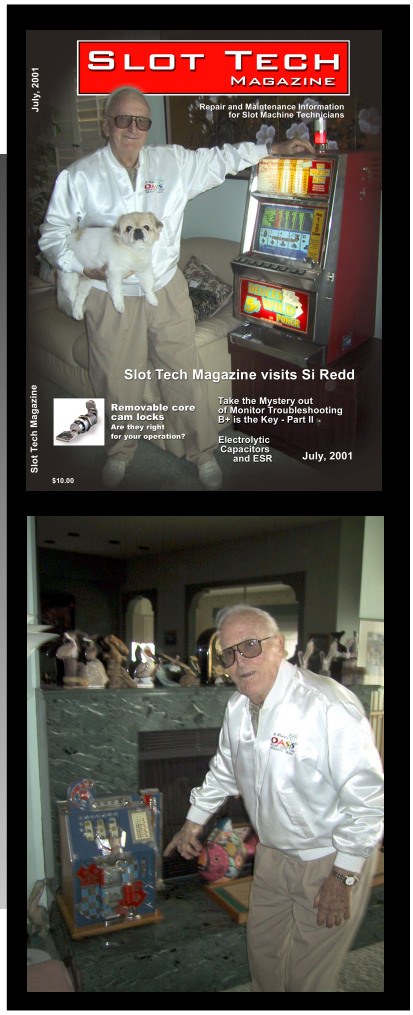
Inside Slot Tech Magazine

November 2003



In Memory of
William S. "Si" Redd
1911 - 2003
"The Father of Video Poker"

Correction: Last month's cover featured Shuffle Master's "The Three Stooges" game. The game was incorrectly attributed to IGT. Slot Tech Magazine regrets the error.

Slot Tech Editorial

As promised last month, Slot Tech Magazine has a couple of additional G2E products to present. One of them is a remarkable little coin hopper that can handle coins and tokens of many different sizes and shapes. It's from Himecs (Tokyo) and it's their new "Global Hopper." You can read about it on page 18.

But the most exciting new product is one that was hinted about in last month's magazine. If you read between the lines, you picked up on this if not revolutionary, at the very least extraordinarily "evolutionary" new product, a two-color thermal printer from Ithaca. In this case, the second color is red (the color of choice for gaming) and if you're a Slot Tech Magazine subscriber, a sample of the ticket has probably fallen out of the magazine already and you're holding it in your left hand. Sweet! It's easy to imagine two-color printing being used in all kinds of clever ways. Even if it's simply used to make the ticket more attractive, it's a nice new feature to have. Read more about it on page 20.

This month's contribution from Kevin Noble (Ontario Lottery and Gaming) touches on a subject that is close to my heart: training. Since technical training is probably the single most enjoyable thing that I do (I truly enjoy showing people how fun and easy electronics troubleshooting can be) I was happy to see something from Kevin on the subject. His column begins on page four.

Herschel Peeler has actually gotten some time away from the workbench at Eagle Mountain Casino in order to attend a geekfest on the subject of "embedded microprocessors." He tells us a bit about them, beginning on page ten.

Last but not least, Slot Tech Magazine takes a close look at synchronization (or syncronisation, for those who don't use American English) in raster scan monitors and introduces sync processing, buffering, detection and amplification.

Finally, it is with deep sadness that I report the passing of IGT founder Si Redd. Si passed away on October 14th at his home in Solana Beach, California not far from the offices of Slot Tech Magazine. He was a good friend to me and to the nascent video poker industry. For more about Si, visit the website at slot-techs.com and take a look at the July 2001 issue of Slot Tech Magazine. Redd was 92 years old.

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

Randy Fromm

Randy Fromm - Publisher

Randy Fromm's
Slot Tech Magazine

Editor
Randy Fromm

Technical Writers

Dion Anderson
Martin Dempsey
Bart Holden
Ken Locke
Kevin Noble
Herschel W. Peeler
Scott Reynolds

Advertising Manager
Dennis Sable

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Slot Tech Magazine
1944 Falmouth Dr.
El Cajon, CA 92020-2827
tel.619.593.6131
fax.619.593.6132
e-mail
editor@slot-techs.com
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By Kevin Noble

TRAINING:

Different Sites, Different Procedures

I often log-in to the Slot Tech forums, and was reading the submissions from everyone that had responded to questions regarding training. I found the submissions to be very interesting and informative with regards to the way different sites go about doing different things.

One thing that caught my eye was the amount of training required to get a job as a technician. I remember my first trip to Las Vegas when I was 18. I put in a quarter, pulled the handle and won 4 quarters. The dealers, attendants and cage did not interest me at all but the technicians and the repairing of slot machines did. In 1994, Windsor, Ontario opened up the first ever Casino in the province of Ontario. The electricity and the excitement were in the air now that I had an opportunity to get into this field.

Which brings me to when I first started. I had to take a training course from the local community college to even get a foot in the door. I had no working knowledge nor did I have any experience with slot machines except to put money in, pull the handle and pray for the best. In this four-month course, I was in awe every day I attended, curious about what the game did, how the parts worked, schematics, calculating the percentages, and everything else that goes along with becoming a technician.

When I completed the class and received my certificate, I had to wait about eight months before I got my opportunity to apply what I had learned from the class. This is where I found out that there are two different worlds: What I had learned in school and what I was actually learning every day out on the floor.

I was never taught about the coin-in jams, or coin-out jams or how they worked. I had to shadow different technicians for the first week until I finally received my first set of keys. This is where I have learned the bulk of my trade. It was my first casino set-up from scratch, passing on what I have learned to brand new technicians that have just started. After three years, I had an opportunity to help start the first ever Ontario Lottery Corporation Casino here in Windsor, Ontario. We had inherited the old machines from both the Northern Belle and the Interim Casino. Here was another opportunity to pass on some of the information that I have learned. As time went by and the technicians got better, they relied on me less and less until a new technician started in the department.

The Slot Repair course is no longer available and so we have had to initiate a training program in our department to train, and instill confidence into new technicians. With 750 games, and the Tech Department being so small (only 12 people, covering all shifts) we promoted people from other departments to become technicians. The training lasted about two weeks, so I had to cram a lot of information quickly. At the same time, I didn't want to loose them.

The Floor

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rives into our department, the casino allows me to do a two-week introductory class with the "new guy." I explain the policy and procedures that go along with the department, and allow him to read the past memo book. This gives him the opportunity to see the rules and regulations that we deal with. Next, I take him out to the floor and show him the different manufacturers and how to tell them apart. I explain the pay tables, the different types of games such as multi, buy pays, and line and show them all the information written on the award, reel, and belly glass. We talk about the multipliers, symbols, how to get into bonus rounds, and pays.

The Parts

Taking the spare parts in the shop, I usually start them off with the disassembly and assembly of different manufacturers' hoppers and handles. I explain how they work but what tech school does not tell you are the problems that you will face, and how to fix them. What this does is start a menu in their heads. They are thinking about what they are going to look for as they walk across the floor to the game.

The Games

With so many games to learn (their options, test modes, programs, and settings) I usually start off with an S+ IGT. We go through all of the parts (hoppers, handles, reels, CPU and motherboard) and explain how the game is played, how the coin is inserted all the way to a win and pay out.

Next, we go through the small pocket book and show the options, how we set them (and why) and show them what each setting will do to the game. We will go to the self-test and explore the test modes and how to enable each test. We will next explore the input and output tests and how to enable them and read what the display is telling you. I allow the new techs time to play with the game, insert coins, and explore the game using their small pocket book.

Each time we get into a different test or option, I will explain when to use the test and what to look for. This again was never taught in my class. We get into the reels and reel strips, and how to install the strips and the baskets. We discuss the differences between the upright and slant tops machines, from the coin-in assembly to the hopper escalators.

We next go through accessing the meters, how to get to them and which ones we use. I have them fill out meter sheets, play coins and have them take final meters. This makes them get the right meters, fill out all the machine information, and verify the actual coins played, dropped, games played. We also do the bill test meter sheets. This allows them to see the bill meters increment and which manufacturers use the bill meters as drops. After they feel comfortable with what they are doing, we move on to other manufacturers like Williams, Anchor, Sigma, Mikohn, and then Bally. This is where my saying of "a slot machine, is a slot machine, is a slot machine" comes into play. We can see that they are all more-or-less the same.

We next go through the small pocket books again for each manufacturer but this time I show them the difference between each manufacturer. The basic concept is now installed into their heads: the hopper test, reel strip test, pay table test, options, inputs and outputs. Again, each new technician is allowed to play and to explore each of the games. I am there for any questions and it is a controlled environment in the shop when the mistakes can be made.

We now try to turn our attention to learning the video slots. We look at how to access their options, diagnostics, and meters. They tend to find this comforting because everything is written right out on the screen for them. We again show them the differences between the reel game and the video, and the traditional and the slant top. When incoming calls are answered, I allow the new guy to follow the tech answering the call to observe the procedure for interacting with the customer, inserting their cards, opening the door, troubleshooting

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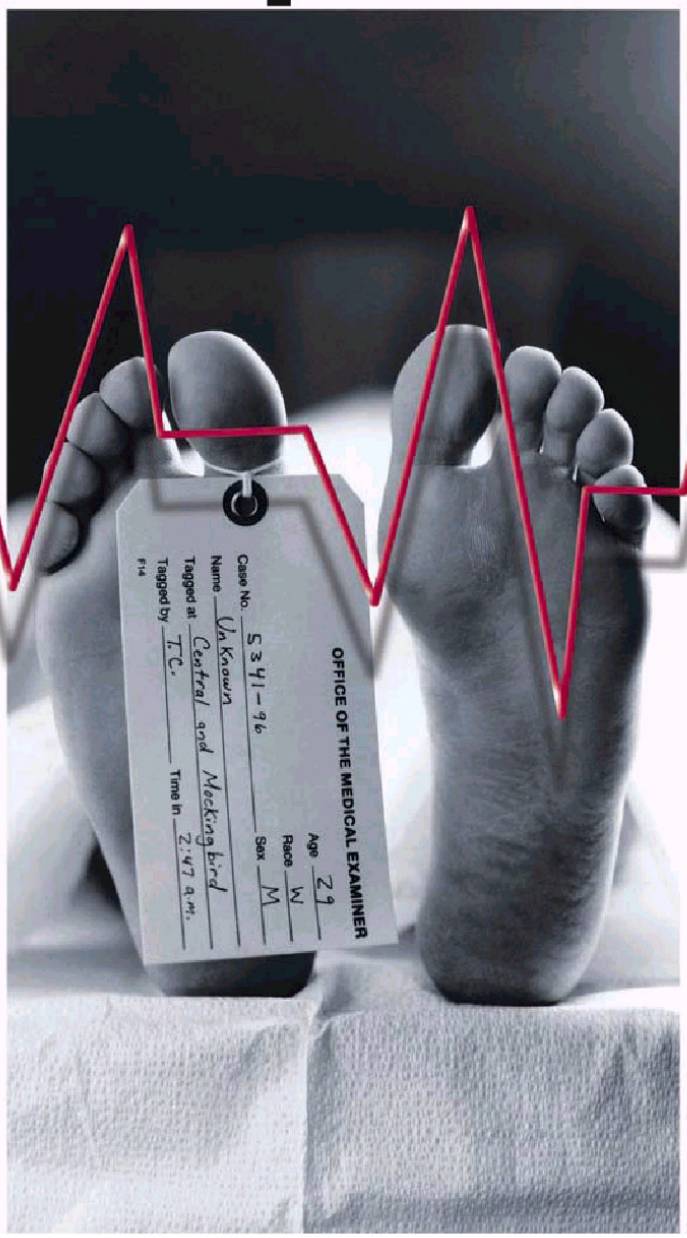

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the problem, and signing the M.E.A.L. book. This allows the technician to explain what he is doing and allows the new tech to experience, first hand, the procedures. It installs a little confidence and the basics on how the slot machines operate. It will take months and months to acquire the needed skill, speed, and knowledge to be a confident technician and shake off the butterflies.

Advice

Experience is the best teacher and although you cannot transfer your experience to another person, you can give them advice, based on your experience. Some of the advice I give new technicians is about using the M.E.A.L. book to our advantage. By documenting everything that you did, any part that was swapped out, and what the game was doing, it will help out the next technician that has to go into the game. We can also use the M.E.A.L. book as a tool. We can see when a problem started, how many times it has happened and what was done previously so we do not have to do the same thing over again. We can start looking in a different direction.

We have another tool in the shop, which is the tech log. The technicians fill this out, indexed by the nature of the problem they have encountered, and how it was solved. My theory is that if it has happened once, sooner or later you will see it again. This has been another great tool.

We also stress to new techs that if they're not sure about something, they should ask somebody. Everyone in our department is there to help them.

Overview

We know that Rome was not built in a day and a tech not made in two weeks but this is a good beginning for the situation that we are in. I try to be consistent in my teachings, and share the responsibility with the other technicians to steer them in the right direction. With no slot repair course offered here any longer, you have to prepare the new techs with as much information in a short period of time. I have taken that course and found it beneficial to me but I was never taught what to expect out on the floor. This is where I think the new technicians have an edge with me and the other technicians' experiences. Showing them the problems that they will encounter, and how to repair them, supplying them with cheat sheets and the menus that we created, a little hands on experience and slowly easing them into floor situations, makes the transition a little easier then when I first started.

We do not have the resources that the major casinos have, the manpower, or even the test equipment but we do make the most of the situation. We are not super techs and do rely on other information from technicians on the Internet, web sites, and manufacturer's representatives. We would love to be bench and floor technicians but our situation does not allow this. We are 12 technicians strong, with only three techs that are still here from when we first opened three years ago. I am going on my eighth year, have a lot of responsibility to keep the floor up and running. This is why I rely on cheat sheets, notes, manufacturers, and other technicians from the Internet to prepare me for something that I have not yet encountered. I enjoy sharing what I have learned: the cheat sheets, notes, and lately my tech log notes with everybody through Slot Tech Magazine.

Every casino, site, and department has different ways of doing things. We each have our own unique way of doing repairs, swapping parts, moves, conversions, and training. I certainly will never disagree with how others go about doing things. How do you do things at your casino? Do you know something that might help your fellow slot tech, somewhere in the world? What is second nature to you might be very interesting to someone in London or Lompoc.

- Kevin Noble
- Knoble@slot-techs.com

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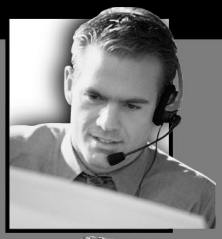

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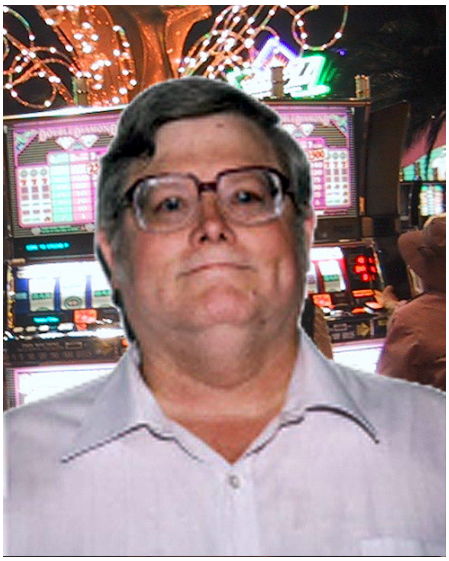

Embedded Microprocessor Designs

By Herschel Peeler

An embedded microprocessor is a circuit where the resources of the microprocessor (memory and I/O) are not accessible by the user. In contrast, a personal computer is not an embedded system. The user has the prerogative of calling up and executing various programs, or using system resources (disks and printers). A microwave oven or cell phones are examples of embedded systems. The microprocessor controls operation of the resources. The operator just supplies the details of the operations. In the case of a microwave oven, the operator only has to specify how long to cook and at what power level. In the case of a personal computer the user must tell the system what function is to be performed (Spread Sheet, Word Processor, Graphics editor) what files to operate on and where to get the files. Slot machines are examples of embedded microprocessors. The operator does not tell the device to act like a slot machine, get to specify which files are to be used, or tell the system what to do with them. At least that used to be a distinction.

Game design

Today's games have a main microprocessor that runs an embedded system. Individual functions may have their own embedded microprocessor. Hoppers, Printers, Bill or Coin Acceptors, Coin-In or Coin-Out optics assemblies, Player Tracking and Accounting systems are all devices that may have their own microprocessor. It would not be unusual for a game to have a dozen microprocessors spread throughout the game. All of these games are also linked together in one huge network that is also run by embedded microprocessors. Our 1,500 game casino floor may easily have over 10,000 microprocessors, all in operation at the same time, working together.

The Operating System

Most simple microprocessor circuits do not require an operating system. IGT's 8032 series, to choose a popular series of games (Player's Edge video games and S-Plus reel games) were very limited in memory capacity. The microprocessor simply ran short routines and manipulated the system resources directly. There was no storage media other than the memory itself. Memory was limited to the addressing capability of the microprocessor, around 64,000 bytes of memory. Microwave ovens and older cell phones were built this way, as are many things microprocessor-based.

With the advent of more complex features in cell phones, these embedded microprocessors now have an Operating System structure. Windows CE is an operating system designed for embedded microprocessor system designs. Programs compatible with a personal computer may be downloaded to the cell phone and run on the system resources of cell phone. Windows XP also has a cut-down version that can be run on an embedded microprocessor.

Many of the newer games (Bally, IGT, GameCraft, and many others) are built around a personal computer converted to an embedded microprocessor design. In these larger systems, an Operating System is used to run the game.

Kernals, Shells, Drivers, and Applications

In the many megabytes, or even gigabytes of memory space available to the microprocessor, we have many programs available for execution. At the central structure of the system we have the Kernal. The Kernal contains the basic routines to load and execute a program. At this same level we have Drivers that allow the Kernal to manipulate the system resources. A certain manufacturer and model of CD-ROM, for instance, must come accompanied by a Device Driver that matches the drives capabilities.

The Kernal has a standard method of communication (DOS, Windows CE or Windows XP, for instance). The drive itself speaks another language of command codes and code sequences. The Device Driver interprets the Kernal's command codes, translating it into codes the CD-ROM drive can understand, and interprets the drive's error and status codes into a format the Kernal can understand. This design allows a standard Kernal to adapt to an ever-changing design of devices it can connect to. The kernel works in the language of the microprocessor. This is a Binary, Octal and Hexadecimal world very unfriendly for the operator to use.

The shell is the operating platform of the system. It may be

Unix (or one of the Unix-like systems) or Windows. This is what sets the language the system will be manipulated in. The microprocessor only runs in binary (typically represented in hexadecimal). To make this binary world usable by non-binary humans we have a shell to present the events happening inside the microprocessor in a form a human can read, and interpret the intentions of the human to the microprocessor in its language (binary).

Our Operating System is a program that interprets the world of the shell for the Operator. The events occurring in the shell are presented to the operator in an amiable visual format (Windows). If you remember what DOS was like, you can appreciate the difference of Windows. To execute a program in DOS you were required to specify a command string that specified what operation was to be done, where the program was to be executed, where the files to work on would come from, where to put the file when you got through and details of the operation to be performed. In Windows we just Click and Drag. In coming operating systems, you pass between various objects in a realm of virtual reality and grab the file you want to work on. All this fantastic visual imagery does little more than can be done on one command line in DOS. This environment we work in is our operating system.

Applications are the actual functions we perform. Microsoft Excel, Microsoft Word or in our case the game is the application software.

Modern games

In bringing all this to the subject of our discussion, today's modern games are personal computers, converted to an embedded microprocessor design. To change the game to be played, all we need to do is download a new program that runs in a Windows environment. All the system resources (Coin Acceptors, Bill Acceptors, Hard Meters, Hoppers, Player Tracking System, Player's Panel and so forth) are controlled by drivers of sorts and remain the same between different games.
This gives us a very friendly platform to create a game on. The hardware is cheap and available. Programmers are abundant on the market. The cost of developing new games is minimal and can be developed almost overnight compared to that of developing a new game from scratch.
The memory capacity of this platform allows the machine to have multiple games stored in memory at any given time or to have the ability to download the games from a central storage drive that may have hundreds of games to choose from. It can even function as a sort of smart "dumb terminal" for server-side gaming applications. All this power and flexibility comes at a decrease in development price. We no longer have to reinvent the wheel when we develop a new game.

Troubleshooting

Much of the time, a failure in an embedded microprocessor system will be accompanied by a description of the problem. The description is often good enough for you to shotgun the most likely failed components. When it isn't, you actually have to get down and do some serious troubleshooting of the board. This is what separates the Masters from the Neophytes.

The Easy Stuff

If we receive the board with a note specifying what function doesn't work, it makes troubleshooting easier. Either a specific input or output doesn't work. A specific module doesn't work (Bill Acceptor, Player Tracking port). Corrupt graphics. Any symptom like this tells us where to start looking for our problem.

As long as we know what pieces of the hardware perform what functions, we can match the symptom to the circuits that perform that function. If we can get it down to two or three IC's the easiest thing to do is just shotgun these devices (replacing them without even doing any troubleshooting). Much of the time we will see the same parts failing repeatedly, and we can make intelligent guesses resulting in quick repairs.

Socketed ICs can be swapped out quickly. If you replace an IC, it is a good idea to install the new IC in a socket. The

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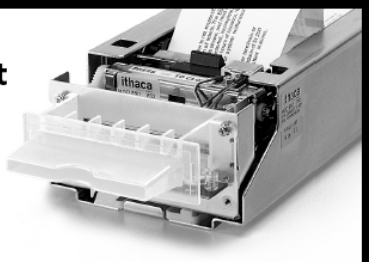

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failed IC may have a history or there may have been a problem in another board that caused that IC to fail (especially if this is an off-board driver you are replacing).

The Almost-Easy Stuff

If the symptom does not point to a specific IC or you have replaced the "good first guess" and it still doesn't work, you may have to get down to doing some serious troubleshooting. Most Power-On-Self-Test (POST) routines are written to run in a loop-on-the-failure when a problem is found. This puts the game in a sequence of operations exercising the section where the problem is. If you know what is supposed to be happening in that circuit, all you need to do is follow the operation through until you find out what is not working.

The Hard Stuff

If the problem is so catastrophic that POST will not run, there are still a number of options for you. We will approach these according to symptom.

Brain Dead

No processor operations are apparent at all. Force the microprocessor into the Reset state with a jumper. All (okay, almost all) microprocessors have a Reset line of some kind. Consult the data sheet for the one you have and pull it into whatever active state it uses with a jumper. This is easy to find if there is an actual Reset button on the board. Once the microprocessor is in the Reset state all Data, Address, and Control Lines should be in the tri-state condition. A line that is hung at the low or high rail will be obvious with a meter or oscilloscope. All address translation decoders should be inactive. All devices connected to the Reset line should be inactive.

Logic Analyzers

Monitoring the address and data lines on power-up can give you an idea of where a problem may lie on a board with a catastrophic failure. Knowing what normal operation looks like, and comparing that to what the defective board does may point you in the direction of a failure. Logic Analyzers are a multi-channel oscilloscope that lets you monitor many lines at one time. When a microprocessor comes out of Reset it should behave in a predictable fashion. Depending on the microprocessor, it will either start execution at a certain address (like Intel devices) or reference a certain address and start execution at the address specified by that reference (like Motorola devices). From that point, it will follow the dictation of the instructions specified by that memory location and those that follow. In either case, it will always be the same sequence.
A Development System or Emulator can accomplish this same process. A development system monitors these address and data lines, allowing you to track the operation of the microprocessor. An Emulator can take this concept one step further and actually plug in to the socket of the microprocessor and take over execution as though it were the microprocessor. There is a wide gray area between what you would classify as a Development System or Emulator. Many devices are capable of both functions. Some may have only limited capacity in one function or the other.

The Really-Hard Stuff

If you have none of the above options, all is still not lost. You may still be able to do some nifty troubleshooting with a much smaller budget. If you suspect a board of having a problem in a certain area, you may write a routine to burn into an EPROM that exercises only that circuit. This, of course, assumes you have an understanding of how the microprocessor works, familiarity with its instruction set, and a limited capacity for programming. None of these are works that require Rocket Science. One need not be an electronics engineer or masterful programmer to accomplish this. It will take a little study on your part, but it can be done. The in-house training we are developing at our casino will cover these topics as you get toward the end of the program.

Suggestions for routines may include: > A memory test for RAM that reads and writes to all addresses. If there is an LED accessible to the software it can be used to blink a

light on a successful pass through memory, or on an error. > An address selection test. The PALs that are used for Address Selection seem to have an unusually high failure rate. These areas have a high concentration of signals passing through them, and are therefore a point of stress and failure. >Read a player panel and turn on a light. This routine might read the player panel switches and toggle a light on and off associated with that switch. >Count Coins In and control the coin comparator. Bill Validators present a little more complexity. >Run a hopper and count coins. > Monitor the Hopper Level Probe and move the Diverter. > Interrupt response test. > Memory checksum tests.

If you have two LEDs available to software you can use one for a "Pass" indicator and another for a "Fail" indicator. As an option you can use the Player Panel to select the test to run and monitor test results, but this wouldn't be a first choice. You have the problem of using system resources to check the operation of the system resources. Does the failure point to a problem in the circuit you are testing, or a failure in a part of the system you are using to report a failure?

A better alternative is to select some address not used by the system you are testing and build a circuit that responds at that address to light the "Pass" and "Fail" LEDs.

Thermal and Intermittent Problems

Using any of the LED monitor methods mentioned in the previous paragraph as a Pass/Fail indicator, you can put a circuit through a looped test while subjecting the suspected circuit to thermal stress with a heat gun (or hair dryer) and a can of freeze spray.

Freeze spray

Freeze spray is a very useful tool. Clean the board with a mild soap and water solution. Dry it completely. Paint the board white with freeze spray. Apply power and see what thaws out first. Defective IC will often heat up much faster than their neighbors. Being familiar with how your board behaves is of great value here. Knowing what normally thaws out first, and how quickly, will help you spot an abnormality.

Editor's Note: Damn, Herschel. That must use up a shipload of freeze mist. Now I know why we have global warming. It's Herschel Peeler's fault! Without casting aspersions upon your methodology, I offer an alternative method that I refer to as "kissing the board." The skin between one's upper lip and nose is very sensitive to temperature changes. By hovering a centimeter above the PCB and scanning it with this area (you don't actually touch the board) one can often detect a warm IC that one might not pick up by simply touching it with callused fingers.

Jurisdiction Problems

Your options of doing any of these things may well depend on your ability to do these things according to jurisdictional requirements. In our case, having an EPROM programmer in-house that is connected to a computer and capable of doing the techniques suggested above, is just not easy to get past the Gaming Commissioners. Having the capability to burn an EPROM in-house also gives you the capability to read or modify a game EPROM.

All is not lost if you are not capable of burning an EPROM

in-house. In our case, I would suggest that we go the EPROM route only as a last resort. The alternative we are going to is to have a personal computer for use as a test bed and designing interfaces to run gaming devices from a serial or parallel port of the computer. We are still in the early development stages of this. We will keep you posted as the project continues.

When to Send the Board Back to the Vendor

When it is an option, you can always do the easy repairs and send the real nasty ones back to the original vendor for swap-out or repair. How long you should spend on in-house repairs depends on your individual circumstances and the cost of sending it out.

If you are a small casino with only a few hundred games and one or two slot technicians with limited electronics background, it isn't likely you would choose to do many in-house repairs at all. There is nothing wrong with doing only the simplest repairs in-house and sending the rest out to a repair depot or back to the vendor. Even mechanical repairs can be hard to fit into a busy slot technician's schedule.

If you are a medium-sized casino, you may have a bench tech to do some of the board repairs and most of the mechanical repairs. What does it cost to do the repairs in-house? What does it cost to have a game down while parts are sent out for repairs? What does it cost to have a bundle of repair parts in stock just in case one fails? All these things result in this being a value judgement on the part of the Slot Manager, and dependent on what kind of talent you can find locally.

In Las Vegas, it is very likely the vendor will only be a few blocks away and repair parts are just around the corner (or a taxi ride away). If you are in An Jung Ni, South Korea, you may consider doing more repairs in-house and investing heavily in repair parts stock parts.

In Conclusion

You are not alone in the battle of the boards. There is a great support structure out there that can reach worldwide. Just to mention a few: Delphi forums has a number of forums some of them open to the public, some not. > forums.delphiforums.com/slottechs is a forum open to all on subjects relating to slot machines in general and Slot Technicians. > forums.delphiforums.com/benchtech is a forum open to all on subjects relating more to Bench Technicians. Some of the topics are on a more technical subject than the Slot Tech forum covers, such as design of test fixtures. > http://forums.delphiforums.com/slotmanagers is a private forum open to Slot Managers or an assigned representative. Confirmation of your position will be made prior to you joining in. > http://forums.delphiforums.com/GamingReg is a private forum open to Gaming Commissioners and such. Confirmation of your position will be required.

This is by no means a complete list.

Herschel Peeler
Bench Technician
Eagle Mountain Casino
Porterville, CA
- hpeeler@slot-techs.com

ADVERTISEMENT

Randy Fromm's Casino School

On-Site Technician training

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

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

Students learn how to work with:

THE DIGITAL MULTIMETER

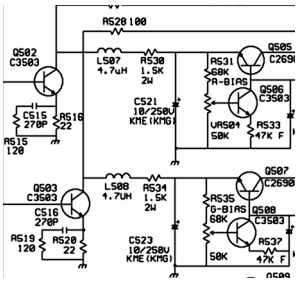
This relatively inexpensive piece of test equipment is easy to operate. Casino School students learn to use the digital multimeter to perform tests and measurements that will pinpoint the cause of a failure down to a single component.

ELECTRONIC COMPONENTS

The individual components used in games are introduced. Parts such as resistors, capacitors, diodes, potentiometers and transistors are covered individually. Students learn how the components work and how to test them using the meter.

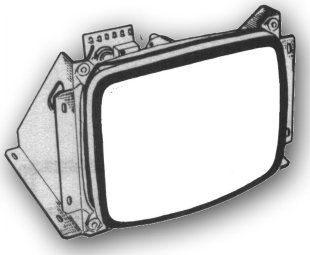
SCHEMATIC DIAGRAMS

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



POWER SUPPLIES

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



MONITOR REPAIR

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

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

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Super Littl

George Makise and Tadanori Maki

When discussion turns to gaming, what often springs to mind are visions of casinos with spacious row after row of gleaming and twinkling slot machines, grand buffet restaurants and felt-covered tables. But there is more to the world of gaming than giant casinos and resorts, much more. A visit to Asia reveals another world entirely. It is a world of much smaller rooms, close aisles and smaller machines. It is a world where every square meter is as valuable as water in the Sahara.

It is also a world with a wide variety of coins and tokens. In some locales, there may be three or four coins of different denominations that a gaming parlor might want to accept and dispense from their machines.

What would be ideal here is a small, reliable coin hopper that can dispense coins of different diameters without conversion. It should also be easy to disassemble to remove debris and other foreign material.

Himecs of Tokyo Japan has such a product. It's a truly "global" hopper that can handle coins of any diameter from 19 millimeters to 32 millimeters with thicknesses from 1.3 millimeter to 3.2 millimeters all without any conversion. The hopper uses a remarkable system of spring-loaded carriers to hold each coin securely and convey them out of the hopper. At the Global Gaming Expo, Himecs' George Makise gave an impressive demonstration in which the GH-3200 flawlessly dispensed coins and tokens with dozens of different diameters and shapes, including hexagonal and fluted edges.

Features of the Hopper

100% NON COIN SPECIFIC
GLOBAL series are 100% non coin specific. The hopper is not only capable of dispensing different coin denominations without changing the components, but it can also cater to a variety of irregularly shaped coins within its specified range.

Innovative Payout Mechanism
The patent-pending rotary-drum system is design to grasp every coin securely, which promises accurate and uninterrupted coin payouts to the last coin.

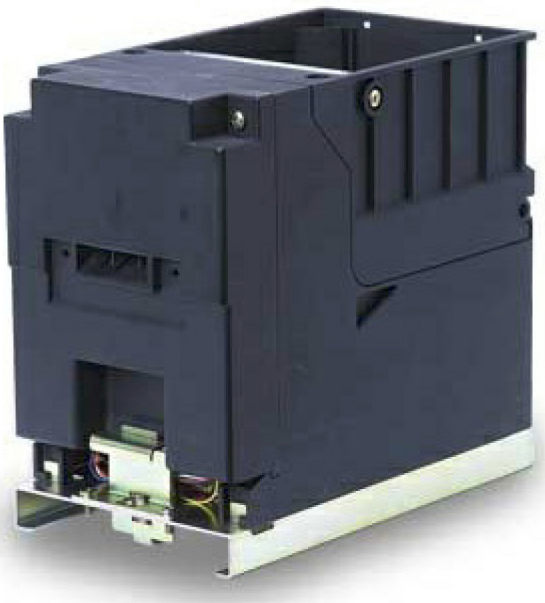
Modular Construction
Like all other HIMECS hoppers, the state-of-the-art GLOBAL GH Series is also modularly constructed with minimal components: a front plate, a coin-box, the patent applied rotary-drum system, and a base.

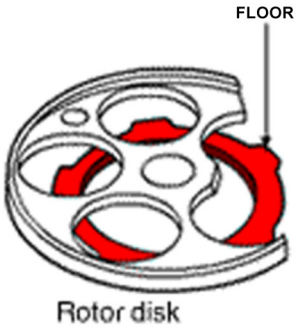
Easy Maintenance
A simple structure not only reduces the problem of coin jams but also minimizes the time for maintenance and servicing.

Durable and Lightweight
Made from high strength, wear resistant material, the GH-3200 weighs only 1.6 kilogram, yet the hopper has a capacity of 800 coins (US$0.25 size).

Less Troublesome Structure
By integrating the rotor disk with the winged floorboards, HIMECS State-of-the-art rotor disc assembly consistently maintains the depth of the

e Hopper





rotor hole to the thickness of the specific coin while the disc rotates. This prevents the rotor disk from wobbling or a coin jam commonly caused by external force or by more than one coin intruding to a disc hole.

The rotor disc housing is designed with an opening groove covering 360 degrees, which helps the debris fall out of the opening. Unlike other conventional hoppers, this prevents the debris from wedging between the rotor disc and the housing.

Easy Maintenance

All hopper bowls are easily detachable by pulling down a stopper pin and giving a slight twist to the bowl. Because the rotor disc is simply placed on the shaft of the motor, it easily can be removed by lifting it with one hand, no tools required. The user-friendly structure minimizes the time for maintenance and servicing.

For more information, contact:
HIMECS CO., LTD.
TOKYO EXPORT OFFICE
3F Hibino Bldg., 1-45-2 Ohi, Shinagawa-ku,
Tokyo 140-0014 JAPAN
TEL:81-3-5709-8093
FAX:81-3-5709-8095
E-mail:trade@himecs.co.jp

Disassembly of the GH-3200 is a snap. After lowering a single locking pin and pulling a couple of connectors, the "coin tank" detaches with just a slight, counter-clockwise rotation. The coin rotor assembly then pulls right off the motor shaft.

Ithaca Introduces

Two-Color Thermal Printing

The recent Global Gaming Expo allowed Slot Tech Magazine to check out new products and new innovations. As I walked the aisles prior to the opening of the show, I cruised by the Ithaca booth where I encountered my friend Denny Salmela. Denny and I have worked together a few times, most recently during a two-week slot tech training school I was presenting at Table Mountain Casino near Fresno, California. Denny had come out to give us some instruction on their Model 850 ticket printer.

"What's new?" I asked.

"Well, we have this new two-color printer," he replied casually. "It's pretty neat."

You have to understand that Denny is a rather understated fellow. What he saw as just another product from Ithaca, I saw as something profound. Two color printing from a thermal printer? Wow. Denny showed me some samples. There it was. Red and black. Beautiful, eye-catching color. If you are a Slot Tech Magazine subscriber, a sample ticket has been included with this magazine so you can see what a difference a spot color can make in the appearance of the ticket.

The latest breakthrough builds on TransAct Technologies Incorporated's long history of pioneering innovations for transaction-based printers.

"Color is the wave of the future and we are thrilled to be the first to introduce color thermal printing to the gaming industry," noted Jon Berkley, Vice President and Business Manager of Gaming for TransAct Technologies. "This latest development is a natural progression for TransAct given our history

Left to right - Jon Berkley - VP Gaming and VLT Sector, Jim Stetson - EVP Sales and Marketing, Denny Salmela - Tech Support and Janet MacDonald - Inside Sales Manager Gaming Markets.

of innovations, the success of our existing gaming thermal printers and the overwhelmingly positive response to our two-color point-of-sale printers."

"With the addition of color, casino operators will be able to turn slot machine tickets into vibrant, two-color, eye-catching marketing media. This is a compelling feature as casino operators look for new ways to increase revenues at their entertainment complexes. For example, slot players can be offered complimentary coupons to restaurants, shows or stores. Two color thermal printing will give casino operators increased capability to provide effectively targeted offers."

Black and white isn't good enough anymore. Imagine the eye-catching possibilities of color! **Red cherries!**

To further support this initiative, TransAct has worked in conjunction with Appleton, a leading North American direct thermal product manufacturer, to bring a standard media, known as ithaColor to the industry. This two-color thermal ticket media will ensure high quality, cost effective point of contact messaging.

For more information, contact:
TransAct Technologies, Inc.
7 Laser Lane
Wallingford, CT 06492
Tel: (203) 269-1198
Fax: (203) 949-9048
www.transact-tech.com

By Clay Harrell

Part 2

Connectors

The BCT-1 hand crimper for crimping Molex connector pins. Picture by aeroelectric.com

Why Use Connectors?

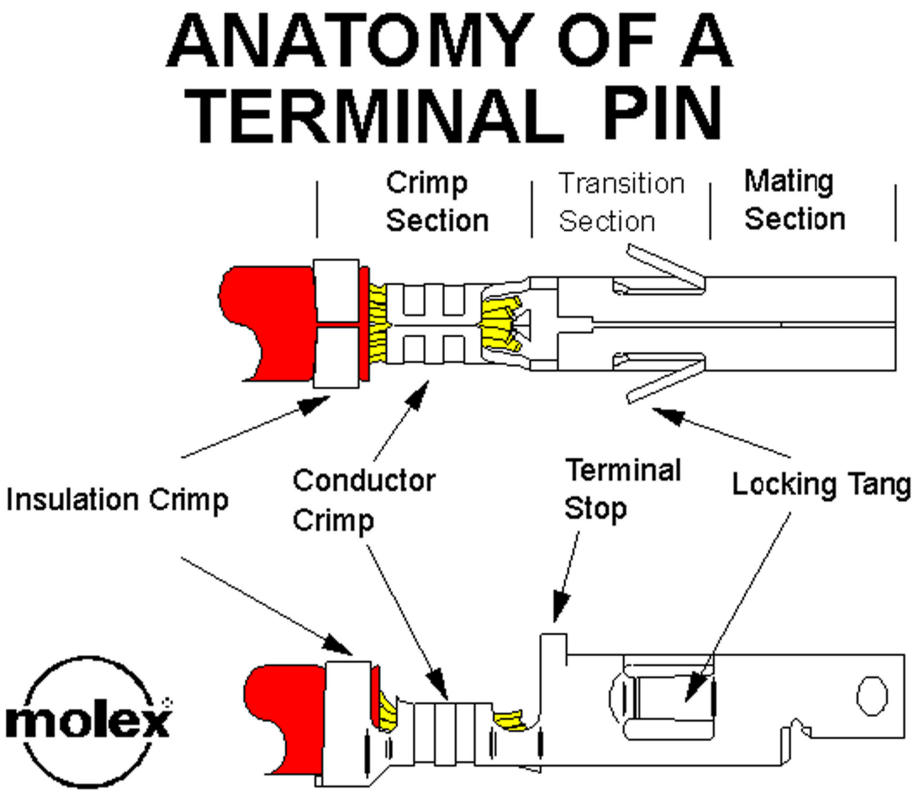
How to Perform a Good Connector Crimp

Info from www.molex.com/tnotes/crimp.html, but re-edited, modified, and embelished with emphasis on hand crimping and slot machine applications. All pictures from Molex.

You've made it through all the slot machine and connector manuals, and found the replacement connector that meets your slot machine's application. It has the right current rating, voltage rating, circuit size, pin size, engagement force, wire AWG capabilities, configurations, termination method, positive locks, fully-isolated contacts, and polarization, it is the perfect replacement connector.

But don't let out a huge sigh of relief quite yet - especially if the connector chosen uses a crimp termination system. While this can be one of the fastest, most reliable and rugged termination methods, if the terminal isn't crimped onto the wire correctly you can forget all about the hard work put into finding the right connector. Although there are many common crimping problems that can reduce the reliability of a slot machine, these problems are easy to avoid with a little knowledge and advance planning.

Before proceeding, you'll need some sort of hand crimper. Several hand crimpers are available from Molex and other sources. See the section above for details on that. But now that you have



the proper hand crimping too, it's time to talk about how to use it properely to make a "good crimp". To begin with, it helps to understand that a terminal has three major sections: *Mating, Transition and Crimping.*

The Mating section, as the name implies, is the section of the terminal that mates, or becomes the interface, with the other half of the connection. This section was designed to mate with a terminal of the opposite gender and to perform in a certain manner by the connector design engineer. Anything done that deforms the Mating Section, especially during the crimping process, will only reduce the connector's performance.

The Transition Section is also designed so it is not affected by the crimping process. Here again, anything done that changes the position of the Locking Tangs or Terminal Stop affects the connector's performance.

The Crimp Section is the only section that the crimping process is designed to affect. Using a good quality hand crimper, the crimp section is deformed so it can be securely attached to a wire. Ideally, all the work done to crimp a terminal onto a wire occurs only in the Crimp Section.

An example of a properly performed crimp is seen in the illustration. In the picture shown, the insulation crimp compresses the insulation without piercing. The wire strands (or brush) protrude through the front of the conductor crimp section by at least the diameter of the wire's conductor. For example, an 18 AWG wire would protrude at least .040". Both the insulation and conductor are visible in the area between the insulation and the conductor Crimp Section. The conductor Crimp Section shows a bellmouth shape in the leading and trailing ends, while the Transition and Mating Sections remain exactly the same as they were before the crimping process.

If a crimped terminal does not look like the terminal in the illustration, the problem was probably caused by something that went wrong during the crimping process. Below are the most common problems that may occur during the crimping process, and how to avoid them.

Crimp Height is Too Small

The crimp height, which is the cross sectional height of the conductor Crimp Section after it has been crimped, is the most important characteristic of a good crimp. The connector manufacturer provides the crimp height for each wire size for which the terminal was designed. The correct crimp height range or tolerance for a given wire may be as small as 0.002".

With a specification this tight, getting a perfect hand crimp can be difficult. And forget measuring the crimp height; terminal geeks would measure this with a "point micrometer", something I can guarantee you don't have in your slot machine toolbox!

But still, the information is good to know. So keep in mind that an over-crimped terminal (crimp height too small) is just as bad as an under-crimped (crimp height too large) terminal.

A crimp height that is either too small or too large will not provide the specified crimp strength (terminal retention to the wire), will reduce the wire pull out force and current rating, and may generally cause the crimp to under perform in otherwise normal operating conditions. A crimp height that is too small also may cut strands of the wire or fracture the metal of the conductor crimp section.

Crimp Height Too Large

A crimp height that is too large will not compress the wire strands properly. This causes excessive voids in the Crimp Section because there is not enough metal-to-metal contact between the wire strands and the metal of the terminal. This also compromises the Gas Tight seal that a good crimp offers.

The solution to problems the above problems is very simple: adjust the conductor crimp height. With a hand crimper, either press harder or lighter to adjust the crimp. Also make sure the right crimper is being used (remember there is

a different hand crimper for .100" and .156" terminal pins).

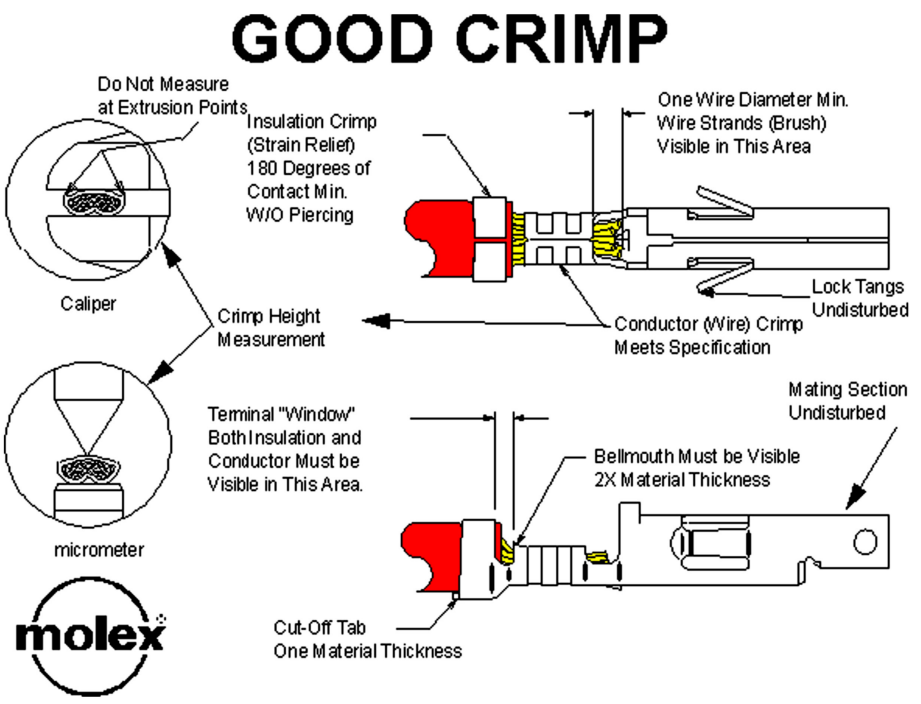
Crimp Width

Crimp width is just as important as crimp height. For optimum crimp performance, the cross sectional area needs to controlled. For the most part, the crimp tool geometry will produce the proper crimp width, when the terminal is crimped to the recommended height. This assumes you're using the manufactures recommended crimp tool. If using a different crimp tool, the width may be incorrect. Therefore, the resultant cross section will be too large or too small.

So what's the bottom line here? Buy a Molex (or Waldom) hand crimper designed for .156" or .100" terminal pins. This will ensure a better hand crimp.

Insulation Crimp Too Small or Too Large

Connector manufacturers do not typically supply a crimp height for the insulation due to the variety of insulation types and thicknesses. The insulation crimp provides a strain relief for the conductor Crimp Section so that as the wire flexes, the wire strands do not break. An insulation crimp section that is too small may overstress the metal in the insulation Crimp Section, weakening the strain relief function (and potentially breaking the wire).



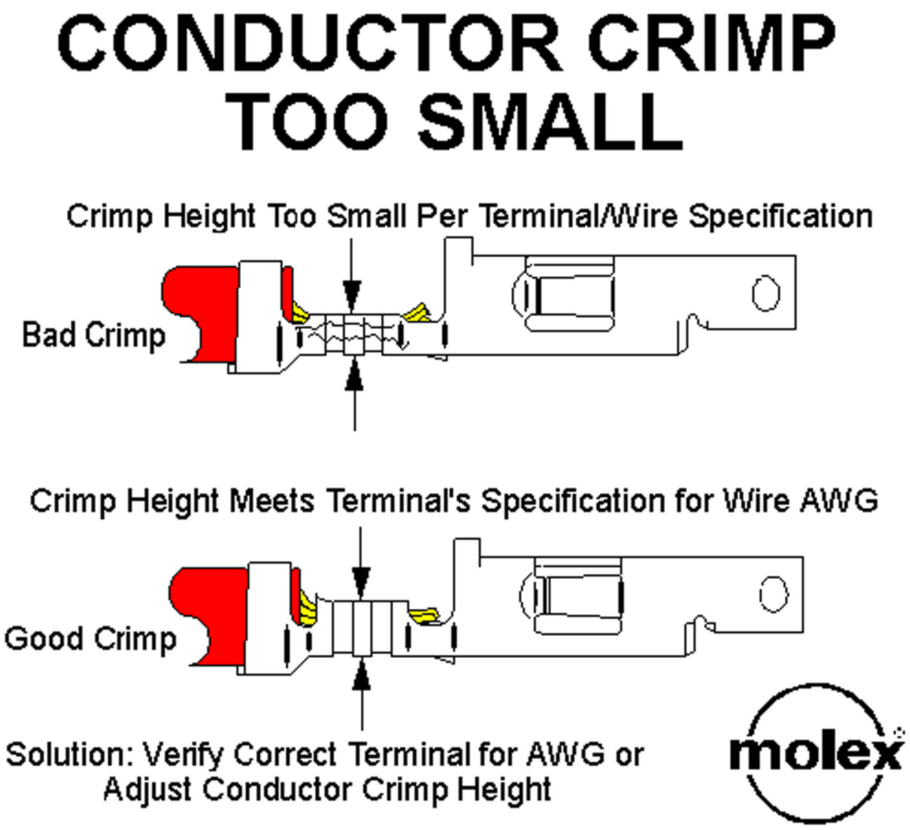
Most types of production crimp tooling allow the insulation crimp height to be adjusted independently of the conductor crimp height. The correct adjustment allows the terminal to grip the insulation for at least 180 degrees without piercing the insulation. An insulation displacement, or compression where the outside diameter (OD) of the terminal's insulation crimp and the OD of the insulation are approximately the same, is ideal.

Loose Wire Strands

Loose wire strands are another common cause of crimping problems. If all the wire strands are not fully enclosed in the conductor Crimp Section, both the strength of the crimp and the current carrying capability may be greatly reduced. To get a good crimp you need to meet the crimp height the connector manufacturer specifies. If all the strands are not contributing to that crimp height and therefore crimp strength, the crimp will not perform to specifications. Generally, the problem of loose wire strands is very easy to solve by simply gathering the wires back into a bunch before inserting them into the terminal to be crimped. Using a "strip and retain" process for insulaton removal, where the insulation slug is not completely removed from the wire until it is ready to have a terminal crimped onto the wire, helps minimize the problem (yea right, now who does that?)

Too Short Strip Length

If the strip length is too short or if a wire is not fully inserted into the conductor Crimp Section, the termination may not meet the specified pull force because the metal-to-metal contact between the wire and the terminal pin is reduced.



As shown in the figure on page 27, the strip length of the wire is too short (note that the insulation is in its proper position), not allowing the required one wire outside diameter (OD) extension in front of the conductor Crimp Section. The solution is simple: increase the strip length of the wire stripping equipment to that specified for that specific terminal.

Wire Inserted Too Far

Another crimping problem that relates to a too short strip length occurs when the wire is inserted too far into the crimp sections. As the figure on page 28 shows, the insulation is too far forward of the insulation Crimp Section and the conductors protrude into the Transition Section. This may cause as many as three failure modes in the actual application. Two relate to a reduced current rating/wire pull out force due to a reduction of the metal-to-metal contact in the conductor Crimp Section. A metal-to-plastic contact isn't as strong, nor does it conduct electricity, as well as metal-to-metal.

The third failure mode may occur when the connectors are mated. If the wire protrudes so far into the Transition Section that the tip of the male terminal hits against the wire, it may prevent the connectors from fully seating or it may bend the male or female terminals. This condition is known as "terminal butting". Under extreme cases, the terminal may be pushed out the back of the housing even though it was fully seated in the housing.

"Banana" (Excessive Bending) Terminal

One of the most descriptive

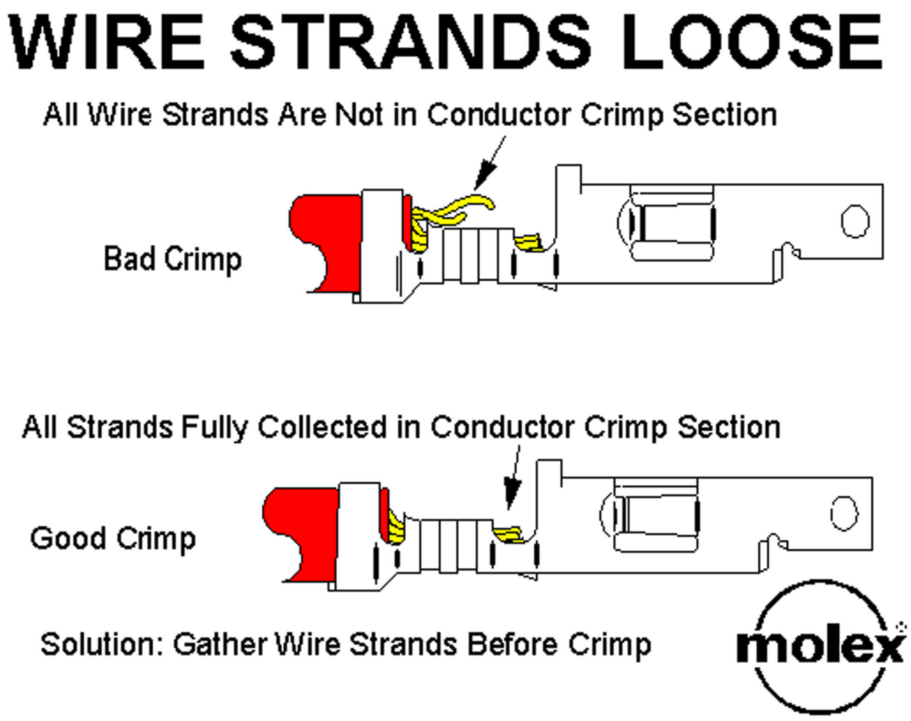
crimping problems is known as a "banana" crimp (page 28) because the crimped terminal takes on a banana shape. This makes it difficult to insert the terminal into the housing and may cause terminal butting. This problem is easy to solve by not squeezing the hand crimper so hard!

Crimp Too Far Forward

One of the more obvious crimping problems is when part of the Transition Section is damaged, as shown on page 28. In the terminal shown, the tab sticking up is a design feature called a "terminal stop". Its function is to prevent the terminal from being inserted too deeply into the housing. If the stop is extremely damaged, the terminal can actually be pushed all the way through the housing.

Undersized Bellmouth

The correct size for a bellmouth is approximately 2X the thickness of the terminal material. For example if the terminal is made from material that is .008" thick, the bellmouth should be approximately .016". While a few thousands of an inch either way will not materially affect the terminal's performance, if the bellmouth is missing or if it is less than one material thickness, there is a risk of cutting the wire strands. The fewer strands that remain, the lower the termination strength.



Oversized Bellmouth

There is also a problem if the bellmouth is oversized because this reduces the total area that the crimp section of the terminal has in contact with the wire. The less the wire-to-terminal interface, the lower the wire pull out force. If the crimp height is correct, then it is likely the problem is caused by a worn hand crimper, which should be replaced.

Bent Lock Tangs

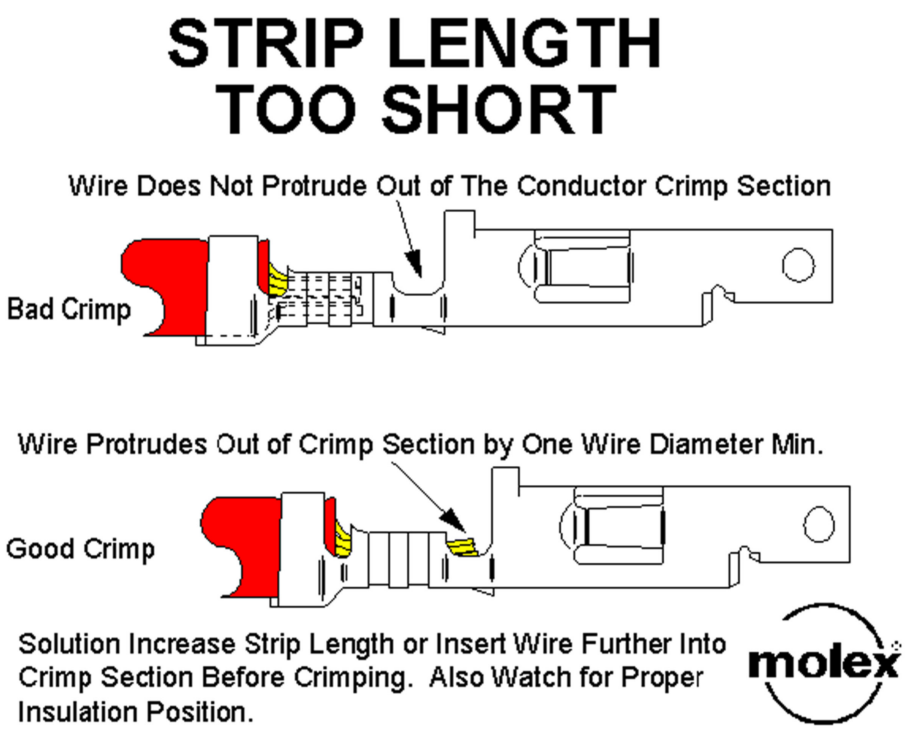
Although bent lock tangs are not necessarily the result of a poor crimping process, the connector can fail just the same. Lock tangs (see page 29) may be bent either in or out too far, which impacts the terminal's ability to completely lock into the shelf in the housing that was designed for this purpose. The tangs may be damaged by handling after the terminals are crimped onto the wires, or if the wire is soldered to the terminal pin (not recommended!)

Rules

While there are problems that may be caused during the crimping process, there are just four simple rules that will help ensure a successful connector application:

1. Choose the right connector for your application requirements. 2. Use the crimp tooling specified by the terminal manufacturer (there is a different hand crimper for .156" and .100" terminal pins!) 3. Properly inspect the crimp tooling to make sure it is not worn. 4. Replace the hand crimping tool if worn, as the parts that displace metal conductor and insulation wear.

Since most of the problems that are reported to connec-



tor manufacturers relate to one of the above crimping problems, Molex offers an easy-to-use guide to help you avoid problems or recognize them quickly enough so that you make only good crimps. To order this guide contact Molex Incorporated, 2222 Wellington Court, Lisle, Illinois 60532, Attention: Good Crimp Drawings.

Should Connector Terminal Pins be Soldered?

Some field repair people feel that after a 'good crimp' is performed on a new connector, the terminal pin should be soldered to the attaching wire. Maybe they are used to dealing with 'bad crimps' or feel they need the additional piece of mind. But is this the right thing to do?

The most common aspect of connector replacement in slot machine is the GI (General Illumination) connectors. These fail the most, and require replacement most often. The generally accepted crimp-on .156" terminal pin to use for GI circuits is the trifurcon style terminal pin (i.e. Molex part# 08-52-0113, Digikey part# WM2313-ND). This terminal pin grabs the circuit board's header pin on three sides instead of just one. Though the current handling capability is not increased, the vibration resistance and durability of the pin goes up dramatically.

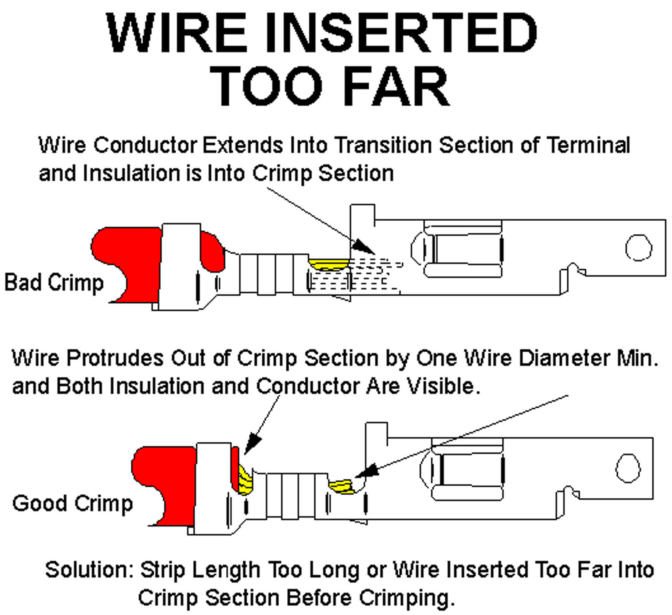
If a trifurcon pin is properly crimped, there is NO need to solder the connecting wire to the terminal pin. The only positive aspect of soldering a properely crimped terminal pin is the "wire pull out force" goes up. Current ratings do not go up with a soldered pin compared to a properely crimped-only pin (that information is directly from a Molex technical advisor who I talked with on the phone).

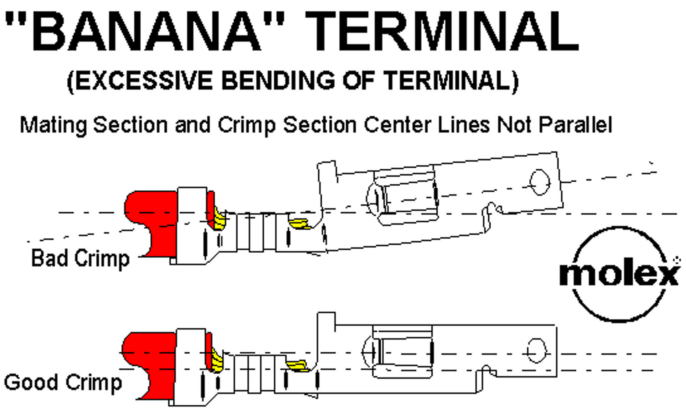
Now if there is a bad or improper crimp on a terminal pin, solder can increase the performance of a crimp. For example, a gas tight crimp is critical to long term performance. If there are voids between the wire strands or between the strands and the terminal because of a bad crimp, oxides can form (oxides are of higher resistance than the clean metals). Granted, in most applications the performance increase is negligible versus an unsoldered crimp, even a bad crimp. And the potential of doing "more harm than good" is very high when soldering a terminal pin (unless the user follows the terminal soldering method outlined below).

The risk of problems when soldering a terminal pin far out-weigh the benefit in most cases. For example, Adding solder to a terminal pin can get solder on the "locking tangs", making it unflexible. This in turn can ruin the connector housing, and make the pin nearly impossible to remove.

Soldering a terminal pin can also cause the terminal pin/wire insulation joint to fail. Or in the worse case, it can melt the insulation back beyond the pin, possibly causing a short.

Another problem with soldering terminal pins is having flux wick down and end up being left on the connector surface. This can interfere



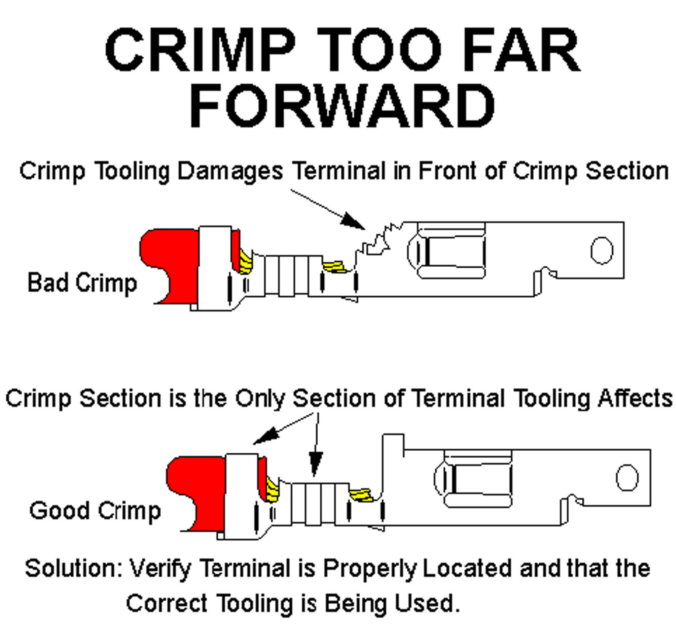


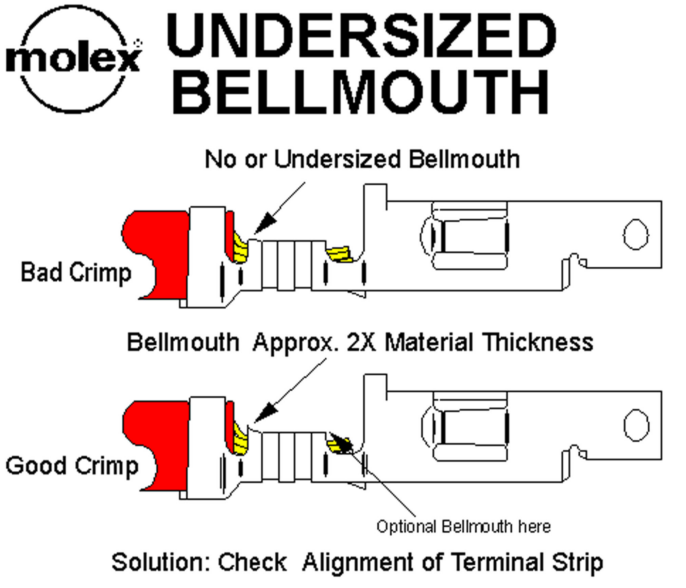
with connectivity to the header pin.

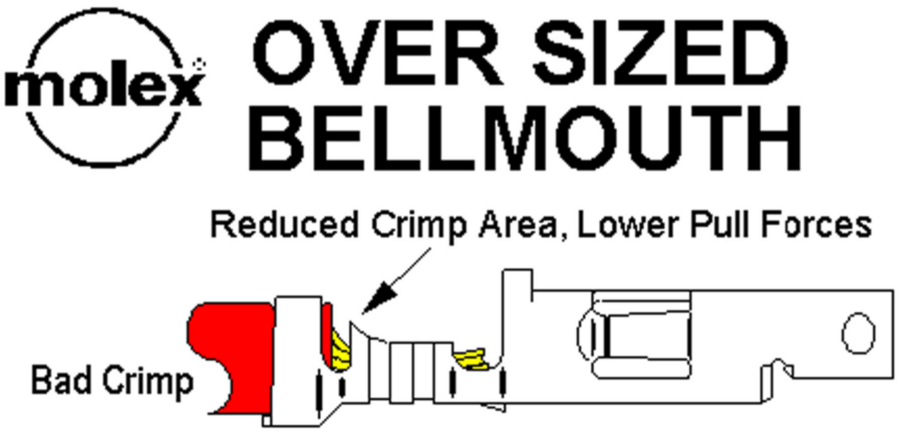
Lastly, though unlikely unless extreme heat is used, the plating on the terminal pins can be damaged by soldering.

Properely Soldering a Terminal Pin (if you must!)

With the potential problems of soldering a terminal pin known, some users may still want that additional "insurance". Or if a good crimp can not be performed (wrong tool or wire gauge?), soldering may be necessary to overcome the bad crimp. Molex reconizes that some user may not following their crimping directions, and may solder a terminal pin anyway. If this is the case, here is the ONLY terminal pin soldering technique Molex (relucantly) recommends. This information came from John Luthy, Molex's connector product division manager: * Before crimping the terminal pin, tin the end of the bare wire with some solder (best method is to dip the wire end into a hot solder pot). * Crimp the terminal properely (see the







Talking to Molex representatives, they really discourage any terminal pin soldering (a good crimp does not require soldering!) But if it is done, the above steps are the technique to use.

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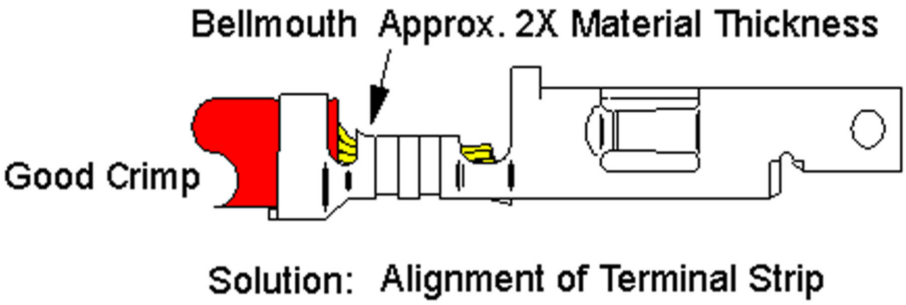
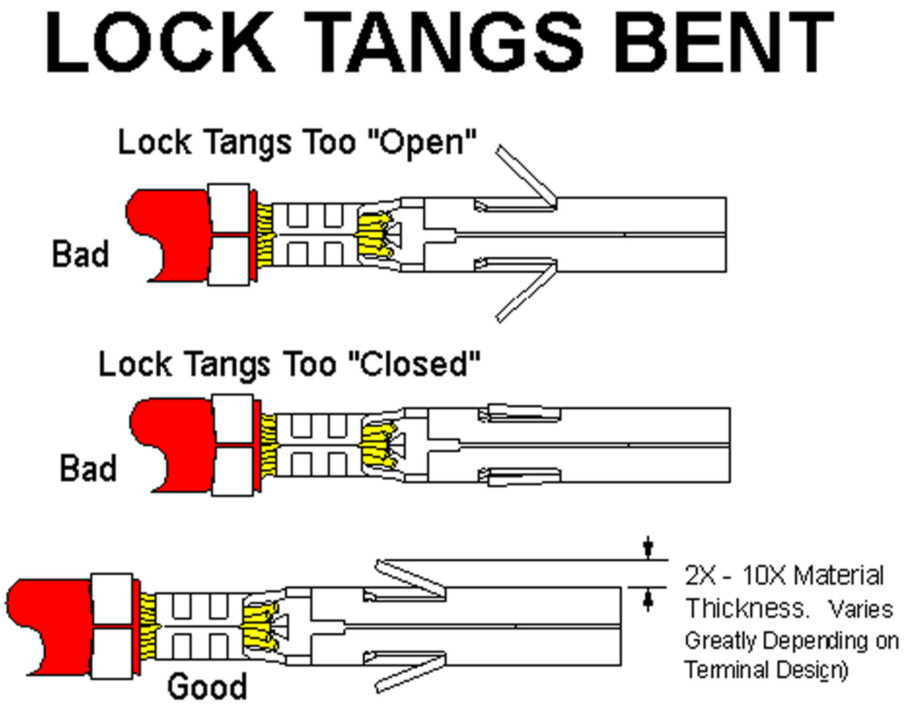


notes above!) using a good quality hand crimper (Molex WHT-1921 part# 11-01-0015, Molex part# 63811-1000, or Amp 725). * After the wire is properely crimped, using a temperature controlled soldering station (750 degree maximum), heat the terminal pin momentarily, right where the tinned wire is crimped in the terminal pin. The tinned wire's solder should heat and reflow, spreading to the terminal pin. Do NOT add any additional solder!



Sync Me!

Video is video, deflection is deflection and never the twain shall meet. They are completely independent of one another. In a monitor, there is absolutely no connection at all between the video circuits that control the red, green and blue electron guns in the neck of the CRT and the horizontal and vertical deflection circuits that create the scanning of the electron beams across the phosphor covered screen of the CRT. And yet, in order for the monitor to display the images properly, the deflection circuit has to be synchronized with the video signal. Without synchronization, the picture would roll or would be completely scrambled. But how is this synchronization accomplished? There is no "feedback" from the monitor to the CPU in the game. How are the CPU and the monitor synchronized with one another?

In the November, 2001 issue of Slot Tech Magazine we took a detailed look at the video circuits used in monitors. From this discussion, we know that the computer generates three video signals. These are for the red, green and blue colors that make up the picture. In addition to the video signals, the computer also generates two synchronization signals: Horizontal and Vertical. These "sync" signals are just momentary pulses.

The horizontal sync signal comes at the end of each raster line. It is the horizontal sync signal that tells the monitor to stop drawing each horizontal line and quickly return to the left side of the CRT to begin the next line. This is known as the horizontal retrace.

The vertical sync pulse is sent out by the computer when the beam is down in the lower right corner of the CRT, at the end of the "field." The vertical sync signal tells the monitor to start the vertical retrace sequence, turning the electron gun off and returning it to the top of the CRT.

Each of the sync signals will generally have its own separate input to the monitor. In some cases, you may see where the vertical and horizontal sync signals are combined at the computer to form something called composite sync.

Computers may produce either of two polarities of sync signals. The vertical and horizontal sync signals may be positive sync or negative sync.

Positive sync starts at zero volts, pulses briefly up to a

		Resolution	H(kHz)	V(Hz)	(H/V)
1.	VESA(r)	640 x 400	31.47	70.00	-/+
2.	Ind VGA	640 x 480	31.47	80.00	-/-
3.	VESA	640 x 480	37.50	75.00	-/-
4.	VESA	640 x 480	43.28	85.00	-/-
5.	VESA	800 x 600	35.13	56.00	+/+
6.	VESA	800 x 600	46.87	75.00	+/+
7.	VESA	800 x 600	53.68	85.00	+/+
8.	VESA	1024 x 768	48.34	60.00	-/-
9.	VESA	1024 x 768	60.00	75.00	+/+
10.	VESA	1024 x 768	68.68	85.00	+/+
11.	VESA	1280 x 1024	63.96	60.00	+/+
12.	VESA	1280 x 1024	79.96	75.00	+/+
13.	VESA	1280 x 1024	91.12	85.00	+/+
14.	VESA	1600 x 1200	75.00	60.00	+/+
15.	VESA	1600 x 1200	87.50	70.00	+/+

Figure 1. Monitor resolution, horizontal and vertical frequencies and sync polarity for various VESA standards

Figure 2. A television with loss of vertical sync.

high level then falls back to zero volts. Negative sync does just the opposite. It's normally at a high level, pulsing down to zero volts briefly and then returning back up to a high level in order to synchronize the monitor.

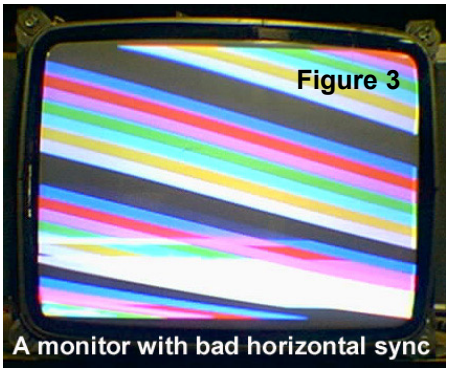
Both sync systems are equally effective. In some cases, the designer of the game's hardware simply chooses one system or the other. In order to make their monitors compatible with any computer system, most monitor manufacturers have designed their monitors to accept both positive and negative sync inputs. Some older monitors use a switch to select either positive or negative sync, others, including just about all modern monitors, are designed to accept either sync polarity at a single connector; automatically detecting its polarity.

As a matter of fact, sync polarity is one of the ways that a "multisync" monitor determines the resolution of the incoming video signal and changes its scan rate accordingly. Take a look at the resolution chart in figure 1 and you'll see how different resolutions use different sync polarity.

Loss of Sync

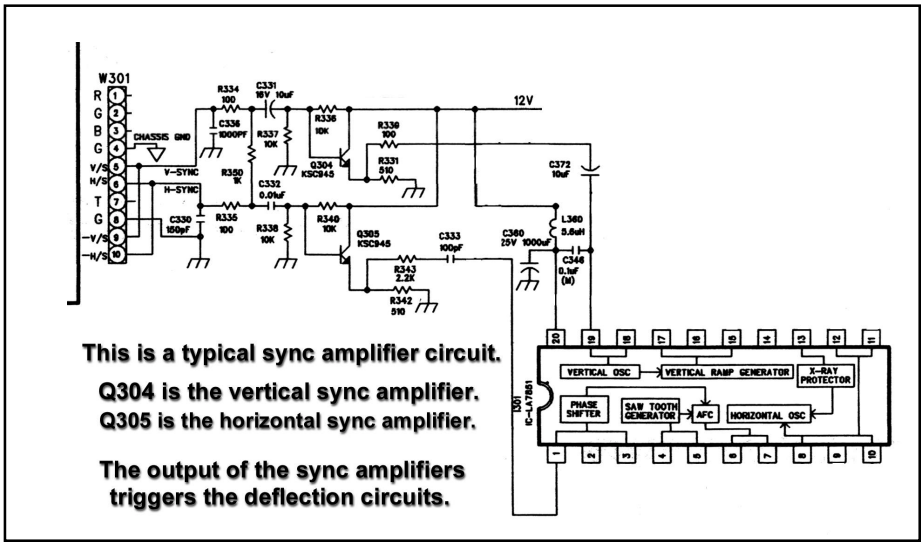
The best way to understand sync is to see what happens to a monitor without sync. If a monitor loses vertical sync, the picture will roll from top to bottom or from bottom to top exactly as if you needed to adjust the vertical hold (also known as "vertical frequency") control (see figure 2). The illustration shows a normal television with loss of vertical sync. The picture has rolled halfway up with what is normally the top half of the screen being displayed from the middle, down to the bottom of the CRT and the what is naormally the bottom half of the image displayed on the top.

Naturally, if you see a rolling picture on a slot machine monitor you will try adjusting the vertical hold control (if it has one. They don't all have vertical hold potentiometers these days). The vertical hold potentiometer is sometimes referred to as the "vertical frequency" control as that is what you are actually doing when you adjust it. You



adjust the frequency of the vertical oscillator with the potentiometer. You sort of get it in the ballpark with the pot and the sync signal then locks it in place so that the vertical deflection circuit is operating at precisely the correct frequency and "phase." If you can get the picture to slow down by adjusting the vertical hold potentiometer but the picture never properly locks in place, you have a problem with vertical sync.

Loss of horizontal sync can be a bit more difficult to recognize until you know what to look for. If the horizontal sync is just barely out of whack, the picture may be seen as shifting from left to right or vice-versa. Generally, the picture will be com-



pletely scrambled (worse than a scrambled pay TV channel) with little segments of diagonal lines all over the screen (see figure 3). Nothing will be recognizable on the screen. Again, try adjusting the frequency control (this time the "horizontal frequency" or "horizontal hold" control) to see if you can lock the picture in place. If not, you most likely have a problem with horizontal sync.

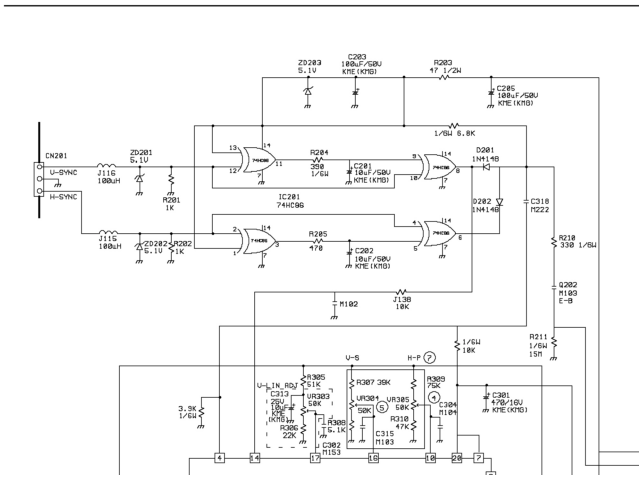


Figure 5. This is a popular method of handling sync signals, regardless of their polarity.

The Sync Amplifiers

The sync signal that comes from the CPU (or graphics engine) is generally buffered, amplified or processed in some way, before it is passed to the vertical and horizontal oscillators in the deflection circuits (see Slot Tech Magazine, June 2003 through August 2003 for vertical deflection and December 2002 for horizontal deflection).

In it's simplest form, this circuit will look something like figure 4. This is a simple, non-inverting amplifier that takes the sync input from the PCB and uses the output to trigger the phase shifter (keeping the horizontal oscillator synchronized) and the vertical oscillator (for the vertical deflection, obviously) in the horizontal/vertical oscillator IC.

Even if you cannot look at the schematic diagram and understand exactly how the circuit operates, it doesn't take a whole lot of electronics knowledge to see that Q304 and Q305 must have something to do with sync.

Another, very common sync circuit is shown in figure 5. This circuit has at its heart, a 74HC86, exclusive OR gate. The subject of digital electronics was presented in the August 2002 issue of Slot Tech Magazine. This is a cool circuit because it allows the monitor to function properly with sync signals of any polarity, positive or negative.

At the same time, this sync circuit also buffers the sync signals before passing them to the horizontal and vertical amplifiers. A buffer is an amplifier with a gain factor of exactly one. In this case, a TTL level sync signal is applied to the inputs of the circuit and a TTL level signal is what comes out so it would be a misnomer to call this circuit a sync "amplifier."

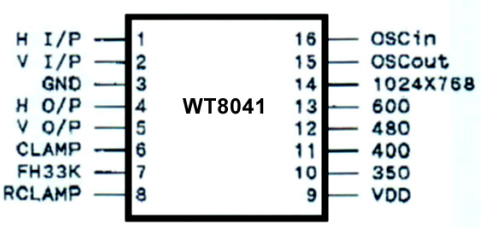
Multisync Monitors

You computer monitor is very likely what is known as a "multisync" monitor. It can handle a number of different screen resolutions. When the computer puts out a 640X480 signal, the horizontal deflec-

Features of WT8041

Accepts separate H&V sync signals with any polarity
Standard IBM video mode control outputs
(1024x769, 800x600, 640x480, 640x400, 640x350)
Built-in delay circuit for horizontal synchronous signal
Built-in video clamp signal generator
Fixed polarity H&V Synchronous signals output
Special pin assignment for H-sync, 33 KHz discrimination
Fixed Mode Setting with no sync signal input

Pin Configuration



tion circuit scans at about 31.5 kHz. At 800X600 resolution, the horizontal frequency speeds up to 35 kHz or higher. Again, take a look at the resolution chart in figure 1 and you'll see how this works. To get more lines on the screen, we speed up the horizontal deflection frequency. Of course, this means that the horizontal sync frequency is changed accordingly.

Wouldn't it be nice to have a single IC that would take a look at the incoming sync polarity and its frequency, and use this information to tell the monitor which mode it's expected to operate in? Just nod and say "Why, yes . . . That would be nice, wouldn't it?"

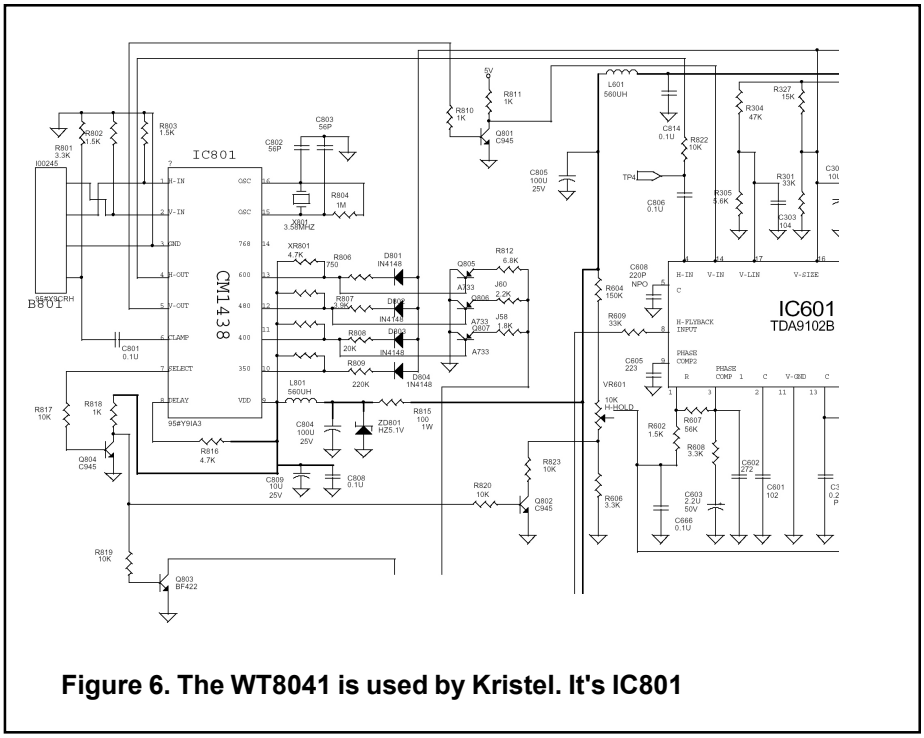
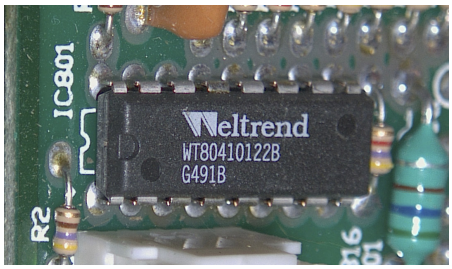


Figure 6. The WT8041 is used by Kristel. It's IC801

WT8041

Well, that's what IC801 in the Kristel monitor is used for (see figure 6).

The WT8041 is a silicon mono-



lithic circuit designed for synchronous signal processing or multi-sync display monitors. It can be applied to display monitors supporting standard IBM VGA, VESA super VGA and IBM 6514/A video modes. Five mode selection pins can be used directly with vertical deflection circuit for auto size control. It integrates about six TTLs and other components to minimize printed circuit board size and reduce the labor cost to manufacture.

WT8041 can discriminate different mixtures of horizontal and vertical input frequencies and provides output signals for use in multi-sync display monitors. Its discriminator circuit can distinguish five commonly used horizontal/vertical frequency standards (IBM VGA, VESA Super VGA, ISM 8514/A Interlaced). It can detect signals with either positive or negative polarity.

Pin 4 provides an active low, fixed polarity signal with the same pulse width as the original H-sync. Pin 6 provides an active high, fixed polarity signal with the same pulse width as the original v-sync. Both signals are used to control the H/V oscillators. The pins from pin 10 to pin 14 provide open drain outputs, depending on which standard is selected.

Pin 6 provides a clamp signal with varied pulse width. This signal is required for use by a very common video IC, the type 1203 (pin14). With a potentiometer, the current can be adjusted to control the vertical size of the screen.

A digital noise filter is used for rejecting noise on the incoming horizontal and vertical sync signals. The input section uses two techniques to improve noise rejection, so that the low level noise and large, short duration noise spikes will be rejected. Horizontal sync pulse widths under 0.84 us and vertical synchronous pulse width under 26.8 us will be considered as noise and rejected automatically.

The resistor between pin 8

This is another look at bad horizontal sync. In this case, it's failure of IC801, a WT8041, that's the problem.

and Vpp determines the clamp pulse width. Normally, the width is between 0.3 and 0.5 us. Recommended value for the resistor is 5k. If the horizontal synchronous input frequency is lower than 15 KHz, the mode select output will set the 640x480 mode active, (i.e. pin 12 output low other modes output remain floating). This means that if you fire up the monitor without a signal applied (such as when it's sitting on your bench with just AC power applied but no video cable hooked up) it will automatically be running in 640X480 mode. Pin 15, pin 16 are connected with an external 3.58 MHz crystal to provide the base of frequency discrimination.

Neat, huh?

But, to quote famous Scottish poet Robert Burns (1759-1796) "The best-laid plans o' mice an' men gang aft a-gley" which, when translated into American English basically means "shit happens." In this case, it's a failure of IC801 which will cause a failure of horizontal sync. The result is a picture that looks like the one shown in figure 7. After replacing the IC, the picture returns to normal.

Thanks to Robert Sult for his assistance in ferreting out and documenting this component failure.

- Slot Tech Magazine

Do you have something to share with your fellow slot techs? Join the best technical writers in the gaming industry by contributing to Slot Tech Magazine. Visit the website at slot-tech.com for details.

The same monitor following replacement of IC801.

Coin Mechanisms and Gamesman Join Forces

Leading coin validation equipment manufacturer Coin Mechanisms Incorporated has announced that the company has formed a joint venture with U.K. pushbutton and reel mechanism manufacturer Gamesman Ltd. As part of its business plan, Coin Mechanisms will begin marketing the Gamesman product line in North and South America, to both new and existing clients. Future plans call for many of the Gamesman products to eventually be manufactured outside the U.K., where all manufacturing is currently taking place.

Stanley Pierz, President of Coin Mechanisms, commented, "We are excited by this new venture and are confident that the combination of Gamesman's innovative design capabilities and Coin Mechanisms' ability to manufacture and support locally, will be met with enthusiasm by game designers. With the addition of the Gamesman product line, Coin Mechanisms is further diversifying its product portfolio and better positioning itself to pursue the company's goals of growth and leadership. We will define the Gamesman brand by our willingness to provide custom, value added products and superior customer service and support."

Contact: Michael K. Meisinger Coin Mechanisms, Inc. 400 Regency Drive Glendale Heights, IL 60139 Toll Free 800-323-6498 Tel. 630-924-7070 Fax 630-924-7088
Email: mikem@coinmech.com

Mark Smith (l), Sales & Marketing Manager of Gamesman Ltd with Stanley Pierz, President & CEO of Coin Mechanisms Inc.

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