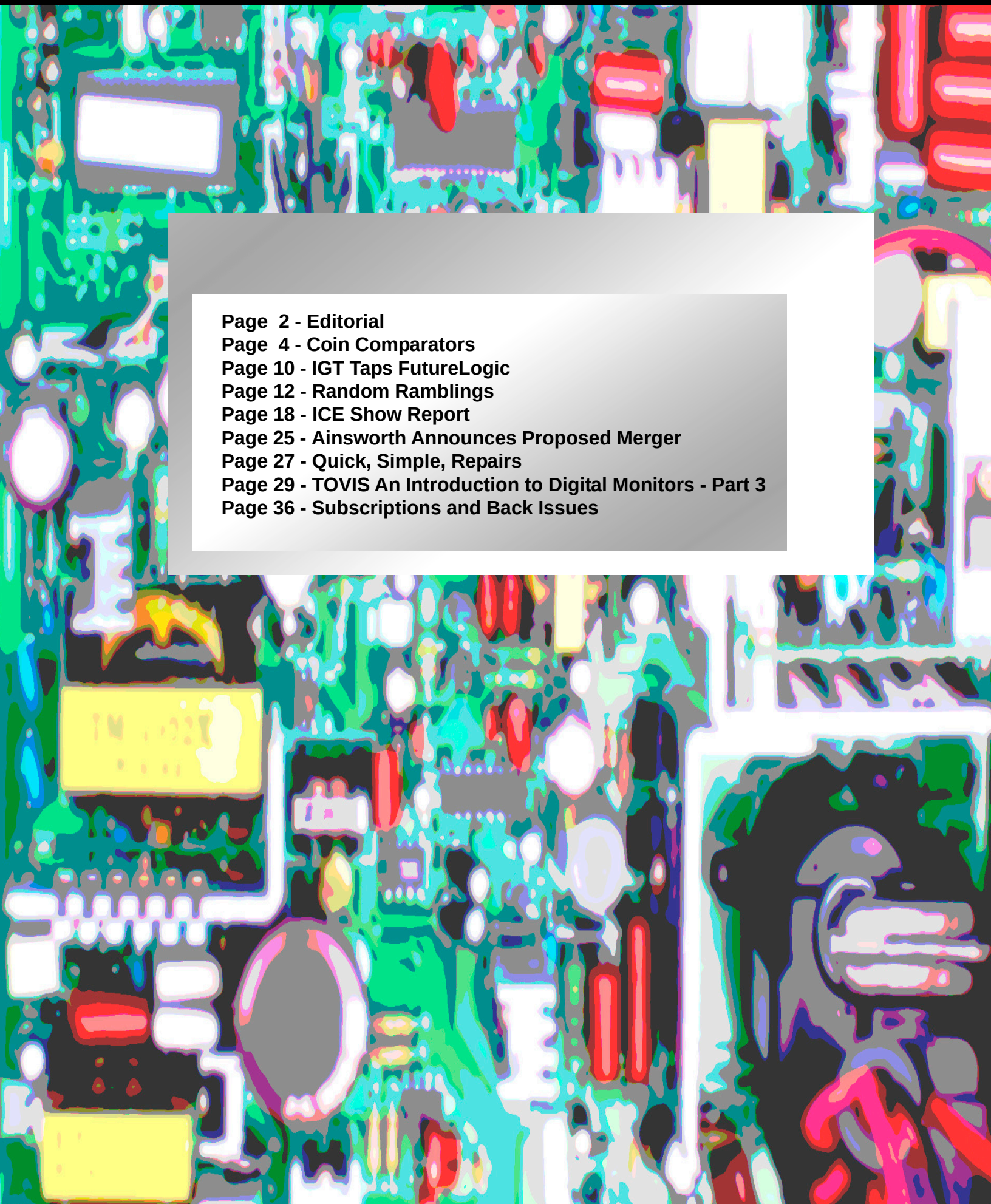

Slot Tech Editorial

The TechFest is coming.
The TechFest is coming!

I am happy to announce that plans have been finalized for TechFest 11. It will be held at the Mystic Lake Casino near Minneapolis, Minnesota on May 10 - 12, 2005.

This time, the program has been revised to include an even greater emphasis on monitor repair with the addition of a full day of training dedicated to Ceronix monitors. Ceronix factory tech trainer Paul Alexander will present a full day of Ceronix repair training on Thursday, May 12th, 2005. This is the final day of the three day TechFest and follows two sessions on the subject of monitor repair given by yours truly. I will be covering the basic theory of operation (no previous knowledge required) and troubleshooting techniques. I will cover monitor schematic diagrams and how to identify the components. We'll spend a lot of time concentrating on what commonly fails in a monitor and how to fix monitors quickly and efficiently. After I am done with you, Paul will take over to discuss Ceronix and some more advanced stuff. Don't worry, though. Ceronix monitors can be easy to repair once you understand them. I am really looking forward to Paul's premier appearance at TechFest.

Also new at TechFest 11 is Bally Gaming. Bally will be giving a technical demonstration of their new M9000 cabinet and the Alpha operating system. They will also be on hand to answer questions about their other current products as well.

Also from the OEM League will be a return appearance from WMS Gaming's Ron Parido who had them packed-in at TechFest 10 with his presentation on the Bluebird Video slot machine and their CPU-NXT operating system. This time, he will be presenting a look at their reel slot. I have mentioned previously that Ron is a really great technical presenter that totally knows what he's talking about and is totally not boring. He's a real down-to-Earth guy that makes you feel more like it's your brother showing you how things work rather than some stuffed-up tech dude that simply recites page after page of arcane technical details.

So, why the new program? First of all, let me make it perfectly clear to everyone that the TechFest program, as it has been held so far, has been really great and has far exceeded my expectations. All the folks that have presented have done a wonderful job. The amount of information presented and knowledge gained has been extraordinary. Most of all, those properties that have sent techs have shown their approval by sending others of their team to subsequent TechFests.

In some cases, the same individuals have returned which sort of started me thinking about changing the program around a bit. TechFest 11 is going to be somewhat different. I don't think it will be better or worse. I just think it will be different. I am especially happy to see Bally Gaming and Ceronix join us as part of the TechFest team but rest assured that all of the excellent presentations on touchscreens, coin validators, bill acceptors, hoppers and other peripheral devices that you have enjoyed at past TechFests will be a part of future TechFests as well. Should I make it four days?

Visit the website at slot-tech.com for more details about TechFest 11. That's all for this month. See you at the casino.

Randy Fromm

Randy Fromm - Publisher

Randy Fromm's
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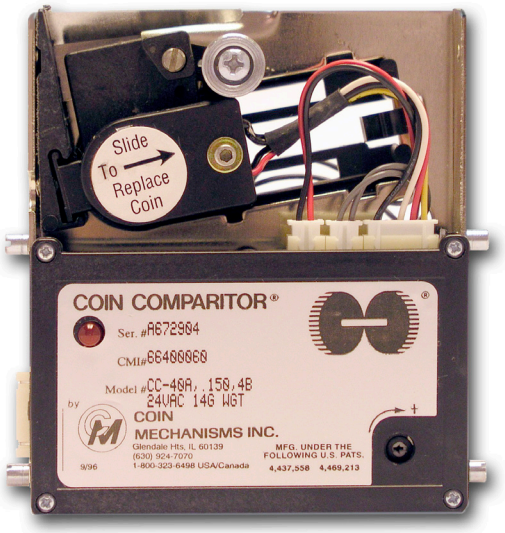
Coin Comparators

By Herschel Peeler



Coin Mechanisms is certainly not the only manufacturer of coin comparators, but they have an extensive history with the gaming industry. Coin Mech makes more models than you probably were aware of. In addition to the ever popular CC-16, CC-3x series, CC-40, CC-62 and MC-xx series, they make many variations of each kind. You can download the schematics and specification sheets from their website (www.coinmech.com). Plan on taking a couple of days if you print them. There are a lot of them! Each model has many variations; they differ from one another in terms of the length of pulse widths and the pinout.

There are about 180 variations of the CC-16 and about 250 variations on the MC-xx theme. Another 200 or so on the IC-16 theme, not to mention IC-32, IC-33, IC-36, IC-37, IC-40 and IC-62 types. Each of these is identified by a unique "CMI Number" printed on the cover. If your shop has misadventures like mine, the cases are always being separated from the boxes and you lose track of which match.

To help you with this task, a file has been uploaded to the Slot Tech FTP site named CoinMech.xls. It lives in the "Herschel Peeler Collection" sub-dir. It is an Excel (*.xls) format. This list crosses the CMI number with which PC board is used, which processor is used and a description of what makes that one unique. This is a work in progress and will always be so. It will never be finished. This is a "living document" in constant growth and change.

Coin Mechanisms, Inc. now puts their part number on the bottom of the PCB housing to keep the number with the part.

When you replace or purchase these puppies, do so by the proper CMI Number or, like Gump's chocolates, you never know what you are going to get.

Three basic connectors are used. The 6-pin JST connector (part number XHP-6) uses pins with the part number SXH-001T-0.6. If you have a hard time finding these, try the industry's friend, Happ Controls (www.happcontrols.com). The pin crimper for these pins is beyond my budget. I confess that I crimp them on the wire and solder them. They also use a 6-pin Molex connector (22-01-3067) and 7-pin (22-01-3077) that uses terminals 08-50-0113. These connectors are compatible to the AMP parts 770602-6 (6-pin), and 770602-7 (7-pin) housings that use terminals 08-52-0123.

Other differences between different models may only center around physical differences like thickness of the coin, use of shims and selection of counterweights. Each modifies the model for a specific coin. They can be designed for use by most countries that have casinos from

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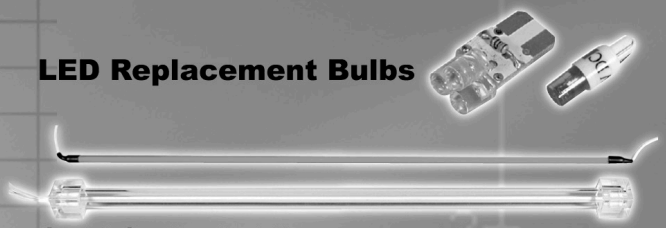

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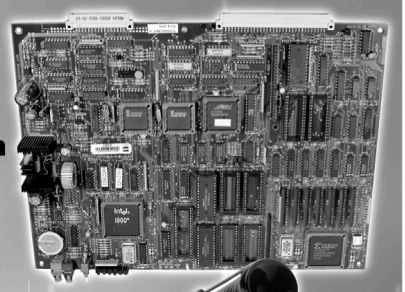

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CC-16

The CMI number for each variation will start with 6616####. Each model has variations that show up as differences in pinouts as well as pulse widths. Some have only the Sense output available. Some may also have an Inhibit input. The width of the Sense pulse may vary. There are three most popular types but realize there are many other variations on each theme. There is the basic CC-16 with no Inhibit that runs on 24 VAC. There is the CC-16 with an Inhibit input that runs on +12 VDC, unregulated. There is the CC-16 with an Inhibit that runs on +13 Volts, regulated. Each of these has variations that can be identified by a unique CMI number.

These are analog devices. They work by Operational Amplifiers and have no microprocessor used in their operation. They gave an indication of detecting a good coin but the game still needed a Coin-In switch just beneath the comparator to detect coin direction and timing.

MC-xx

CMI numbers 6646####. Even though they are listed as MC-16 or MC-40 and such they are all primarily the same on the inside. The part number identifies what that specific CMI numbered model will emulate, a CC-16, CC-40 or whatever. What makes one different from another is primarily software and jumper configuration. These are microcontroller based devices and this gives Coin Mech considerably more control than could be attained using the analog design.

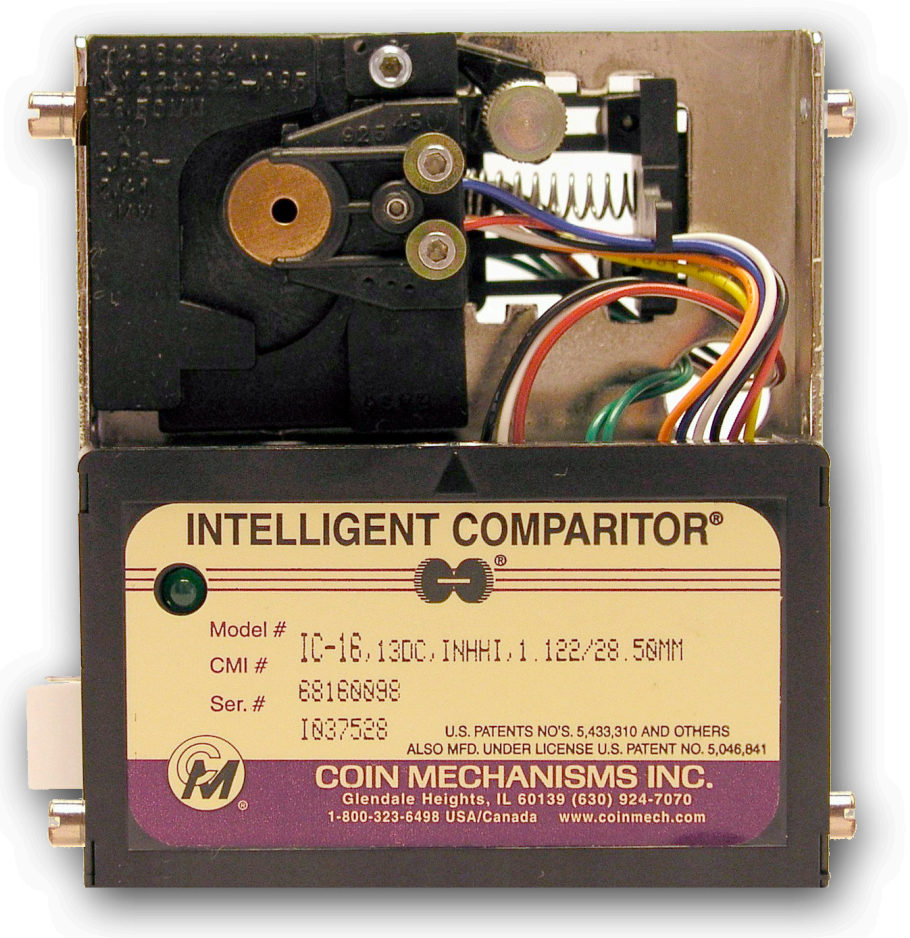
If you have all the information, one version may be converted to another. Yes, that is a general statement and you will certainly find exceptions to it.

CC-40

CMI numbers 6640####. I think the CC-40 was originally designed to be an upgrade for games that used mechanical coin acceptors, lockout coils and whisker switches. If you've been around a while you remember these. The CC-40 was powered by what used to be the Lockout coil power and provided a Coin Comparator function, giving out a Sense pulse when a coin was detected. It also had built-in optics that could be used to measure coin detection time as well as coin direction.

CC-3x

This series of coin comparators were designed for larger coins. As the coin's size was increased, there was relatively less difference between a proper casino token and a slug that one could make in



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their kitchen. These devices were designed to detect the differences as well as the larger physical size of dollar (and higher) tokens. They are also analog devices and the basic circuit was much the same as the CC-16 type. If you understood how the CC-16 models worked, the CC-3x was easy to learn.

The CC-32

CMI number 6632#### works on +12 or +13 VDC and has an Inhibit function. These have a 6-pin AMP / Molex type connector. Typical application is for US dollar size casino tokens.

The CC-33

CMI number 6633#### have no Inhibit function and typically work on 24 VAC. Different models work on different voltages. These have a 3-pin JST type connector. Typical application is for US dollar size casino tokens in IGT machines. The CC-36 (CMI number 6636####) are similar to the CC-32 function but are typically used in Five Dollar and higher games. The coins are slightly larger than the one-dollar tokens.

The CC-37

CMI number 6637#### are similar to the CC-33 function but are typically used in Five Dollar and higher games. The coins are slightly larger than the one-dollar tokens.

These are the older lines. Coin Mech has newer products

available including the "Defender." Not having any in our casino at this time, perhaps we will make an article on these others in the future.

Electronic Coin Acceptors

Coin Comparators compare an incoming coin against a reference coin that is installed in the Coin Comparator. Electronic Coin Acceptors analyze the characteristics of the incoming coins against a pattern that is usually programmed into the acceptor in some way. Often it is a matter of inserting a good coin a number of times and telling the acceptor to memorize the characteristics.

Most coin acceptors are made to be plug and function compatible to a popular standard. Switching from Coin Mech to some other manufacturer's device is a plug and play operation. The game, in many cases, cannot tell the difference. In other cases, there are differences. Most games are designed to accept a small variety of popular coin mechanisms by simple selection in setup procedure.

- Herschel Peeler
Hpeeler@slot-techs.com

The .xls database mentioned in this article can be downloaded from the "The Herschel Peeler Collection" sub-dir on the Slot Tech Magazine FTP server.

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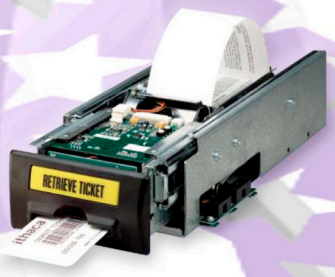

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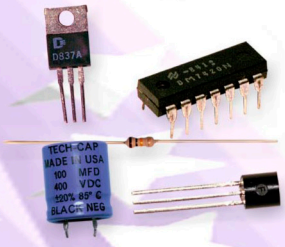

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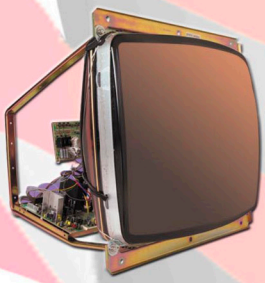

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IGT Awards Default Status to FutureLogic Printer for all new TITO Slot Machines and Video Games

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FutureLogic developed and launched the first PSA-66 printer, in collaboration with IGT designers, for the introduction of EZ-Pay in 1999. says,

"The FutureLogic printer was sole-sourced for the first several years of EZ-Pay and continues to be our default component for new games," said Randy Hedrick, vice president of IGT Labs. "FutureLogic's excellent design and service record with IGT, and their ability to keep pace with our aggressive development and release schedules, makes the decision to spec the GEN2 printer an easy one."

The latest generation of FutureLogic printers was developed with design feedback from leading game manufacturers and casinos. The device has been extensively field-tested for more than a year.

> GEN2(tm) will be installed as the standard ticket printer in all new IGT games, unless otherwise specified.

The GEN2 printer retains the robustness and reliability of the prior generation device and protects a current user's investment in both training and spare parts. It also offers a new feature to eliminate player interference. Dubbed ITH for "Intelligent Ticket Handling" the technology ensures that all information is printed prior to presentation of the ticket and eliminates torn, smeared or crumpled tickets.

Other value-added features include the ProMatrix promotional couponing and triggering system, as feature in last month's Slot Tech Magazine. This integrated solution allows casino marketing departments to deliver real time targeted promotions from any GEN2-equipped TITO system. FutureLogic's innovative ProColor technology allows these promotional coupons to be delivered to customers in eye catching color.

For further information, contact FutureLogic at 949.487.4829 for sales inquiries or 702.597.5355 for technical service.

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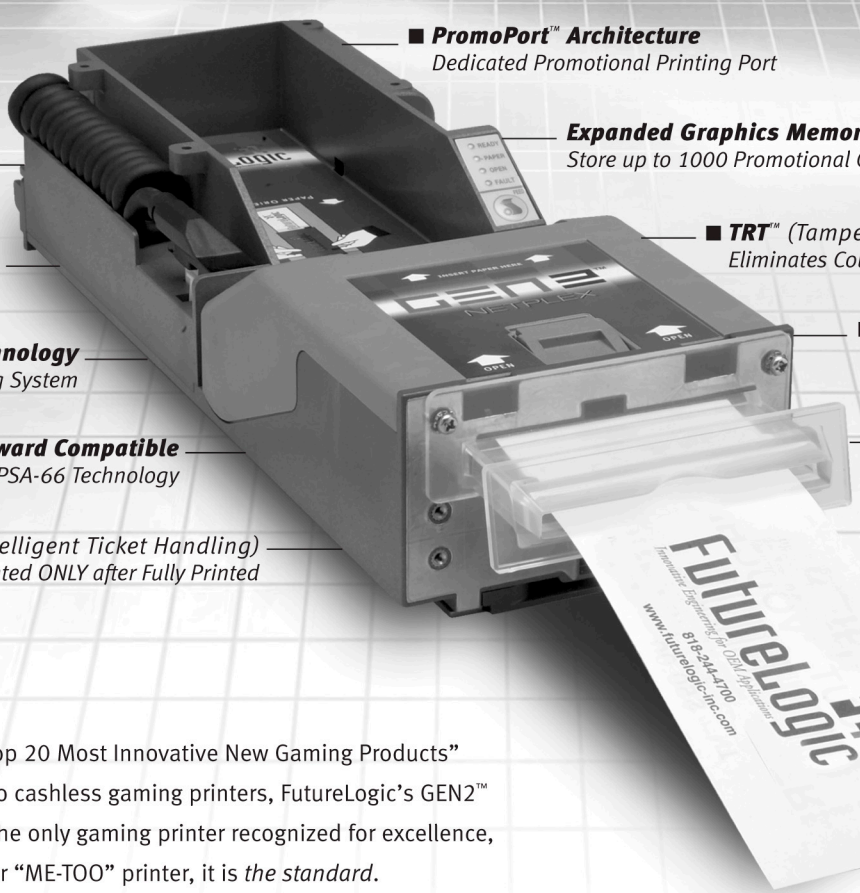

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Random Ramblings

By John Wilson

You're hired! There's a mystery here, and we need to solve it.

Everyone loves a good mystery. Urban legends, conspiracy theories and a good tale or taradiddle can be infinitely more interesting, though. When it comes to stories and incorrect information, perhaps nothing tops the list above the Random Number Generator. Players don't think the outcome of a game is random at all. Technicians are confused over what this Random Number Generator is. Let's spend some time together unravelling this mysterious object that creates so much confusion for everyone. Over the next few months we'll find out what a random number generator really is, why we need one, what it is used for and, of course, how they work. We'll even create our own random number generator and test it to see if it really is random. And, of course, we'll have some software to play around with.

A Random Definition. That is, a definition of 'random'

The best way to solve a mystery is to define what we are looking for. What are random numbers and how are they generated? A dictionary will tell you that random is "lacking any definite plan or order or purpose." For our purposes, a random number is one that we can't accurately predict before it is chosen. This is vital for our slot machines and gaming machines. We don't want the players to predict the outcome of the next game. If a cherry-red seven always comes up after a single bar symbol, we simply wait for three single bar symbols to line up on the payline, immediately take the machine out of service, and play it later when nobody is watching. If only it were that easy...

There is little value in a random number generator that provides only one number, either. Generally, you need a series of numbers for any practical application. If you pick

a lottery ticket, you might need six numbers in order to play. A random number generator, therefore, needs to pick a quantity of numbers, not just one. As we will see later, this is a very important aspect of a random number generator.

What is the use of a random number?

Perhaps examining what we would need a random number for will help us clarify what it is. A lottery ticket is a perfect example of an application of a random number. Many lotteries have six winning numbers drawn. You try to predict them beforehand. If you're right, you're off to a sunny beach in the Caribbean, with nothing to do but lounge in the sun reading Slot Tech Magazine (Who doesn't share this dream?). If you're wrong, it's back to work with the dream of next week's draw.

The lottery providers know that it's virtually impossible to determine the outcome of the draw beforehand with any certainty. They pick numbers at random and you're trying to predict the future with your numbers. Perhaps your lucky number will be drawn. However, should the lottery numbers end up being predictable, then the entire lottery collapses. This is just like a slot machine. If a customer can predict the outcome of a spin, your casino goes out of business.

Games need random numbers as well. Slot machines, video poker, keno and computer games all use random values. Even board games use random numbers generated by a toss of the dice. It's not all fun and games, however. Scientists use random numbers for theoretical work. Perhaps you have come up with a way to study how a chemical spill will affect the environment based upon certain factors. You could have the wind speed, direction, temperature, etc. all selected randomly. This might help you determine problems in your theoretical work, by allowing the external factors to be determined randomly, as they would be in nature. Perhaps your theory doesn't work when the temperature falls below freezing. Although you would never guess it, random numbers have an important place in serious scientific work.

Cryptography can also use random numbers. On a simple level, perhaps you have an Internet forum where users can sign up for an account. The account passwords can be determined randomly making it harder for hackers to guess users' passwords. Other cryptographs use a key to work in a random number generator. Based upon this key, the message

can be decoded, or the key could be used to generate further random numbers. Random numbers are more than just fun and games and big winnings. National security and confidential information relies on a random variable in order to provide encryption.

A detailed study of random numbers would fill volumes. Indeed, hundreds of books have been written on the subject, and people devote their entire careers to random numbers. In short, the use of random numbers in gaming machines is a very small application of the 'industry' of random numbers. We're barely touching the surface of this discipline.

Now that we have a very basic idea of what a random number is and why we might need them, let's try to reverse engineer one by studying one already in place. I have an old Intel(r) motherboard that has a hardware-based random number generator chip on it. Trying to locate the actual rng is difficult, but we do have a clue to solve this mystery. It's probably black. After all, most stealth objects are black in color. Furthermore, it should be concealed and is probably unmarked. Manufacturers and governments alike try to hide their most secret technology. If it can't be hidden, then it is disguised.

I see a large cooling fan that I suspect isn't for cooling a component. It's likely a ruse to disguise this device. The spinning blades of the fan are intended to shear off the fingers of prying hackers. Have you noticed that newer computer boards actually sense the fan and tell you if it's not working? That's because the Rotational Needle-sharp Guillotine (RNG) can't protect the circuit when its not spinning. Now that we've identified the device, what can we do? Carefully prying the fan off, my suspicions are confirmed. There is a small black integrated circuit below. Deep inside this black casing is the electronics of the random number generator! We're close to cracking the entire industry wide open, my friend! With careful diligence, I pry the chip from its socket and place it on my workbench. Using surgical skills, the case is opened with the benefit of a hammer. It seems that the plot to conceal RNGs runs very deep. I'm unable to determine how it works by a visual examination. Unfortunately, this device may never yield the truth. After deciding to run some power through the chip to watch it work, I realize that the RNG must have sensed the intrusion and then let the smoke out of its components. It won't work now.

If we can't reverse-engineer this thing, then let's put our minds to work and start building from the ground up. First of all, what is random? Well, a random number has a clear purpose and a definite plan so it must lack order. Essentially, it's a number that follows no apparent sequence or order that makes it virtually impossible to predict what number follows the previous one.

The Paradox of Randomness

If a number is to be truly random, then there must be no perceivable order or underlying pattern to it. Using a computer to determine a random number however, requires a computer program and logical programming instructions to determine the number. These logical instructions mean that the numbers cannot possibly be random at all as we're determining them through a very precise, logical method. Therefore, computers and slot machines must not have truly random numbers. Aha! That is the problem with random number generators. They do not generate random numbers at all. They generate pseudo-random numbers. That means that given the algorithm to the random number generator and knowing how the software is created means that you can duplicate the numbers. This is why manufacturers take such great steps to protect their random number generators. The numbers are seemingly random but aren't truly random.

A number of devices have been proposed (and some patented) that generate true random numbers. Some measure the background radiation and use this to determine the random

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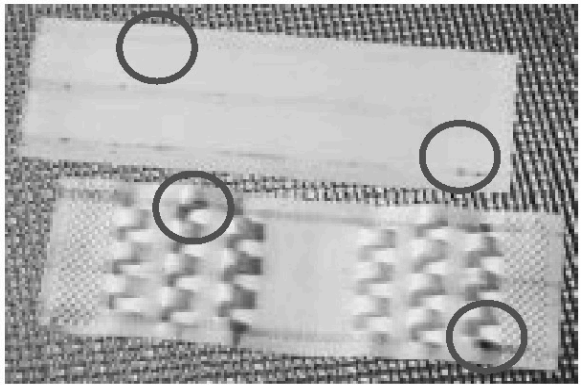

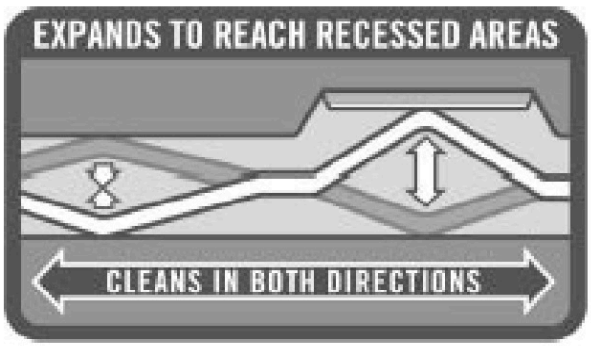

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value. Since it's virtually impossible to determine the background radiation level at any point at any particular time, we could consider it to be random. It is random in that we can't predict it accurately. Generally, in order to determine a truly random number, we need some sort of external device connected to the computer (or slot machine) that generates a number entirely separate from the computer. The Intel(r) motherboard I mentioned before, has a hardware-based random number generator that measures thermal attributes of the board, which are seemingly random.

The Random Number Generator is a complicated (or surprisingly simply) arithmetic formula used to pick numbers seemingly at random. Since the random number generators (or, more accurately, the pseudo random number generators) that we're used to are not hardware, they must be software. In other words, they are simply computer programming instructions that are based upon an arithmetic formula. That is a key point. The RNG we have is a formula. It isn't really a device inside the slot machine. It doesn't get 'turned on' or 'turned off.' Each time the slot machine operating system needs a random number, the CPU calls this arithmetic formula which then returns a number that is our somewhat random value.

Some Random Rules of RNGs

To further confuse you, let's identify a few rules to which a random number generator must adhere:

1/ the pattern of numbers cannot be easily determined before they are generated
2/ the numbers must be evenly selected
3/ the numbers cannot start out the same every time
4/ the numbers must be reproducible.

Rule #1: This is a fairly straightforward rule. If the numbers can be easily predicted, then they aren't random.

Rule #2: We don't want to favor one number over another. One of the models of the TRS-80(r) computer back in the late 1970s had a slight problem with its rng. It tended to favor smaller numbers over the long term. That meant that over a million numbers, smaller numbers would be chosen slightly more frequently than larger numbers. Not only did this mean that the distribution of numbers was skewed, but the same flaw in a slot machine could work to the favor of either the casino or the player. How? Well, the theoretical payout shown in the volatility index will tell you the range of payouts over millions of spins. If the jackpot symbol were placed at the start of the reel, a low number would select the jackpot symbol. Therefore, you have the chance of having more jackpots than there should be. Placing the jackpot symbol at the end of the reel means that the number of jackpots will be slightly lower than it should be. Do this on a multi-million dollar jackpot machine and you can skew the payout percentages considerably.

Rule #3/ The rng can't start with the same numbers each time the machine is turned on. For example, if a Silver & Gold(r) machine always comes up with 3 single bars on the first spin and three red 7s on the second spin, an observant player will determine this and use it to his or her advantage. In fact, such an occurrence took place!

Let's consider a case in Montreal, Canada during 1994. A fellow by the name of Daniel Corriveau, a computer analyst, made some keen observations about keno games located in the Montreal casino. Can nothing get by these clever Canadians? Through observation and simulation on a computer, he noticed that the keno games were actually repeating numbers in a predictable pattern. The end result was that he (and his family) played the keno games and won over $600,000 Canadian (approximately $375 US) by winning 3 times. Beating such astronomical odds generated a lot of scepticism and he was investigated for fraud. In the end, he received $620,000

Canadian (approximately $376.28 US) after a major problem was found with the keno games. The problem? You guessed it, the Random Number Generator.

Actually, the problem wasn't with the random number generator per se but rather with the machine's time-of-day clock. At certain times, the keno machines were turned off for cleaning, hopper refills, etc. It was when they were first turned on that they started to repeat a predictable pattern. As it turns out, the real-time clock had been removed from the machine during some form of engineering change. The clock wasn't necessary any more, so there was no need to continue to produce boards with them. However, the random number generator had been designed to check the time in order to get the initial random value. Since there was no clock on the board, the time was always returned as the same value. As a result, it always started at the same place. The seed value is very important, however. In the case of many casinos that never close (or never have the machines turned off), this isn't a problem. If the casino does shut down the machines on a regular basis, then it is a very real problem.

Rule #4: If they are random, how can they be reproducible? My head is starting to hurt. Doesn't this contradict our very definition or randomness? Well, they are complicated in nature but only because of how they have to operate. They are very simple, however, in how the mathematical formula actually looks.

The truth is that this arithmetic formula is predictable and will always select the same group of numbers. Mind you, this group of numbers could contain billions of numbers but it is always the same group. Let's call it the 'cycle' of the random number generator, just like our base games and bonus games have their own cycle. If you know the RNG formula, all of the parameters used and a small sample of sequential numbers from the generator, you can accurately predict the numbers that will follow.

The plot thickens and we're about to step into the thick of things. Next month we'll make our own random number generator, and take a look at some actual formulas used in commercial rng's.

- John Wilson
jwilson@slot-techs.com

ICE 2005 Show Report

The 2005 editions of ATEI and ICE/ICEi, which took place across 25, 26 and 27 January at London's Earls Court Exhibition Centre, were the most successful on record, according to the three-day attendance figures issued by show organizers, ATE.

The figures, which remain subject to an ABC independent audit, show that a total of 24,278 industry professionals visited the exhibitions, a 9.86 per cent increase on the 2004 total. Of these, 15,270 registered for ATEI (up 3.34 per cent year-on-year) with 9,008 attending ICE (a 23.03 per cent rise on 2004).

The international credentials, which make the London Shows unique within the calendar of gaming and gambling expos, were once again to the fore with 10,067 (41.47 per cent) attendees based outside the UK - a 12.09 per cent increase on the 2004 figure. Within ATEI, international attendees numbered 4,956 (32.45 per cent of the total ATEI audience and 6.37 per cent up on the 2004 figure). In ICE, international visitors totaled 5,111 (56.74 per cent of the overall ICE attendance and 18.26 per cent up on 2004). A total of 110 countries/jurisdictions were represented on the Earls Court show floor.

Peter Rusbridge, ATE's chief executive said: "These figures affirm the widely held view that ATEI and ICE are the pre-eminent events of their type in the world. The international credentials in terms of both the spread of exhibitors and attendees are without equal."

He added: "The continued success of the London Shows is down to a concerted team effort on the part of our exhibitors, which numbered close to 500, the international community of b2b media who continue to support the exhibitions and my team at ATE who have worked tirelessly to provide the most professional environment in which exhibi-

WMS Gaming's Sabastian Salat takes just a moment to sit down at the busy ICE show. WMS Gaming had an extensive range of games on show including Milk Money, American Adventure, Mardi Gras Madness, and Aztec Adventure, to name but a few.

tors can promote themselves and who have put into place the most extensive communications and marketing program in the long and distinguished history of ATEI and ICE."

Next year's ATEI and ICE shows take place at London's Earls Court Exhibition Center on 24, 25 and 26 January 2006. For information visit www.ateonline.co.uk/atei or www.ateonline.co.uk/ice

Some Exhibiters

Kimble launched two new products - SPEED, their eagerly awaited games development platform and Match & Win, their new poker game. They also presented games from manufacturer Smart Games, who Kimble are representing in Europe, and a full range of used slots form major manufacturers IGT, Bally, Atronic, Aristocrat and WMS.

Amatic / Genesis displayed their new 6 player Roulette Grand Jeu and their range of multigames.

Carnaby Gaming showed Red Hot Slots, Ruby 7s and Ivory Tusks and demonstrated IntelliReels and EMMS systems.

Happ Controls presented desktop LCD monitors with wide angle viewing, high contrast and high brightness in both 15" and 17" sizes. These were accompanied by a 46" plasma TV complete with speakers etc. They offered their normal array of spares plus cold cathode tubes, LED strips and electroluminescent

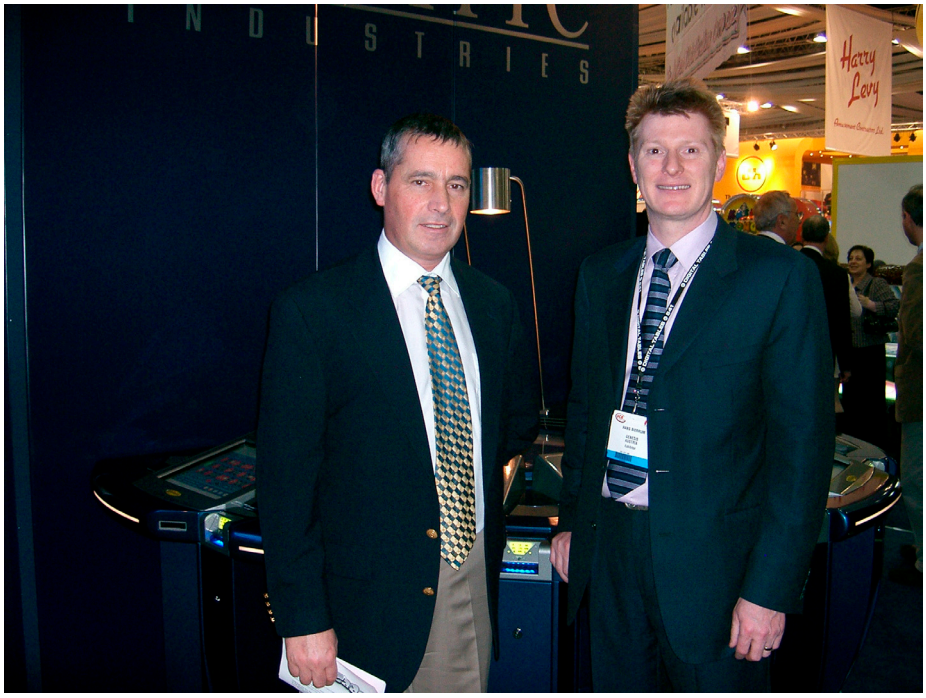
Jim McCann and the Kimble team at the ICE with their Poker machine

sheets.

R. Franco showed their range of games including Olympic Diamonds, Olympic Cash Deluxe and Fortune 10.

Capital Gaming exhibited their Horse Racing game and roulette game - Golden Bonus Roulette, which has new landscape monitors. They are working with Magistr from Ukraine by supplying them software.

Austrian Gaming launched their new Multi Wheel Bet-



Freddie Piper, Ireland and Hans Bierrum, Genesis with Roulette Grand Jeu from Amatic.

What will you learn?

- CRT vs. LCD
- RGB Interface
- DVI Theory – DVI Interface
- Performance Testing
- LCD User Adjustments
- Color Theory
- Precision Color Balance Adjustment
- System Block Diagram Overview
- Power Supply
- Backlight CCFL
- DC to AC Converter
- Digital Signal Processing
- LCD Display Module

Who Should Attend?

- Mangers
- Servicers
- Slot Technicians
- Government Technicians
- A/V Repair Shops

What Do You Get?

- Hands-On Troubleshooting Experience
- Workbook Procedures
- Certificate of Achievement

dates & locations

2005 DATES & LOCATIONS

Take the Course!

Location	Date
Las Vegas, NV	Jan. 17-19
Las Vegas, NV	March 14-16
Atlantic City, NJ	May 9-11
Reno, NV	July 11-13
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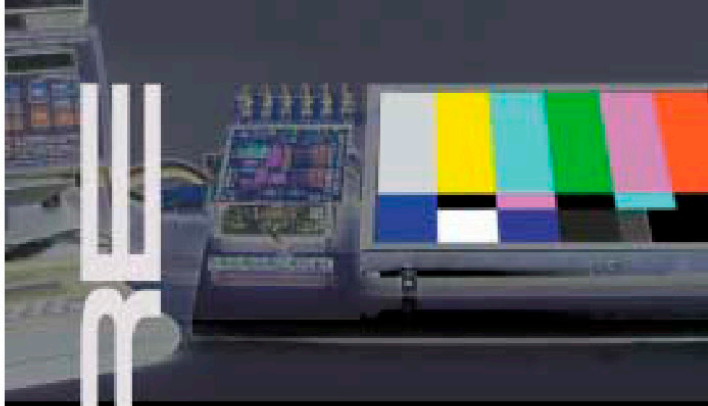


SENCORE

3-Day Hands-On

LCD Troubleshooting

and Calibration

Tech School

SENCORE

3-Day Hands-On LCD Troubleshooting and Calibration Tech School

With a class limit of 20 students, instructor to student ratio provides a great deal of hands on experience.

Today's LCD panels have greatly improved (and continue to improve) and are beginning to rival CRT's in most performance areas. In terms of size, weight, and power consumption LCD displays are far superior to their old CRT counterparts.

This comprehensive hands-on program covers troubleshooting and calibration concepts and techniques for LCD display types.

The course you have asked for!

What Will You Learn in this 3 Day Tech School?

- *Understand and apply safe servicing techniques*
- *Use test equipment to performance test and troubleshoot LCD monitors (SC3100, PSL60, VP401, LC103, CP5000U)*
- *Understand how to thoroughly performance test an LCD computer monitor*
- *Be familiar with switch mode power supply (SMPS) and LCD Inverter power supply operation and troubleshooting*
- *Relate SMPS and Inverter power supply block diagram test points to the equivalent schematic test point*
- *Understand multi-mode formats and circuit operation*

- *Understand analog (RGB) and digital signal formats and connectors (DVI)*
- *Explain the advantages and limitations of CRT vs. LCD displays*
- *Understand the theory and operation of fixed pixel displays, including LCD panel operation, signal processing, and backlighting*
- *Perform an LCD backlight replacement*
- *Perform LCD video calibration , including chromaticity (color temperature), black level, white level and geometry*

Course Description:

DAY 1

Equipment Familiarization/LCD Displays

The course begins with equipment familiarization and an overview of LCD displays. Students will discover how LCD panels work by learning the major functional blocks of an LCD monitor. Sencore has developed specific LCD trainers for hands –on demonstrations and troubleshooting exercises.

DAY 2

Hands-On LCD Monitor Troubleshooting

The second day of this course provides an introduction to troubleshooting LCD monitors. Entry level technicians and seasoned veterans will learn troubleshooting techniques and short cuts by using block diagrams and hands – on lab exercises.

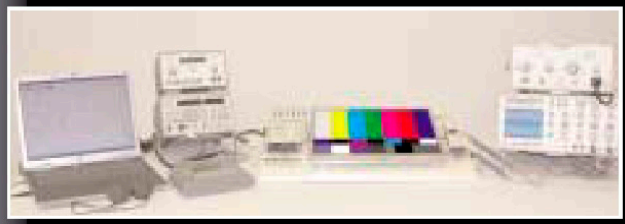
DAY 3

LCD Inverter power supply and SMPS Troubleshooting

The last day of the course provides an introduction to power supplies and their uses. The students then learn how each type of SMPS and inverter power supply works by performing experiments on a working model. This course is truly a hands-on course with approximately 70% devoted to lab time performing tests utilizing an exclusive Sencore power supply trainer.

Students will also be presented with Certificates of Completion following the Tech School.

This course is eligible for Continuing Education Credits (CEU).



ting feature for their Novo Multi-Roulette and Touch Bet as well as presenting new games including Pharaoh's Gold II, Just Jewels, Book of Ra and High Roller. They also showed their Gaminator range of machines.

WMS Gaming had an extensive range of games on show including Milk Money, American Adventure, Mardi Gras Madness, Aztec Adventure, to name but a few. They also showed their Monopoly range and they will be launching new games to the market in the near future.

Heber demonstrated Axis integrated video control system, the new addition to their range.

Semicom displayed their new software IQE - Image Quality Enhancement - which offers the latest in 3D colour control by emphasising colour and contrast without harming the entire LCD screen. They also showed Smart Media monitors with embedded CPU and OS and a range of industrial PC systems for gaming applications.

3M had new technology on show including DST - Dispersive Signal Technology which was shown for the first time. They also showed new touch technology, which enables touch on large screens, palm rejection, scratch resistant and very high light transmission.

Unicum at ICE

Russia's dominant distribution and manufacturing market player, Unicum, has released the first unique games for their recently-developed Adventures platform. The four new games, Russian Mafia, Gold of the Slavs, Papirus and Tam Tam, made their international debut together with Their Systems in Progress online management solution at ICE 2005.

Unicum Group has been developing slot games for the CIS market since 2003, when the company introduced the first series of Adventures slot

Derek Lynch, Carnaby Gaming with Ruby 7s. Sticklers for punctuation will notice the inappropriate apostrophe in the artwork, making it Ruby 7's.

Koen Stomph, 3M Touch Systems demonstrated their new Dispersive Signal Technology which was shown for the first time in Europe.

machines to the Russian market. Built on the knowledge gained from many years of activity in the East European gaming markets, particularly Russia and the CIS, and augmented with international technology, gaming knowledge and experience from world's best developers, today Unicum delivers slot and system products based on a unique combination of quality and affordability.

Another strategic product unveiled by Unicum at ICE is Systems in Progress, an effective online casino management and monitoring instrument. This slots management solution provides full control over all gaming events in a gaming site, manages and sets various jackpots and stores advanced reporting data. SiP's main advantages are extended functionality combined with the system's usability.

Systems in Progress has already made its international start with a number of installations in Russia, Ukraine and Germany, where it now administers casino slot halls and WAP jackpots. Results of ICE 2005 exhibition revealed that Systems in Progress has become an interest not only for the European gaming community (where it was developed) but also a target for Asian and Latin American operators who spent long hours at Unicum's stand discovering every feature of Systems in Progress and discussing cooperation plans with the SiP crew.

Amy James, Heber who were demonstrating Axis, the integrated video control system

Yuri Larichev, the Vice President of Unicum Group of Companies, shares company's plans: "Today we are going abroad with slots and systems tested in an unequaled and constantly changing environment. We have built a product that fits well into both a casino and a slot hall. The four games we brought to the ICE trade show are fully equipped to enter the international non-regulated market."

- Slot Tech Magazine

Unicum and Systems in Progress at ICE 2005

Ainsworth Game Technology Limited Announces Proposed Merger

Ainsworth Game Technology Limited ("AGT") has announced a proposal to merge with Russia's largest casino and gaming equipment supplier, the privately owned Unicum Group of Russia.

Unicum has been distributing AGT's gaming machines since late 2003 and has made strong inroads with AGT products into the Russian market.

The merger is proposed to be implemented through AGT issuing ordinary shares to Unicum's President and sole shareholder Mr Boris Belotserkovsky, will become President of the combined entity. Following the merger, Mr Belotserkovsky would hold the majority stake in the expanded capital base of AGT and AGT Chairman, Mr Len Ainsworth's holdings would be diluted as a result. Mr Ainsworth would continue as the Chairman following the merger.

While the merger negotiations with Unicum are progressing, there can be no assurance that a transaction will be consummated or that any final transaction structure will be on the terms currently contemplated.

The merger will be subject to AGT being satisfied with the results obtained from due diligence investigations and receipt of required regulatory, government and AGT shareholder approvals.

Process and Timing

Subject to satisfactory due diligence and agreement on merger terms the companies propose to enter into a Merger Implementation Agreement in the coming months. An Information Memorandum, including an Independent Expert's report, setting out full details of the proposed merger is expected to be sent to AGT's shareholders in the second half of the 2005 calendar year.

An Extraordinary General Meeting of AGT's shareholders will be called to vote on the proposed merger once the Board have completed their due diligence and are satisfied with final terms of the transaction.

AGT Results for the Six Months to 31 December 2004

The merger announcement has been made as AGT announced a loss of $1.83 million for the six months to 31 December 2004, which

File Photo - Circa 2002
Everyone reads Slot Tech Magazine!

was in line with updated guidance provided by the company last December.

The company's sales increased to $40.7 million, compared with $29.2 million in the corresponding period in 2003, an increase of 40 per cent. The loss for the period was affected by the deferral of a major international order and increased expenditure on research, new licenses and market development. This major international order has been received and shipped in February 2005.

During the half year the company entered a number of new markets in North America, South America and Europe and currently sells product in 38 jurisdictions globally (30 June 2004 – 20 jurisdictions).

Background information on The Unicum Group

• The Unicum Group ("Unicum") is a privately held group of companies owned by Mr. Boris Belotserkovsky, and is the leading manufacturer and distributor of products and solutions for the gaming industry in Russia, the CIS countries and Eastern Europe.
• Created in 1990, the company manufactures and distributes slot machines for casinos, gaming halls, and entertainment centres as well as providing consulting and system integration services. In addition, Unicum is involved in operational projects, such as slot management systems, WAP operations and joint participation for industry operators.
• The company has a 200,000 sq ft manufacturing facility located in St Petersburg where it assembles under a license the Ainsworth, Atronic and Bally machines, with plans to add WMS machines. The company also manufactures slot machines of its own design. The company has sales and service offices in Russia (Moscow, St Petersburg, Ekaterinburg, Saratov, and Khabarovsk), Ukraine (Kiev), Latvia (Riga) and Kazakhstan (Almata).

Products and Services
• Slot machines – Unicum's management estimates that it had sales of approximately 21 thousand slot machines in the 2004 calendar year, representing around 90 per cent of revenue. Unicum's management also estimates that the company has a 50 per cent distribution market share in Moscow and 35 per cent in Russia in the high-end slot market.
• Entertainment machines and equipment – Unicum sells a broad range of entertainment equipment such as racing and shooting simulators, mechanic machines, laser games, electrokarting, bumper-cars and others. The company distributes brands such as Elaut, Konami, Midway, Namco, Nova Games, SAM Billiards and Sega.
• Consulting and other services – Unicum provides a comprehensive range of gaming market services, such as i) amusement centres concept design, business plans development and feasibility studies, ii) equipment selection and equipment placement design, iii) installation and maintenance of equipment.
• Systems in Progress – Unicum develops and both installs the machine it sells and distributes separately casino management and real time monitoring solutions, functioning as a player tracking and accounting system.
• Wide Area Progressive Jackpot System (WAP) – Unicum provide electronic links between gaming machines at different locations with a central computer, which controls a progressive jackpot increasing with every wager placed on linked machines. WAP systems allow for a larger jackpot to be won than on a non-linked stand-alone gaming machine.
• Joint Participation – Joint Participation is a new business line for Unicum with launch expected in 2005. Unicum will lease gaming machines for a participation fee - a share of the net wins per machine or a fixed fee per machine.
• Eastern European Leisure Exhibition (EELEX) – Unicum has been organising EELEX for around 14 years. Currently, EELEX is the second biggest gaming and amusement exhibition in the world.

- Slot Tech Magazine

Quick, Simple, Repairs

By Pat Porath

On a day to day basis my job varies quite a bit. It ranges from giving a customer back a couple coins that didn't give credit, to setting up slot tournaments and from returning a jammed bill to replacing chips on a board.

Many of the repairs are quite simple, once you know what to do. Below are some quick fixes for different manufacturers of slot machines.

IGT S-2000 (the newer IGTs with the VFD and the seven segment display)

One problem that we ran into was that a bank was coinless and yet on the display, the game read "coin out jam." What? Coin out jam? This game doesn't even have a hopper in it. The game is coinless, with no hopper and no coin comparator. Come to find out, the game thought it had a hopper. It needed to be keychipped to turn OFF the hopper, turn ON the ticket printer, turn OFF jackpot receipts, turn SAS on, etc. It is best to ask a fellow tech to show you how the first couple of times. Once the Base chip is removed, and the proper Keychip is installed, power up the game and there should only be two lights that are on, on the main processor. After about 30 seconds, power down the game and put the Base chip back in. Power up and the display should read "keychip config." Now you can change the options on the game.

Konami Video Slot Tilts

You may want to purchase a laser lens cleaning disk for these games. We had problems with games when customers are in the bonus rounds or the game may lockup or it may not boot up. Purchase a laser lens cleaning disk from Staples or Wal-Mart. When you look at the underside of the disk, you will see two tiny brushes that will wipe the dust off the lens. It usually works really well.

Sigma

Sigma games stealing coins and not giving credit? If it has the MC 40 or similar Coin Comparator, you will see at the bottom of it, a small optic. That is the coin in sensor optic for the game. Sometimes a quick disassembly and a quick cleaning will get it working again.

Bally 6000 model or newer coin in problems

When you get a little angry at a machine

when it keeps having coin in tilts.....The solution is usually easy. It is called a prism. What? A prism in a slot machine? Yes sir. Bally uses it in part with infrared light to make a coin in optic. Open the belly door on an upright game and you should be able to see it. There are only a few nuts or bolts to remove it to check it out. The prism may be dirty; the light path back to the coin in board may be obstructed with lint or dust bunnies. With a clean prism and a clean light path, there shouldn't be any major coin in problems.

Bally, older and newer games.

If it won't accept bills or coins, there is a chance that the machine could be "disabled." On the newer games, the "enable/disable" switch is on the outside of the main processor. It is a small toggle switch. If a slot attendant accidentally bumped it while putting a fill into the game and it is on DISABLE, guess what? The game won't work. Simply flip the switch back to enable and the game is good to go. I ran into that one quite a few times.

JCM WBA

Quite a few of the problems that you may run into with these are to simply clean and calibrate. We use a cordless Dremel, dry paper towel, the JCM calibration paper and a cute little jumper cable (I'm sorry I don't have the part number of it). When it is slow in the morning, someone can grab the materials they need, go to a bank of slot machines and "tune them up." Remove the transport unit from the game, turn on only dips 5678 on the BV. Clean the plastic wheels EVER SO CAREFULLY with the Dremel, then wipe off the dirt. Close up the BV and connect the jumper cable from the game to the BV. It should cycle for a second or so. Then, insert the JCM calibration paper. It will accept and reject it quite a few times if everything is good so far. Once the BV fully rejects the paper, the LED on the jumper cable should flash very fast. If it has a slow flash, something is wrong. A fast flash means the unit is good to go. BUT DON'T FORGET TO PUT THE DIPS BACK IN THE ORIGINAL POSITION or it won't accept any bills.

- Pat Porath
- Island Resort Casino

http://www.eds-inc.com/88users.html page 1

"Thank you for making such a fine product available to the technical service industry. I am delighted with the CapAnalyzer units purchased in March. Please keep up the good work." -Cliff Erickson, KFWD-TV52 Irving, TX

"I know you have a boatload of letters singing the praises of the 88A DCR ESR Cap Analyzer, but I just had to write. I've been using one for years now, and I can't tell you how much troubleshooting time it has saved me. Truly a great product at a great price. Thanks!" -Jim Hartland, MTC Technician, COX Communications

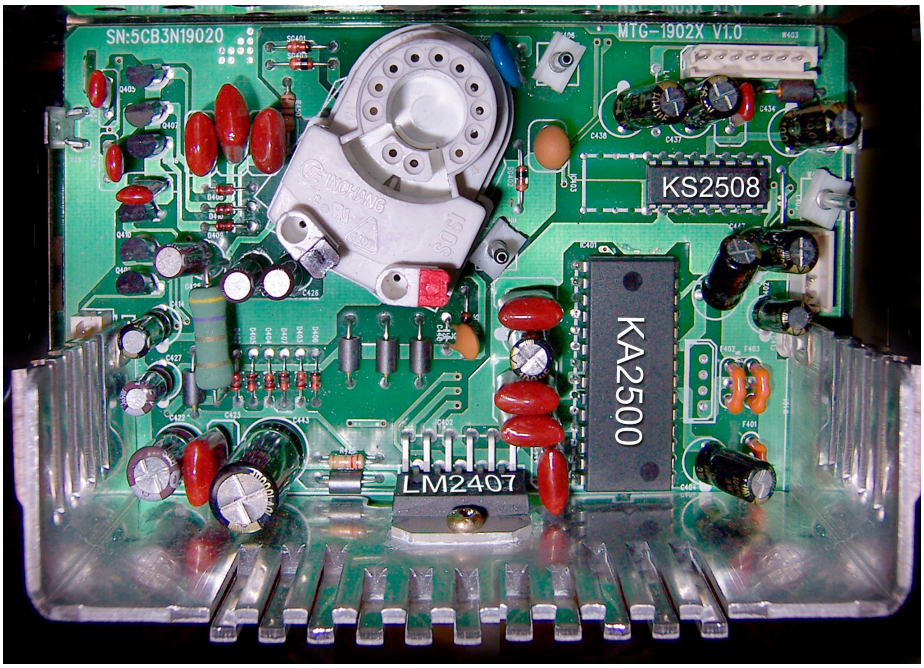
"We repair industrial electronic parts and after years of struggling to identify faulty electrolytics it was an instant joy to find a piece of test equipment that does the job instantly and extremely effectively.
Being a design engineer myself, I am always impressed with well designed electronic equipment. This is an excellent piece of work by your engineers." -Wilkie Electronics, Scotland, United Kingdom.

"I received my 88A tester on Thursday and put it directly to work. We used it (in place of our Cap Wizard) to troubleshoot 35-40 of a monitor power supply board that we commonly work on. The Wizard has served us well but I wanted a second cap tester for extended production / backup. I was skeptical about your unit as we normally do not see many "shorted" caps so I did not think the DCR testing would be of much benefit. WRONG! It immediately notified us of other (non cap related) problems in about 6 of the boards. It only took about 10 minutes of use (per person) to get the 'hang' of the probes and develop some efficiency. Will be using it next week on another 50 or so boards. The Wizard has now become our 'backup' tester. Thanks for convincing me to try your product. I am positive it will play a major part in our service work." -Mark Allen, Trident Data Systems, Denver

to be continued . . .

TOVIS

Part 3 - Video
An Introduction to Digital Monitors



This month, we're going to look at the video circuits in the Tovis digital monitor. It is here that we finally get our first peek at just what it is that makes this a "digital" monitor. We'll also look at new devices and, perhaps, lament the loss of our old friends, the video output transistors.

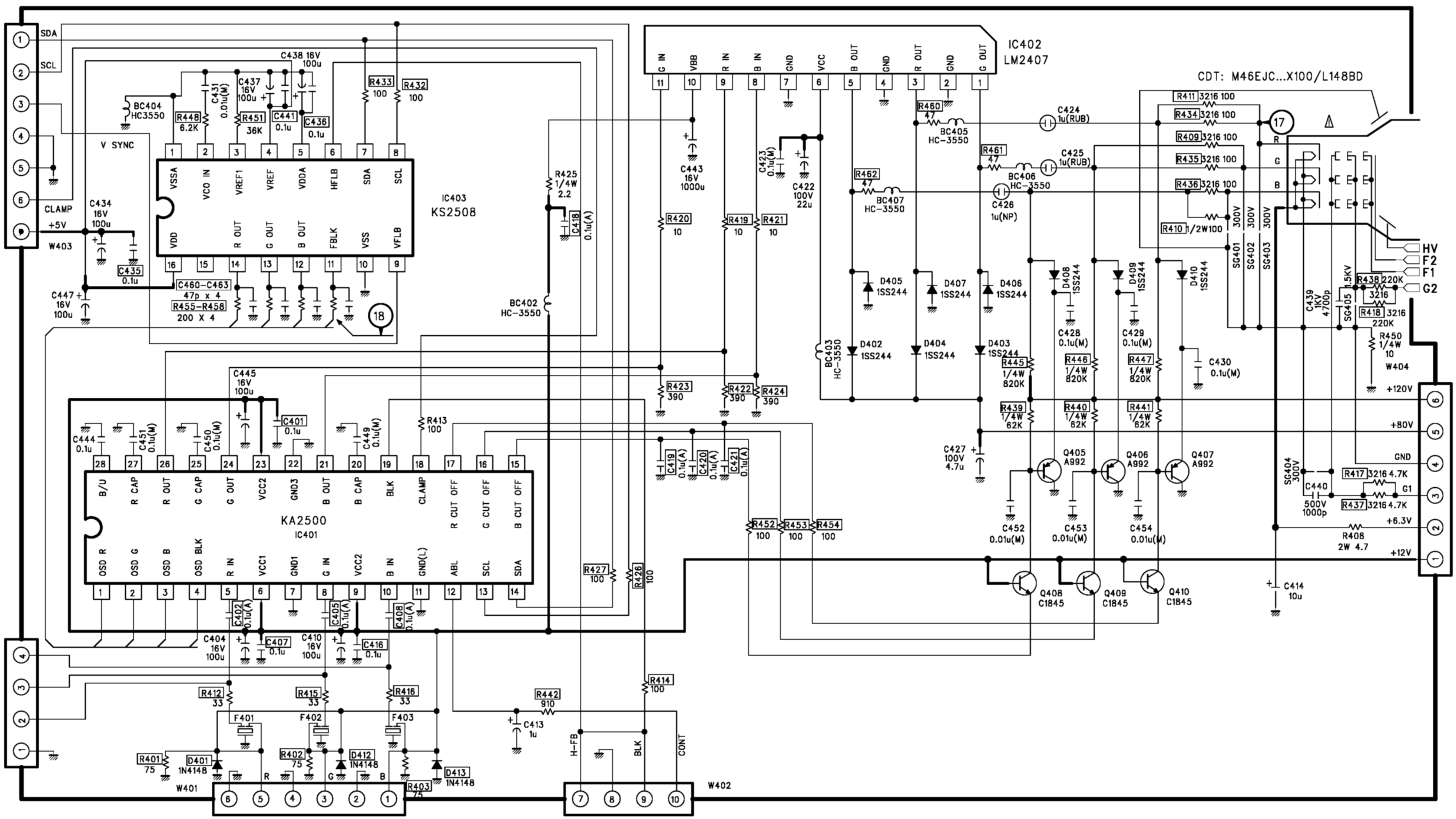
Let's start at the video input, on the bottom of the schematic diagram at W401. It's a six pin connector. The odd pins are the red, green and blue inputs. The even numbered pins are all video grounds. Like all standard monitors in use today, this monitor is looking for a maximum video input voltage of .7 volt. This is ensured by the three 1N4148 diodes (D410, D412, D413) that "clamp" the input at no higher than .7 volt. Maintaining the worldwide standard input impedance of 75 ohms is the job of the three resistors, R401, R402 and R403.

From there, the video signals pass through three LC filters, labeled F401-F403. Don't be mislead into thinking that these are fuses just because they're labeled "F." Of course, nobody fuses video inputs! These are just little noise filters that suck off any EMI to ground. From here, the video signals pass through 33 ohm resistors and .1 microfarad capacitors - the capacitors block any DC component of the incoming video signal and pass only the AC video signal. DC restoration is accomplished later on in processing - to the input pins of the video amplifier, the KA2500.

You can kind of think of the KA2500 as an LM1203 on steroids. No, it's not bigger. It's in the same 28 pin DIP but it's much more capable, integrating a more-or-less standard video amplifier package with the ability to perform a video mix with the output of an on-screen display (OSD) character generator and control the whole thing with a data bus that is the "digital" part of this monitor.

The basic video amplifier part of this IC is the same as it ever was. The red, green and blue signals are input at pins 5, 8 and 10. The outputs are at pins 26, 24 and 21. Naturally, these signals are not powerful enough to drive the cathodes of the electron guns. We need another stage here, the video output stage.

In the past, this was the job of the video output transistors. For as long as there have


IC401
KA2500
IC402
LM2407
IC403
KS2508
CDT: M46EJC...X100/L148BD
W401
W402
W403
W404
SDA
SCL
V SYNC
CLAMP
+5V
H-FB
BLK
CONT
HV
F2
F1
G2
+120V
+80V
GND
G1
+6.3V
+12V
SG401 300V
SG402 300V
SG403 300V
SG404 300V
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Q405 A992
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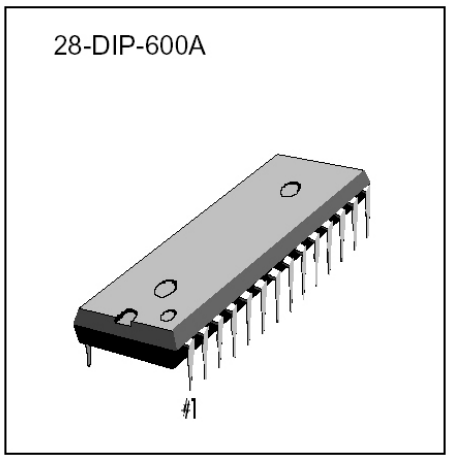
Q407 A992
Q408 C1845
Q409 C1845
Q410 C1845
BC402 HC-3550
BC403 HC-3550
BC404 HC3550
BC405 HC-3550
BC406 HC-3550
BC407 HC-3550

I²C BUS CONTROLLED R/G/B VIDEO AMPLIFIER FOR MONITORS - KA2500

The KA2500 is a very high frequency video amplifier system with I C Bus control used in Monitors with high resolution up to1280x 1024. It contains 3 matched R/G/B video Amplifiers with OSD interface and provides flexible controlled adjustment systems.



FUNCTIONS

- R/G/B Video Amplifier
- OSD Interface
- I²C BUS Control
- Contrast/OSD Contrast
- Brightness Control
- Cut-Off Brightness Control
- R/G/B SUB Contrast/Cut-Off Control
- Blank/Clamp Gate
- Halftone
- Brightness Uniformity

FEATURES

- 3 - Channel R/G/B Video Amplifier, 150MHz
- I²C Bus Control Items

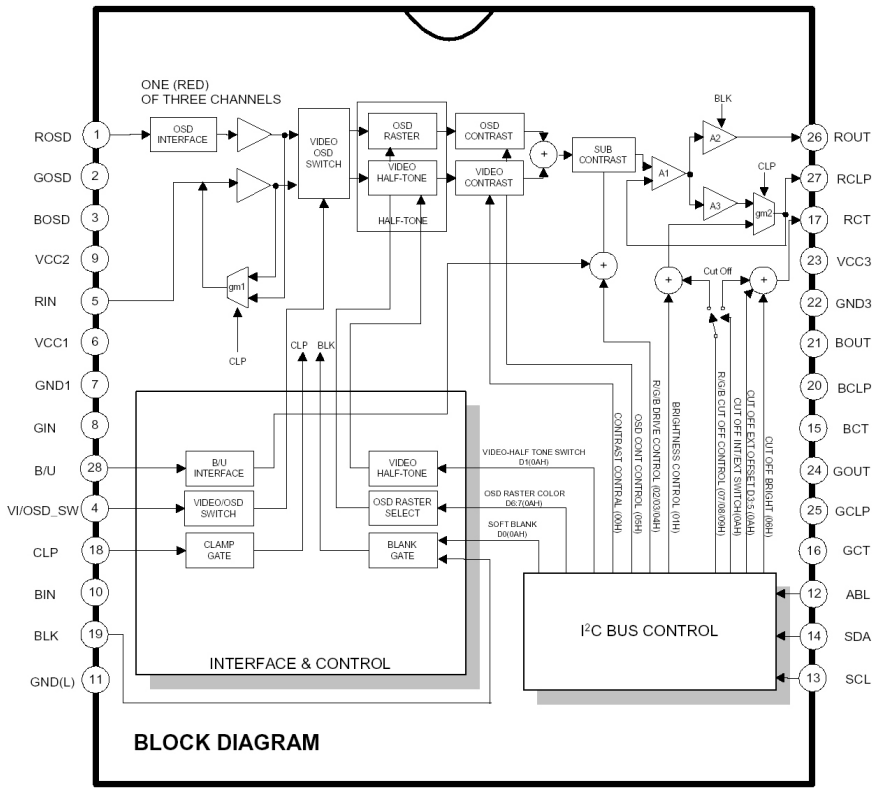
- Contrast Control
- SUB Contrast Control For Each Channel
- Brightness Control
- OSD Contrast Control
- Cut-off Brightness Control

- Cut-off Control For Each Channel
- Switch Registers for SBLK and Video Half Tone and Cut-Off INT/EXT
- SUB Contrast Control Range: -11dB
- Capable of 7.0Vpp Output Swing Range
- Video/OSD High Speed Switch
- Clamp Gate With Anti OSD Sagging B/U (Brightness Uniformity) Interface Video Input Clamp, BRT Clamp Video & OSD Half Tone Function on OSD Picture
- (OSD Raster Selection by HS1, 2: 4 colors)
- OSD Interface, OSD BLK
- ABL
- TTL R/G/B OSD Inputs, 80MHz bandwidth

Contrast Control Range: -38dB
OSD Contrast Control Range: -38dB

been solid-state color monitors, we have seen three identical power transistors, usually mounted on the neck board near the CRT socket. However, that was "twen-cen" technology. Modern monitors have migrated to the use of a single output device (an LM2407 in this case) that integrates all three video output stages into a single package.

The device couldn't be easier to understand: Three inputs, three outputs, three grounds and a couple of power supplies (+12 VDC and +80 VDC) for a total of 11 pins. The outputs drive the cathodes of the electron gun but in a slight twist to the usual scheme of direct coupling, the outputs



BLOCK DIAGRAM

of the LM2407 are capacitively coupled to the cathodes through 1 microfarad, non-polarized capacitors.

I am going to make a bold prediction here and point to these as likely failures that will cause color problems (weak color), especially in the red and green guns. Why especially those two when the three circuits are identical? Because they are both adjacent to the heat-producing, 4.7 ohm, two-watt resistor that is in series with the CRT heater. In fact, in the sample I received, C424 (for the red channel) was actually touching the resistor. They both are situated in such a way that they sit directly above R408 in the warm air that rises from the resistor. This is bound to cause premature capacitor failure.

On the other hand, Tovis did use super-bodacious, 105 degree capacitors in this application so I can only hope that a: I am wrong, the capacitors don't fail and we don't have to worry about it or b: I am correct, the capacitors do fail and the bench techs have that much more job security.

I do have one more gripe about the new monitor designs. It's more of a rant, really and it is directed at just about all monitor manufacturers, not just Tovis. It is regarding this business of the single video output device as opposed to using individual transistors. I do understand why a manufacturer would opt for using the output IC instead of individual transistors. Manufacturing is much easier with fewer PCB holes and fewer devices to mount. Bandwidth is really high due to the tiny distances and capacitances between the components in the device. However, I am thinking as a technician. Video output transistor failure is not uncommon. When it happens, a quick repair with a replacement transistor (and there are hundreds of different transistors that can used as replacements in this application) is out of the question. The specialized video output IC will have to be located and ordered and it will be much more expensive than the output transistor, which might normally run about a buck.

A case in point is a very nice, high-end, ViewSonic brand monitor that I was asked to fix for Wolfgang Puck's Spago restaurant in Beverly Hills, California. The symptom was obvious. It was missing one color. Troubleshooting was simple. A quick look with the oscilloscope at the output IC revealed all three colors coming in but only two coming out. Bad IC (duh). Obtaining the replacement part was difficult and expensive. I had to hunt for hours before I located the component because it was obsolete, even though the monitor was just a few years old. It cost nearly $30 for the part itself, without which, this otherwise perfectly good, five-hundred dollar monitor was useless and, in fact, would cost you an additional $25.00 here in California to take it to a recycling yard for disposal.

There are some transistors connected to the cathodes in the electron gun but they're not my beloved video output transistors. Q405-410 are three pairs of transistors that are used to control the cut off of the electron guns. In other words, they control the point at which each gun cuts off and stops emitting electrons. The cut off control circuits are used to properly set the white balance / color temperature of the CRT. Instead of using potentiometers to establish cut off levels, each of the transistor circuits is controlled by one of the three cut off outputs of the KA2500. These cut off outputs are really current sinks that control the current through each of the transistor pairs (Q405 / 408 - Q406 / 409 - Q407 / 410).

But what tells the KA2500 where to set the cut off? That, my friends, brings us to our first look at the digital part of this monitor. The KA2500 is connected to a couple of magic signals in the monitor, known as the I²C control bus.

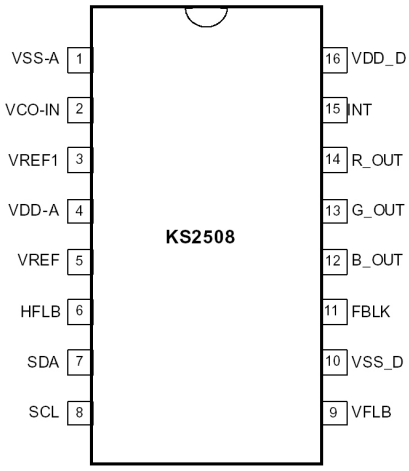
The Inter-IC bus, commonly known as the I²C ("eye-squared-see") bus, is a control bus that provides the communications link between integrated circuits in a system. Developed by Philips in the early 1980s, this simple two-wire bus with a software-defined protocol has evolved to become the de facto worldwide standard for system control, finding its way into ev-

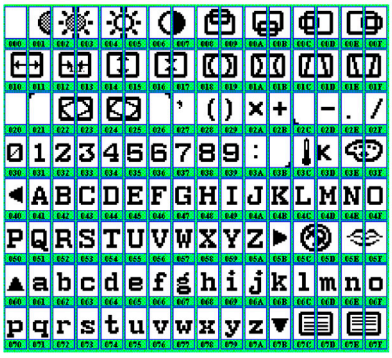
KS2508 OSD PROCESSOR FOR MONITOR

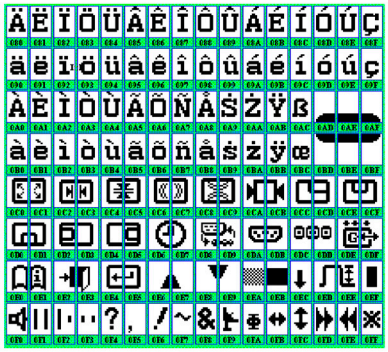
The KS2508 is used to display some characters or symbols on a screen of monitor. Basically, the operation is to control the internal memory on chip and generate the R,G,B signals for some characters or symbols. The R,G,B signals are synchronized with the horizontal sync. Then the R,G,B signals are mixed with the main video signal in the Video Amp IC. The font data for characters or symbols are stored in the internal ROM. These stored data are accessed and controlled by the control data from a micro controller. The control data are transmitted through the I2C bus. There is a PLL circuitry on chip, which allows all timing control signals (including the system clock) to be synchronized with the horizontal sync.

FEATURES

- 256 ROM fonts (Each font consists of 12 x 18 dots.)
- Full Screen Memory Architecture
- Wide range PLL available (15 kHz ~ 120 kHz)
- Programmable vertical height of character
- Programmable vertical and horizontal positioning
- Character color selection up to 16 different colors
- Programmable background color (Up to 16 colors)
- Character blinking, bordering and shadowing
- Color blinking
- Character scrolling
- Fade-in and fade-out
- Box drawing
- Character sizing up to four times
- 96 MHz pixel frequency from on-chip PLL
- I²C Protocol Data Transmission

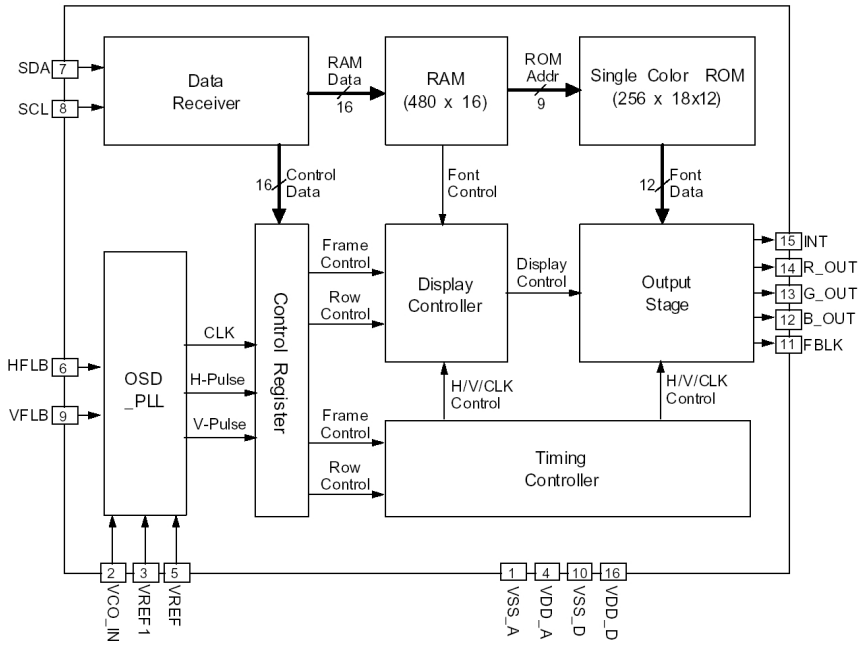






These are the characters that can be generated by the KS2508 OSD Processor

BLOCK DIAGRAM



erything from temperature sensors and voltage level translators to EEPROMs, general-purpose I/O, A/D and D/A converters, CODECs, and microprocessors of all kinds.

This is a serial control bus that runs on just two wires, called SDA and SCL. SDA is the serial data and SCL is the clock. These two signals run to many ICs in the monitor. We're going to look at two of them here in the video circuit but there are others as well, not the least of which is the microcontroller itself that is at the core of a digital monitor.

Any I²C device can be attached to a common I²C-bus and any master device can exchange information with any slave device. The software-controlled addressing scheme eliminates the need for address-decoding hardware.

Each of the ICs on the control bus has a name that identifies it. It's called the "slave address." The HA2500 happens to be known as "DC." There is another IC in the video circuit whose slave address is "BAH." When the control bus wants to talk to either of these devices, it simply calls out its name over the I²C bus ("Hey, DC. Wake up!") and tells it what to do.

In the case of the cut off controls, the current sink is adjusted in accordance with what the microcontroller has told the KA2500 to do through the bus. The human interface comes into play only through the menu and setup buttons on the control panel. You have to enter the menu and navigate to the setup screen where you can adjust each of the red, green and blue cut offs as necessary.

Of course, to enter the on-screen menu, something has to be generating the display and, whatever it is, it has to be able to generate the OSD when there are no video or sync signals present. That's the job of the other video IC that's connected to the I²C bus. It's the KS2508 OSD Generator. This device is a little character generator with three video outputs (RGB) that connect to the three OSD inputs of the KA2500. There is also a "fast blanking" output (FBLK) that tells the KA2500 to ignore the OSD inputs when we don't want to see them on the screen.

Inputs to the KS2508 include horizontal flyback (HFLB) and vertical flyback (VFLB). These, of course, are deflection-based signals and this is how the OSD generator is able to remain synchronized with the raster, regardless of whether or not the monitor is receiving external sync or video. There is an on-board dot clock that is synchronized by an internal phase-locked loop (PLL). Pins 2, 3 and 4 are involved in generating the dot clock. The associated resistors and capacitors set the base frequency of the Voltage Controlled Oscillator (VCO) which is then corrected by virtue of the two flyback signals.

The dot frequency (which determines the size of a single pixel of the OSD) is variable (up to 96 MHz) so that the size of the OSD remains the same regardless of the resolution setting of the monitor. The equation is simple and obvious if you think about it logically for just a moment, it's the horizontal frequency multiplied by the number of the horizontal resolution.

The KS2508 contains both analog and digital circuitry. Each has its own power supply and ground connections. VDD_A is the analog power supply input at pin 4. VDD_D is the digital power supply input at pin 16. Both are +5 volts DC. VSS_A and VSS_D are the analog and digital grounds at pins 1 and 10 respectively.

The bottom line here is that this is a nice, simple little video board that is very competent and should be a snap to troubleshoot and repair, should the need arise. It also disconnects easily from the deflection PCB so if you're the type that likes to swap neckboards (I am not) knock yourself out. It takes just a minute to disconnect everything from the neckboard, including the two focus wires at the CRT socket which uses an easy method of capturing or releasing these high voltage wires.

- Slot Tech Magazine

LM2407
Monolithic Triple 7.5 nS CRT Driver

General Description

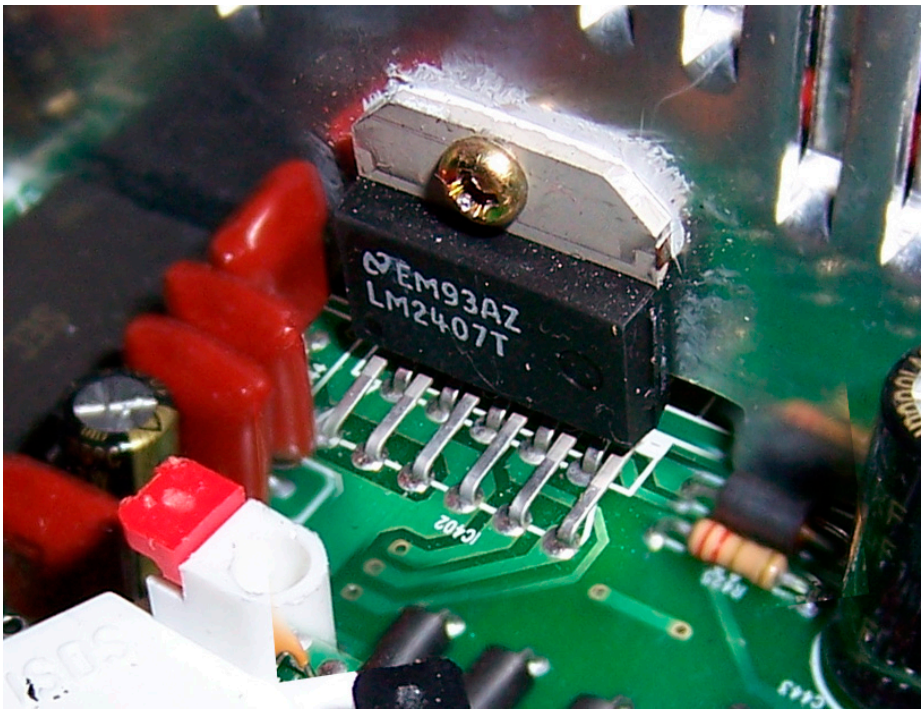
The LM2407 is an integrated high voltage CRT driver circuit designed for use in color monitor applications. The IC contains three high input impedance, wide band amplifiers which directly drive the RGB cathodes of a CRT. Each channel has its gain internally set to -14 and can drive CRT capacitive loads as well as resistive loads present in other applications, limited only by the package's power dissipation. The IC is packaged in an industry standard 11-lead TO-220 molded plastic power package.

Features

Low power dissipation
Well matched with LM1279 video preamp
0V to 5V input range
Stable with 0 pF–20 pF capacitive loads and inductive peaking networks
Convenient TO-220 staggered lead package style
Standard LM240X Family Pinout which is designed for easy PCB layout

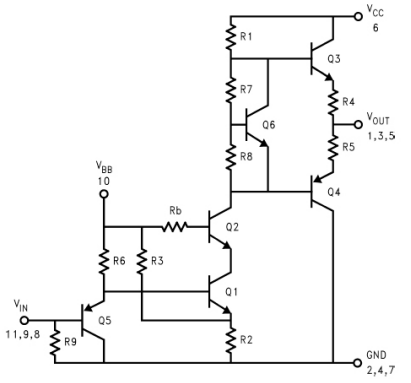
Applications

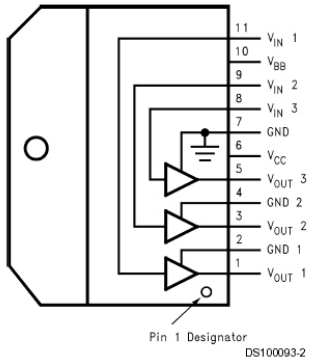
1024 x 768 displays up to 85 Hz refresh
Pixel clock frequencies up to 100 MHz
Monitors using video blanking



The LM2407 replaces the three video output transistors and their associated circuitry.

Schematic and Connection Diagrams





Note: Tab is at GND

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