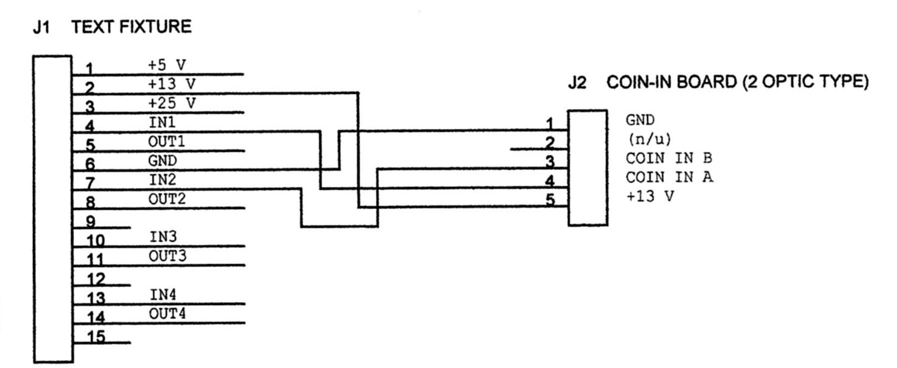
Most SENET assemblies and boards can be exercised and troubleshot with only a little complications in the test procedure. We have to manually emulate what the game's SENET controller does. This is useful for troubleshooting and also pretty educational.
Door I/O
Cabinet I/O
751179xx - 7-segment Display

In order to test these manually we have to manually go through operations on switches that we would otherwise do under microprocessor control. We shift out an address on the SDATA_ADDR line using the SEN_CLK line as a clock pulse. This selects the board for use. We then shift in data on (SDATA_TxA), while watching data coming off the board on SDATA_RxA. For a big box, we can put LEDs on the outputs and switches on the inputs (16 of each for the Door I/O board). Or, if we jumper the board outputs back to the inputs we can use the board to test itself, but this makes for more complicated troubleshooting process.

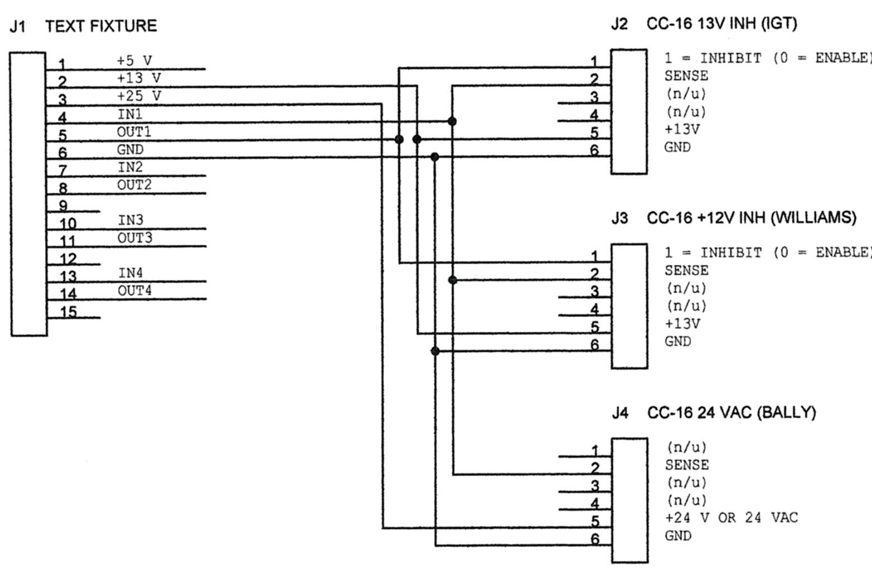
Door I/O and Cabinet I/O use the SDATA_TxA data line. The 7-segment display boards use the SDATA_TxB



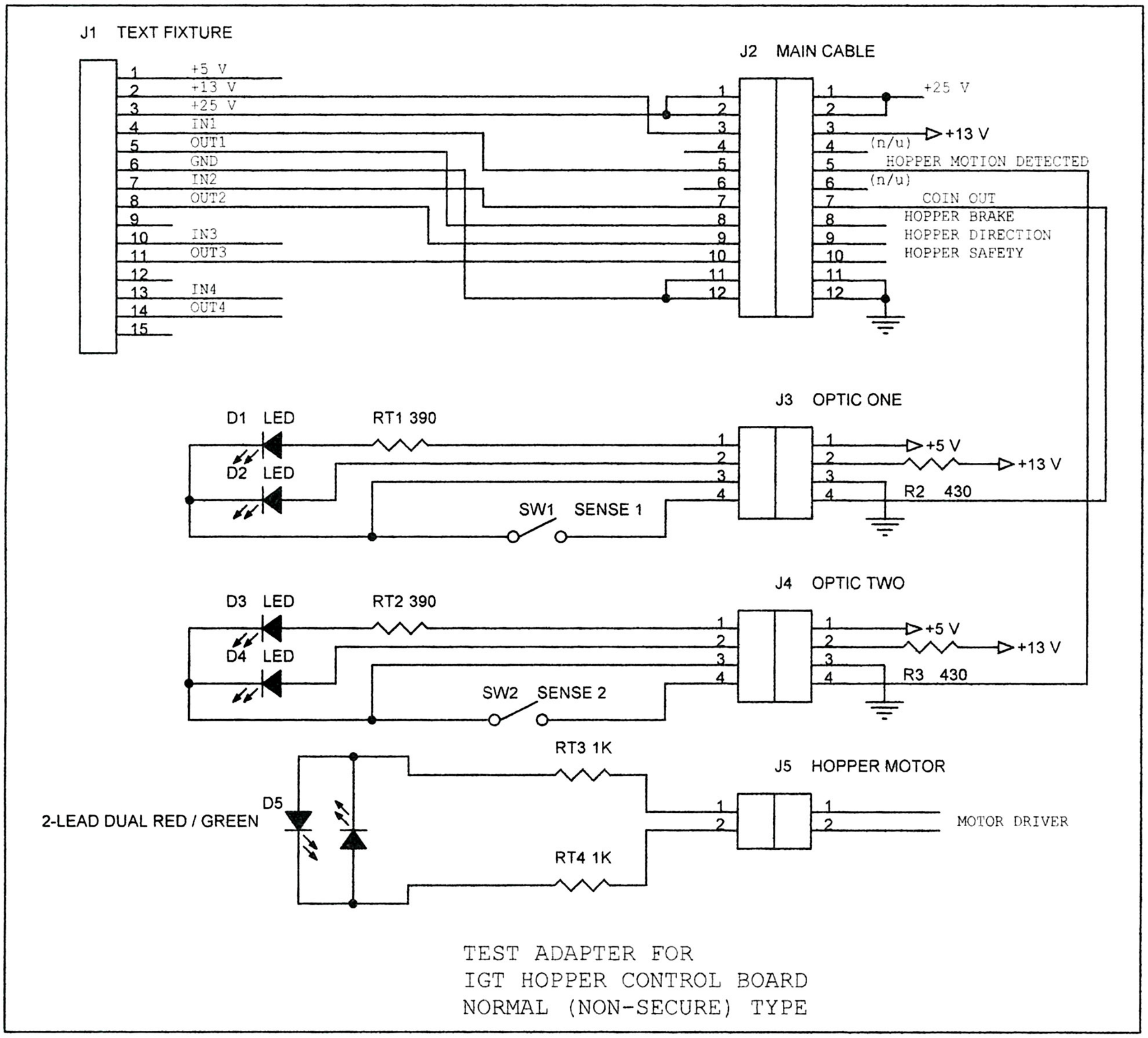
DOOR I/O AND CABINET I/O TEST CABLE



COIN-IN OPTIC TEST CABLE (IGT 2 OPTIC TYPE)



COIN COMPARATOR TEST CABLE
12 V OR 24 V VERSIONS



data line. The difference can be seem in the cables.

Payline Display Boards

751183xx, 751184xx, and others like them. Displays with 3 lamps can be tested directly. For those with 5 lamps it requires a trick to switch the fourth out between the other two lines. Again, it is suggested that the lamps be replaced with 13 Volt LEDs for troubleshooting purposes.

Communications Board

The 75430100 Communications Board. This can be tested and troubleshot with some degree of difficulty. Since there are many different types of inputs and outputs to deal with we have to get a little creative, but it isn't impossible. All outputs are tied back to a like input. (RS-232 Out is tied back to RS-232 In. RS-485 Out is tied back to RS-485 In. Fiber Optic Out is ran back to Fiber Optic In. You get the idea.) While this does not run the assembly at real time speed, most problems can be made obvious enough for troubleshooting.

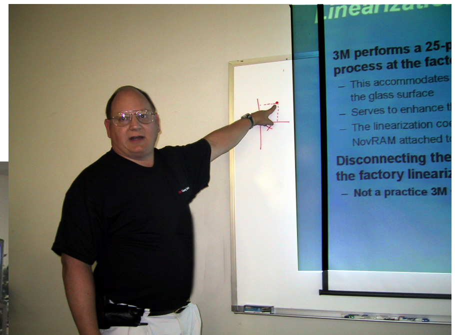
76602110 – Power Distribution board

754298xx – Hard meter board. Since this assembly requires +25 Volt drivers we need to adapt our test interface to drive +25 Volt signals at heavy current. An ULN2003 was chosen because we had them in stock.

- Herschel Peeler
hpeeler@slot-techs.com

Editor's note: *Additional schematic diagrams for various test fixtures are available at the Slot Tech Magazine ftp site, in the "Herschel Peeler Collection" sub-directory.*

TechFest 7 Review



Sencore couldn't attend TechFest 7 but they were represented by their generous donation of two DM501 digital multimeters which were given out as door prizes.

Ken Miller (l) and Paul Hatin (above) from 3M Touch Systems gave a wonderfully informative and high-spirited presentation on their touchscreens. Questions were encouraged throughout the presentation and participants were rewarded with gifts like electronic dice and "Slot Tech" T-shirts. Each TechFest attendee also came away with a genuine AAA Mini-Maglite as well. Thanks, guys. That was mighty generous.

Below: Tommy Giardina (l) of Atlantic Cape Community College invited the TechFest team to his crib in Atlantic City, New Jersey for TechFest 7. Over thirty slot techs from across the country attended the three-day event. Only a few actually came from Atlantic City. Weird.

Above: A first-time presenter at TechFest, Brian Tindall from IDX discussed the operation and programming of their IDX coin validator.

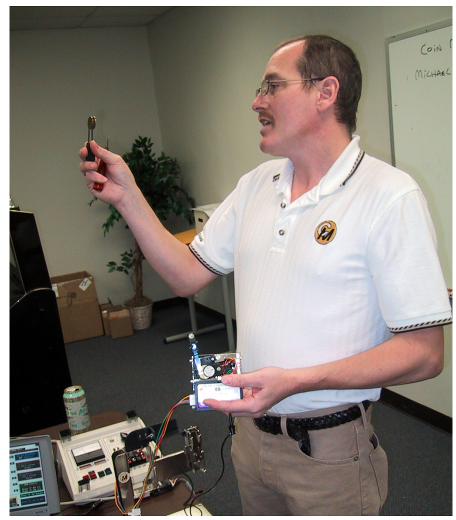
Left: AESI's Brian Carty gave us the lowdown on ticket printers with their FutureLogic (formerly called Seiko) ticket printer. Brian also presented repair information on the MEI model ZT-1200 bill validator (popular in Atlantic City) and introduced their latest BV, the Cashflow SC66 with its nearly indestructible cashbox. With Brian is Nick Colasante. You can learn more about AESI at the website: www.gamingstuff.com

Right: TechFest mainstay Michael Harris from Coin Mechanisms, Inc. discusses calibration using a pair of matched "coinsticks."

Left: Another TechFest first-timer, Global Payment Technologies (GPT) gave TechFest attendees a close-up and personal look at their GII and GII+ series of currency validators during one of the afternoon "bonus sessions." That's Bernard Atkinson and Haydn Smith doing the honors.

Left: Money Controls' Armando Gomez gave us a complete run-down on two products: The Condor coin validator and the Gamesman coin hopper. Armando's only complaint about TechFest? He was allowed too much time for his presentation. "My products are too simple to work on," he said. "It only takes a couple of minutes to completely dis-assemble and re-assemble my coin hopper."

Above: Label Rite, Inc.'s Mike McGuire gave participants a brief lesson in slot tickets, ticket printers and what to look for in a quality ticket that will not leave your printer optics coated with dust.



And then, Jack Geller of JCM turned on his magic power supply and he grew and grew and grew ever-larger until his head nearly popped out of the ceiling. Thus, TechFest 7 came to an end. - Slot Tech Magazine

Video B+

Okay, okay. We know what B+ is. The subject has been covered on more than one occasion here in the pages of Slot Tech Magazine. We know how the horizontal output circuit uses the B+ current to drive the horizontal deflection coils in the deflection yoke. We know too, that the B+ is used in the primary circuit of the flyback transformer, creating the EHT at the second anode of the CRT, the focus voltage(s), the screen voltage and, in many cases, the 6.3 VAC heater voltage for the picture tube as well.

So, what the heck is "video B+" and how can we use it to expand our spiritual consciousness and attain a state of nirvana? Well, we can't. I don't even know what all that means. But I do know that there is more than one power supply in a monitor and that one of them is used in just one place, the video output circuitry on the neck board of the monitor. The video B+ power supply is typically around +120 VDC - +175 VDC. In a nutshell (and by way of review for those who have not been reading Slot Tech Magazine for the past couple of years) here's how it works:

In the electron gun of a picture tube, changing the voltage at the cathode modulates the emission of each gun. The cathode voltage is obtained from the video B+ power supply through the collector load resistor. Typically, this is a 2 watt resistor. The resistance varies quite a bit. Expect something between 1.5k and 6.8k ohms. There are three of them, of course, one for each of the three guns in the electron gun assembly. They are typically the three largest resistors on the neck PCB and, undoubtedly, the only three large resistors of identical value.

When the cathode of the CRT is at the highest voltage possible (at the full potential of the video B+ power supply) the electron gun will be in what is known as "cutoff." As the name implies, the electron gun will be completely turned off. It will not emit a single electron.

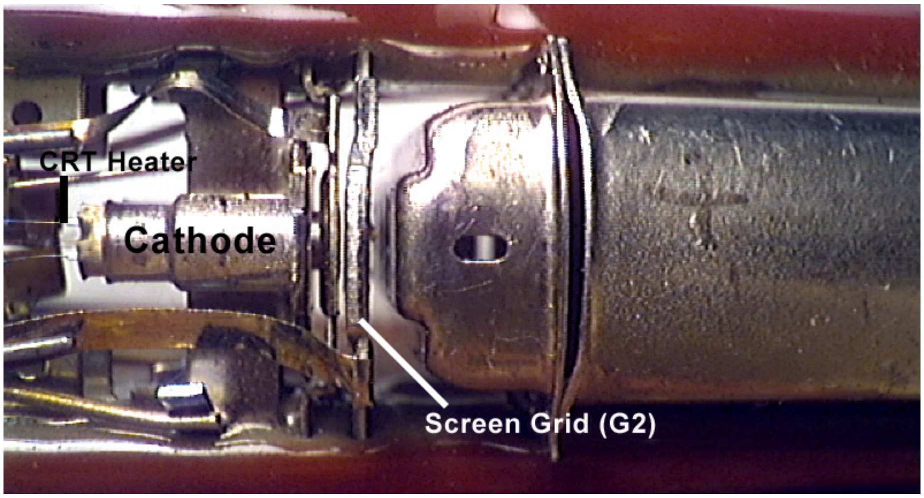
As the video output transistor begins to turn on, the voltage at the cathode of the CRT drops. As the voltage drops, the electron gun begins to emit its beam of high-energy electrons. As the cathode voltage drops, the electron gun leaves the cutoff region of its operating curve and enters the "emission" portion. The lower the cathode voltage, the greater the emission from the electron gun. Naturally, this translates into brighter color on the screen.

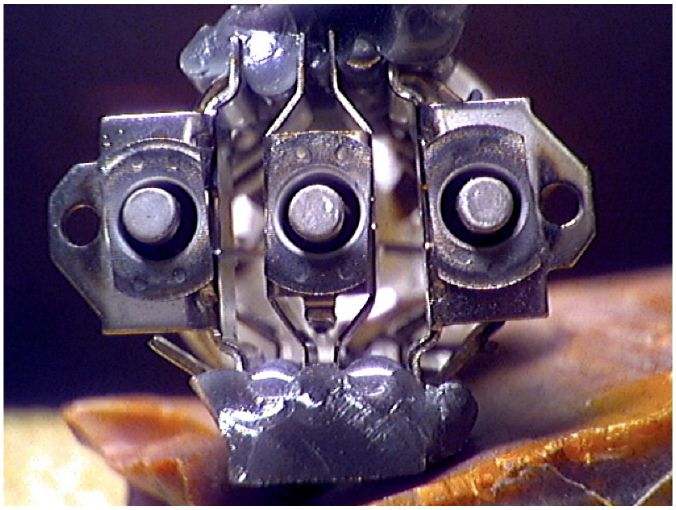
Electron Gun Construction

As discussed previously in Slot Tech Magazine, lower cathode voltage translates into brighter color. The reason for this becomes clear with a close look at the construction of the electron gun:

The cathodes of the electron gun assembly are actually small cylinders. Coating the surface of each cylinder is an element called Barium. It is the Barium that is the actual source of electrons in the electron gun.

In order for the Barium to re-





With the electron gun assembly broken apart, we can take a close-up look at the business end of the three cathodes. The three tiny holes in the screen grid line up with the cathodes.

lease its electrons, it has to be heated up. The CRT heater is tucked up inside the cylindrical cathode. The orange glow that you see in the neck of the CRT is just a small portion of the heater. Most of the heating element is inside the cathode. The heater does not actually touch the cathode; it just resides inside it.

The next element in the electron gun is something called the "grid." In this case, the grid under discussion is something known as the "screen grid." It's also known as grid number 2 or simply G2. When you use the "screen" potentiometer on a flyback transformer to adjust the brightness of the display, you are actually adjusting the voltage at the screen grid. Typically, the voltage might be +150 VDC to +350 VDC depending on the size of the CRT and where you have the potentiometer set. With the screen voltage set at its lowest, the display will be completely dark. The higher the screen voltage, the brighter the display will be.

The grid is not actually a crosshatch of wires as the name suggests. It's called the "grid" because, in the early days of vacuum tubes, this control element was (and continues to be) a crosshatch of fine wires, used to control the flow of electrons between the cathode and anode (also known as the "plate") of the vacuum tube. In the case of the CRT however, we're looking for a finely focussed beam of electrons and so the grid is actually a flat metal plate, with three tiny holes punched in it, one for each of the three electron guns in the electron gun assembly.

The electron gun works by virtue of the fact that the negatively charged electrons that are boiled out of the Barium by the CRT heater, subsequently are attracted toward the positively charged grid. Instead of slamming into a solid piece of metal, the accelerating electrons pass through the tiny hole in the grid, known as the "virtual aperture." Later on, as they pass through the remaining elements in the electron gun, the beam of electrons is focussed by the focus grid(s) and accelerated even further by the accelera-

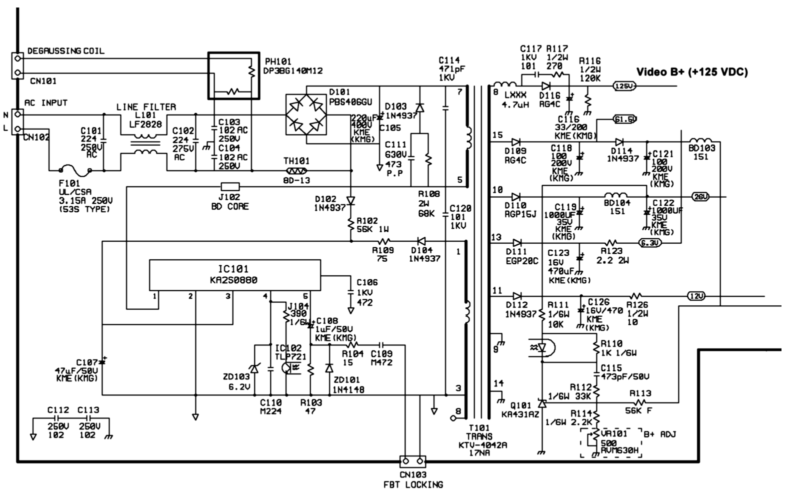
tor grid before shooting out toward the phosphor covered face of the CRT.

Thought Experiment

Understanding the relationship between the video B+, the cathode voltage and the brightness of the display is now a simple matter of understanding the way the electron gun operates. Imagine, for just a moment, that the cathode and the grid are at the same voltage. Let's just say, for the sake of discussion, that it is +125 VDC. Imagine, too that we have a cloud of negatively charged electrons, floating in the space between the cathode and the grid. The electrons have been released from the Barium-coated cathode because they have been heated by the CRT heater.

We know that oppositely charged particles will attract but because the negatively charged electrons feel the same attraction from both the cathode and the grid (they're at the same potential, remember?) the electrons will not move at all. They'll just sit there as the cathode is pulling them back with the same amount of force as the grid is pulling them toward the screen of the CRT.

Now, let's turn on the video output transistor. This lowers the voltage on the cathode and viola! Now we no longer have a situation where the electrons are being held back by the charge on the cathode. When the voltage at the cathode is lower than the voltage on the screen grid (G2) the electrons are attracted toward the grid, where they pass through the virtual aperture (the little hole in the grid) and sail through the remaining elements of the electron gun, eventually being shot out of the electron gun at practically the speed of light.



This is the SMPS from Kortek. In this case, the video B+ is simply taken from the uppermost tap on the transformer secondary. This is pretty typical as there is generally nothing that requires a higher voltage than the video B+, other than the EHT, focus and screen voltages which are always flyback derived power supplies.

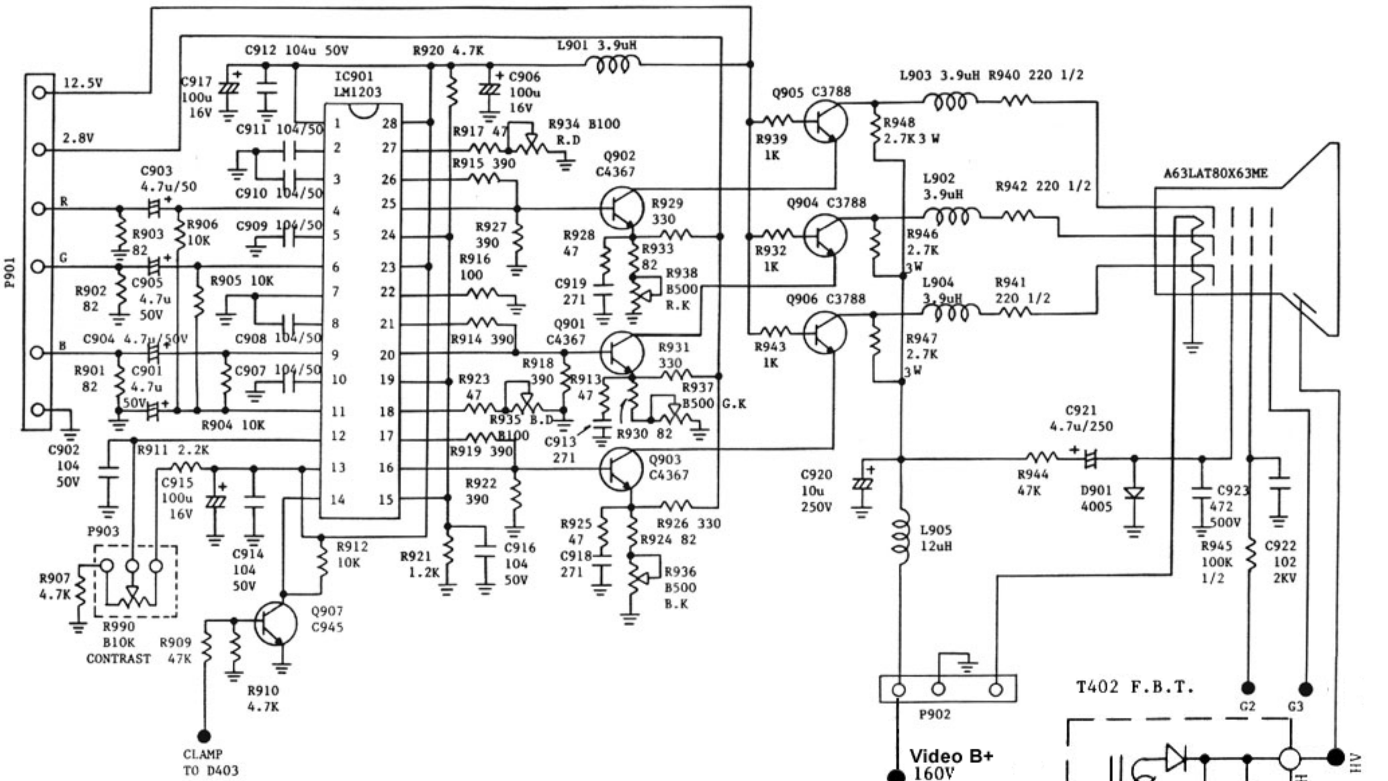
If you experience a loss of the voltage to the video output stages on the neck PCB, the guns will be turned on full-blast. The video B+ is derived in one of two ways, depending on the design of the monitor:

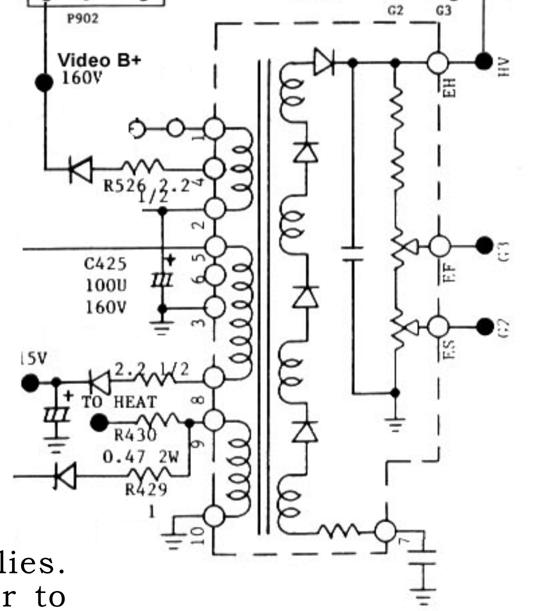
In some cases, the video B+ is derived from a tap on the primary winding of the flyback transformer in the high voltage unit. The output is rectified and filtered to provide a DC power supply. As mentioned previously, this voltage will vary between monitors but you will generally find it to be around +120 VDC to +175 VDC depending on the make and model of the monitor. In some monitors, the video output stage may powered by the B+ itself but generally, it is somewhat higher in voltage than the actual B+.

In other cases, the video B+ is derived from the SMPS itself. Since a monitor requires a number of different power supply voltages, it is often most convenient to obtain them all (all except the EHT, focus and screen voltages, that is) from the SMPS. It's a simple matter of throwing some additional windings on the SMPS power transformer, rectifying the outputs with diodes and filtering them with electrolytic capacitors.

If this power supply is missing, either through a bad component or broken conductor, the voltage at the cathodes drops to zero and all three electron guns come on full blast. I know it seems weird that a missing power supply would cause too much output but this is the case with the electron guns.

If you suspect this is your problem, measure the voltage at the collectors of all three video output transistors with no input signal. If





This is an example of a flyback derived, video B+ power supply.

you find the voltage to be low or non-existent, you MAY have located your problem. I say “may” because there is another possibility here.

The video amplifiers drive the three video output transistors as we have seen in previous issues of Slot Tech Magazine. An integrated circuit generally handles the job of amplifying all three color signals and passes the amplified signal to the output stages.

The outputs of the video amplifier IC typically drive the bases of the output transistors directly. They are DC or Direct Coupled amplifiers. What that means is that if the IC fails in such a way that it puts out too much DC voltage, it will turn on all three video output transistors. In fact, the transistors will be “saturated” or turned on as hard as they can be. When you measure the voltage at the collectors, it will be very low because the collectors are now connected more-or-less to ground through just 200 ohms or so of resistance.

There are a couple of ways to determine where your problem lies. One is to use a meter to measure the power supply voltage of the video output stages. In other words, after you’ve checked the collector voltage and found it to be very low, more your meter lead to the other side of the collector resistor and measure the voltage there. It’s always easy to locate these resistors on any monitor because they are three identical resistors and typically two watts. One side of all three resistors will be tied together and connected to the video B+ power supply. That’s where you measure the voltage. If the voltage is low there as well, you have a problem with your video B+ power supply.

On the other hand, if the power supply is good but the voltage is low when measured at all three video output collectors, your outputs are probably being over-driven by a bad IC. An easy check is to touch the collector resistors. If they are really hot, you’ve narrowed down your problem.

- Slot Tech Magazine

Slot Tech Training at Camel Rock Casino

Above: Jack Geller showed the class how to work on JCM bill validators. He has some neat tricks for testing every sensor and motor in the unit.

Right: Coin Mechanism's Michael Harris spent the better part of the day with the class. As usual, he covered the operation and calibration of Coin Comparitors. In a nice change from the hurried pace of the TechFest program, his extended visit allowed him some extra time to visit the slot floor where he showed the class some simple solutions to the all-too-common "long coin" fault. In one example, some simple tweaking of the door was all that was required. In another case, a couple of tiny washers did the job.

The men and women of Camel Rock Casino in Santa Fe, New Mexico. "I think it was just about the best training we ever had," said lead technician Robert Valencia.

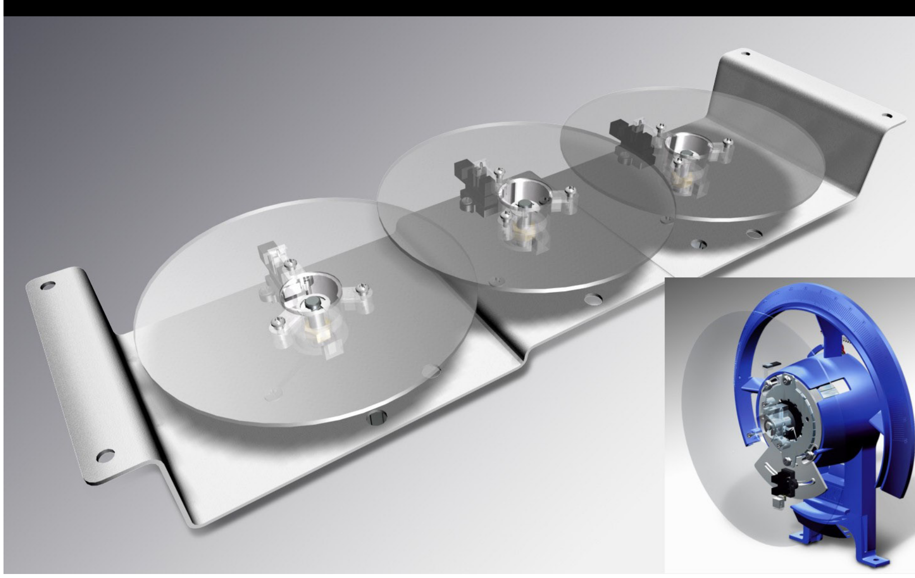
Above: Sid and Thomas work on a monitor during one of the hands-on monitor repair labs.

AESI's Eric Walla introduced the slot techs to the FutureLogic (formerly known as Seiko) ticket printer for slot machines. Visit AESI at www.gamingstuff.com

Ramiro Limon of Ceronix. Ramiro gave a full day presentation on monitor repair, Ceronix style.

Santa Fe, New Mexico was the scene of two weeks of intensive slot tech training at Camel Rock Casino. The training took place November 3rd - 14th, 2003 and included training in everything from basic electronics and soldering skills to coin mechanisms and bill validators, with a special emphasis on component-level monitor repair. The class was lead by Slot Tech Magazine publisher Randy Fromm and included guest instructors Jack Geller of JCM and Michael Harris from Coin Mechanisms, Inc. Also participating was Ramiro Limon (left) of Ceronix who gave a full day presentation on repairing Ceronix monitors using just a digital multimeter and a bit of logical deduction. For information on how you can bring this type of training to your casino, contact Randy at Slot Tech Magazine. tel.619.593.6131

Slot Tech New Product - Gamesman Brand Products by Coin Mechanisms Inc.



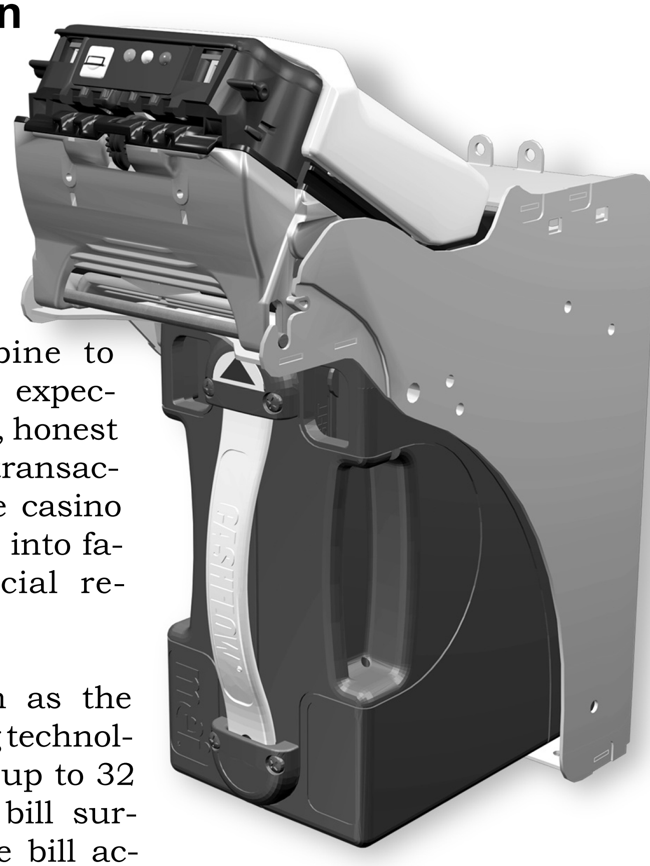
Gamesman

Single & Triple Disc Unit

Coin Mechanisms Inc. has announced the release of the Gamesman Single and Triple Disc Unit. Both the Single and Triple Discs can be custom configured for each application and can be run by 48 step or 200 step motors. Small discs can be run on the GM3000 Mini-Mech while larger units use the GM1000 or GM2000 systems, or customized metal mounting racks.

For more information, visit www.coinmech.com.

MEI Bill Acceptor Employed in State-of-the-Art Casino



Borgata, New Jersey's newest casino property, has chosen to fully integrate MEI CASHFLOWTM SC66 across the game floor. During July 2003, Borgata opened its doors with MEI CASHFLOW SC series bill validators in 100 percent of games representing IGT and Bally. The path to implementation began in January 2003 when AC Coin & Slot approached Paul Tjoumakaris, vice resident of slot operations and proposed MEI products as a solution.

Tjoumakaris visited MEI in January and was impressed with the MEI engineering staff and development process. During the competitive review process, Tjoumakaris recognized the key differentiation points of the MEI CASHFLOW SC Series and the potential to improve profitability, customer satisfaction and be easily accessible for the operators and technicians to manage.

MEI CASHFLOW SC66 has a superior ability to securely accept valid bills in all conditions while rejecting counterfeits. The unit has proven in real-world casino applications to provide ultimate acceptance rates. Just as important, the product delivers on MEI's promise to reduce the total cost of ownership with easy-to-use equipment. These benefits combine to exceed patron expectations for fast, honest and reliable transactions. For the casino this translates into favorable financial results.

Features such as the optical sensing technology, scanning up to 32 points of the bill surface, made the bill acceptor stand out from the competition. Future-proof innovations such as simple upgrade capability and an interactive display further impressed the Borgata team. However, the subtle benefits cemented the decision to choose MEI CASHFLOW SC series. For example, Tjoumakaris knew that having the fewest number of parts, down to the welded-plastic design, would resolve issues on the floor and prevent downtime. After a careful design and features review, Tjoumakaris determined that the MEI product has the best and most valuable "bells and whistles" in the industry.

Prior to the decision, MEI submitted the SC series for IGT approval. The lingering question - would the totally new design fit into existing products? MEI carefully managed the process and gained IGT approval. Each time Tjoumakaris met with MEI his confidence level grew and MEI CASHFLOW SC Series was the right fit.

Customer Vision

"Seeing the technology come alive, I was confident the process would work and that IGT approval was becoming a possibility," says Tjoumakaris. "I knew this was the right choice when the testing was complete in late August 2002 at Bellagio and MGM Mirage. The results were extremely encouraging. We saw we

would be ahead of the game with single wire ticket in/ ticket out. We set the bar and everyone else will have to catch-up."

"As the first casino opening in Atlantic City in 13 years, we've chosen innovative technology, such as MEI bill acceptors, that reflect our approach to the gaming environment and provide a quality experience for our patrons," says Tjoumakaris. "We did not want to open a state-of-art, $1.1 billion casino with old technology and then have to retrofit in six months. MEI has developed a future-proof product solution that has the potential to keep enhancing our cash flow even after our grand opening."

"MEI jumped through hoops and was supportive of deadline to get MEI CASHFLOW ready in time for the grand opening. We have nickel slots, multi-denomination slots and even a $1000 slot machine, adds Tjoumakaris."

AC Coin & Slot Viewpoint

"We find MEI to have the most sophisticated optical recognition system of any in use today," says Mac Seelig, founder and president of the New Jersey-based AC Coin & Slot. "Our objective is to offer casino operators the most convenient, yet most up-to-date technology in the bill acceptor market, and we found that in the MEI product line. Through our relationship with MEI, we can provide our customers with a

better alternative that benefits high-end properties such as Borgata, here in Atlantic City."

MEI Insight

The product embodies 30 years of MEI innovation and insight, gained from selling more than 3 million bill acceptors and direct relationships with more than 30 casinos. MEI CASHFLOW SC66 technology heightens customer satisfaction, measurably increases cash flow and significantly reduces operating costs in a ticket in/ticket out environment.

According to Neil Young, MEI marketing manager, the goal of MEI CASHFLOW SC66 is to fulfill the needs of three distinct audiences better than competitive products:
Gaming patron - *wants a fast, honest, reliable transaction.*
Casino operator - *deliver on the patron's needs, while protecting against fraud and reducing total cost of ownership with easy-to-use equipment.*
Gaming machine manufacturer - *exceed the operator's expectations with a flexible, easy-to- configure bill acceptor at a competitive acquisition cost.*

Meeting all of these requirements called for an array of new technology within MEI CASHFLOW SC66. The unit includes 14 pending patents, covering 30 unique design features. Features include new sensors, advanced digital processing technology, complex algorithms, innovative design engineering and an illuminating light bar with six wavelengths of light to cover the majority of the bill surface. The welded plastic cash-box is so durable that it can withstand repeated six-foot drops onto concrete. Additionally, the product is easy to use with the industry's first dispute resolution window in the cash-box, allowing floor personnel to view the denomination of the last bill stacked without opening or removing the cash-box.

"During the development phase, more than 1.5 million bills were fed through MEI CASHFLOW SC66, with unmatched performance results," says Young. "Our engineers have developed a system with lifecycle durability and solid technical specifications, for a lower total cost of ownership for casinos."

Jim Gabriele National Gaming Industry Manager

Jim Gabriele is national gaming industry manager representing MEI in the U.S. and Caribbean. In this role, Gabriele partners with customers to identify and forecast future industry opportunities. He works closely with MEI engineers to translate market opportunities into technology solutions to help casino and gaming operators improve bottom-line profits.

Gabriele guides MEI sales strategies and team members to ensure current customer satisfaction and lead new business development to generate new customers. Additionally, he manages all

Jim Gabriele is national gaming industry manager representing MEI in the U.S. and Caribbean.

OEM and distributor relationships, working closely with AESI and AC Coin & Slot.

Previously, Gabriele acted as U.S. amusement, gaming and lottery sales manager. And, during his 23 years with MEI, Gabriele has served in various capacities from quality control, manufacturing engineer, training manager and manufacturing manager. His depth of knowledge in manufacturing, engineering and the gaming industry have been instrumental in establishing and maintaining customer partnerships

- Submitted to Slot Tech Magazine by Rene Stahl of VIVID
770.418.9924
renestahl@mindspring.com

For more information, contact:
MEI
1301 Wilson Drive
West Chester, PA 19380
Telephone: 1 610 430 2500
Facsimile: 1 610 430 2694

TECHFEST 8 - CLINTON, IA - MARCH 9, 10, 11 2004
TECHFEST 9 - MINNEAPOLIS, MN - MAY 4, 5, 6 2004

Make plans today to join the gaming industry's top engineers, technicians, technical writers and instructors for 3 days of technical seminars and presentations that will enhance your performance as a technician and dramatically increase your value to your employer.

TechFest 8 will be held March 9-11, 2004 at The Franciscan University in Clinton, Iowa. TechFest 9 will be held May 4-6, 2004 at Mystic Lake Casino Hotel, 2400 Mystic Lake Blvd, Prior Lake MN 55372. Registration fee for TechFest is $450.00 per person and includes lunch each day.

This is a technical presentation. The TechFest is geared for working slot techs and technical managers who are looking for a way to make a dramatic improvement in their understanding of video slot monitors, touchscreens, bill validators, hoppers and more with no-nonsense technical presentations from:

- **Asahi Seiko - Coin Hoppers**
- **Coin Mechanisms, Inc. - Coin Comparitors**
- **MEI - Bill Validators**
- **3M Touch Systems - Touchscreens**
- **Sencore - Test Equipment**
- **FutureLogic (formerly Seiko) - Ticket Printers**
- **IDX - Coin Validator**
- **Money Controls - Coin Validator/Coin Hoppers**
- **JCM - Bill Validators**
- **Ithaca - Ticket Printers**

- PLUS - A special instructional series on video slot monitor repair presented by Randy Fromm

BE A BETTER SLOT TECH

Come and spend 3 days at TechFest. With engineering and technical representatives on hand from the gaming industry's leading suppliers of touchscreens, bill validators, coin comparitors, hoppers and monitors, YOU have a chance to ask about YOUR problems. You have a chance to get REAL answers to your questions, face-to-face with some of the most qualified technical experts in the industry.

TechFest is for slot techs of all skill levels, from novice techs who want to learn the basics of BV and hopper maintenance to advanced techs that need to brush up on monitor repair.

SCHEDULE OF EVENTS

Events subject to change

Day One

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

1:15pm - 3:15pm
Mars Electronics, Inc. - BV troubleshooting and repair

3:30pm - 5:30pm
FutureLogic Printers - Printer troubleshooting and repair

Day Two

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

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

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

Day Three

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

1:15pm - 3:15pm
Money Controls - Coin validator and coin hopper maintenance and repair.

3:30pm - 5:30pm
JCM - Bill Validator Troubleshooting and Repair

PLUS - Bonus sessions from 3M Touch Systems (MicroTouch) IDX (coin validators) Ithaca (ticket printers) and Sencore (Test equipment to speed through monitor repairs)

Dates and times to be announced

Visit the website at slot-techs.com for more information

Space is limited - Register today!

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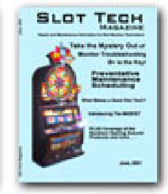

Slot Tech Magazine is strictly technical. As such, the magazine's contents are not time critical. The repair information and technical data contained in past issues is just as valid today as it was the day it was published.

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

Randy Fromm's

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