JANUARY, 2002

Page 2 - Editorial

Page 4 - Another Posessed Poker Game
Slot Tech writer Bart Holden is cursed (blessed?)
with another interesting poker machine failure

Page 8 - Mikohn's Casino Link - Part 2
Troubleshooting tips for Casino Link

Page 13 - Thermal Printer Failures
Preparing for the risk

Page 14 - Complex Peripherals and Netplex
Evesdrop on your slot machine with the communications analyzer.

Page 17 - Atronic at ICE
At the ICE 2002 Atronic International will present
a wide range of new games, accessories and signage.

CenterFold
ICE2000 Floorplan

Page 20 - Bally Gaming and Systems to Showcase 29 Slot Titles at ICE Trade Show in London
Whew! That's a mess of new games, isn't it?

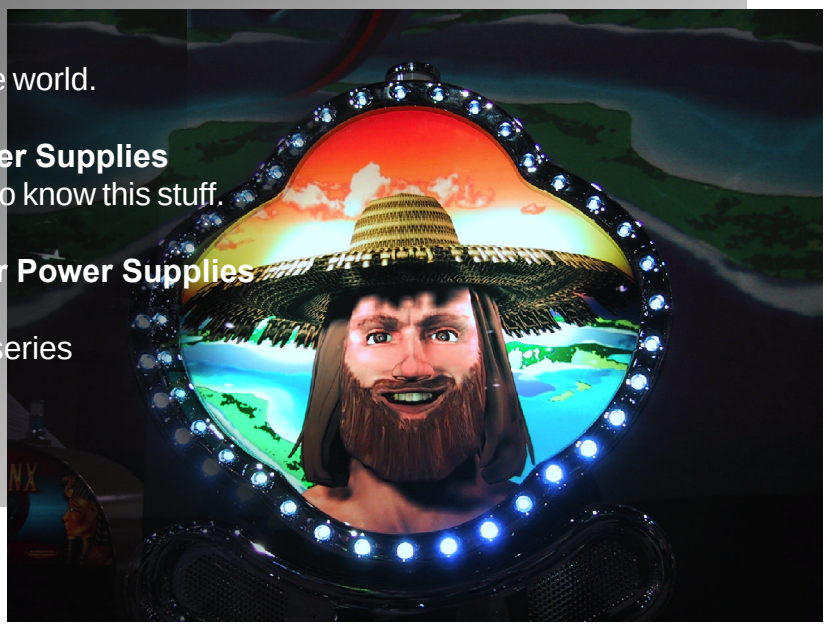
Page 22 - WMS Gaming Selects Coin Mechanism's MC-40 for Use in Slot Machines
DEFENDER Series offers the highest level of security
yet offered for non-optically marked coins

Page 24 - International Scene
Gaming news from Europe and the world.

Page 28 - Flyback Derived Power Supplies
If you work on monitors, you need to know this stuff.

Page 31 - Understanding Linear Power Supplies
This month, it's voltage regulation
in the conclusion of this two part series

Page 36 - Subscriptions and Back Issues Order form



Slot Tech Editorial

Randy Fromm

Happy New Year to everyone. January is a big month for Slot Tech Magazine. As you know, TechFest II is right around the corner, January 9th - 11th. Once again, response to the TechFest program has been overwhelmingly positive. So much so, in fact, that I am considering putting together another TechFest but I need your input. Do you think it might be a good idea to hold it somewhere other than Las Vegas? How about Atlantic City? What about a Gulf State like Mississippi? Perhaps in London? Please drop me a line if you're interested in attending a TechFest and where YOU'D like to see it held.

Following TechFest, I'm off to London to cover the International Casino Exhibition. ICE is a really big deal in Europe and I'm proud to say that Slot Tech Magazine will not only cover the show for our readers but will be holding our premier exhibition as well. It sort of seems fitting as my first trade show EVER was the ATE show (which is now the ATEI and held downstairs at Earl's Court at the same time as ICE) in 1976. According to my friend David Snook (read his column in IGWB Magazine) this will be an especially important show for Europeans as many chose not to attend October's gaming shows following The Attack.

Bart Holden has encountered another off-the-wall failure in a poker machine. This month, he takes us on a step-by-step journey through the repair. Full of suspense, read about Another Possessed Poker Machine starting on page 4.

On page 8, read the second half of Kevin Noble's discussion of Mikohn's Casino Link, in which he discusses troubleshooting and presents us with some common symptoms and solutions.

Last month Ken Locke took us through a look at simple peripherals and SEnet. This month things heat up a little with Complex Peripherals and Netplex starting on page 14.

In response to those that have written to me with a sort of "Hey, mate. How about more on fruit machines?" this month marks the inauguration of a new monthly column. International Scene covers gaming news from Europe and The World and is penned by internationally acclaimed trade journalist Martin Dempsey. From his home base near Dublin, Ireland, Martin travels to gaming shows in both Western and Eastern Europe.

I am still working on bringing you more technical information about fruit machines and club machines from the folks at Barcrest, Maygay, Stella, JPM, Novamatic and the like. It's one of the things I'll be working on while I'm in London. Be patient, Grasshopper. In the meantime, turn to page 24.

And last but not least, there are two articles on power supplies. One of them is the conclusion of the two-part article on the linear power supplies. This month we look at voltage regulation.

The other article is about power supplies in monitors. Huh? What the heck am I talking about? Well, there are lots of power supplies in monitors. This month, we'll take a look at flyback derived power supplies.

That's all for this month. Perhaps I'll see you at TechFest II or at ICE. If I don't drop dead in January, I'll see the rest of you back here in the pages of Slot Tech Magazine in February.

Aloha

Randy Fromm

Randy Fromm's
Slot Tech Magazine

Editor
Randy Fromm

Technical Writers
Pete Bachran
John Green
Bart Holden
Ken Locke
Kevin Noble
Jake Olson
Herschel W. Peeler
Scott Reynolds
Frank Sutter

Advertising Manager
Dennis Sable

Slot Tech Magazine is published monthly by
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
Visit the website at
slot-techs.com

SUBSCRIPTIONS
Domestic (USA)
1 year - $60.00
2 years - $120.00
International
1 year - $120.00
2 years - $240.00

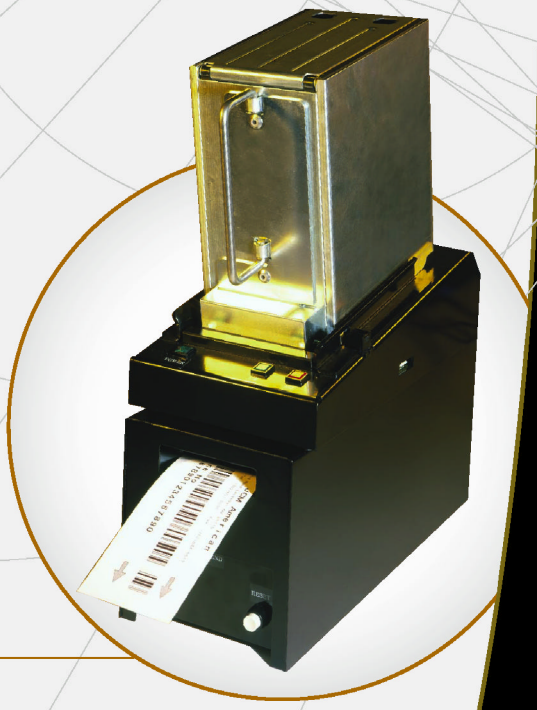
copyright 2001 under the Universal Copyright Convention. All rights reserved.

YOU ASKED... WE LISTENED.

JCM offers new solutions to your currency handling needs.

SENTRY,™ *JCM's Smart Entry*

JCM's SENTRY displays acceptable bill denominations and coupons, faults, errors and cashbox status using easily identified colored LED icons. SENTRY's function and appearance enhance game appeal to the players, and maintenance for the operators.



Intelligent Cashbox System

JCM's new cash-handling system uses a memory module, reader, and printer to efficiently eliminate errors in the conventional soft count process.

SECURITY. TECHNOLOGY. SOLUTIONS.

USA
JCM American Corporation
925 Pilot Road Las Vegas, Nevada 89119
Tel: 702.651.0000 **Fax:** 702.644.5512
www.jcm-american.com
email: sales@jcm-american.com

Europe
JCM Germany GmbH,
Büttgenbachstraße 5, D–40549 Düsseldorf
Tel: +49.211.5306450 **Fax:** +49.211.53064565
www.jcm-germany.com
email: info@jcm-germany.com

JCM® AMERICAN CORPORATION

Another Possessed Poker Game

By Bart Holden

I had only been enjoying my last conquest over the door open signal on the Players Edge Plus Video Poker slant top for a few weeks when my next nemesis emerged. I arrived at work in the normal fashion that morning. I signed out my keys and began my walk through on the first floor poker section. I held my head high as I walked past the bank of slant top pokers only to see that another one bit the dust during the night.

I hesitantly opened the game and according to the machine entry log, it was only a problem with the buttons. I released a sigh of relief. To be exact, the cash out, bet one, deal draw, bet max, and change buttons were not functioning properly. I also noticed that the vertical size would not adjust on the monitor without displaying a double image. I decreased the vertical size until I could read the diagnostic screen to troubleshoot the buttons. I thought it would be a cool change to troubleshoot the letterbox version of the game.

I entered diagnostics, stopped at the self-test inputs page, and started with the obvious. Normally a faulty or mispinned microswitch is to blame. I verified the wiring was correct and began replacing the switches one by one. And one by one, the replaced switches didn't fix the problem. I opened the game beside me to verify the pinout once again. And behold, I found a discrepancy on the change switch. I corrected the discrepancy and again the switches failed to work.

Now I know it was too soon to panic, but I was beginning to feel a touch of discomfort considering my track record with these games. See my article in last months copy of Slot Tech Magazine if you're not sure what I'm talking about.

I felt that this was a great point to open the belly door, remove the coin mechanism and hopper, and verify that all of the connectors were seated properly. Everything looked and felt right and once again, I hoped that the buttons would work after reseating the connectors. I'm sure I don't have to tell you that it didn't work. If it had you wouldn't be reading about this.

I closed everything and returned to the shop to retrieve the digital multimeter to take some continuity and voltage checks. While in the shop, I informed my Tech Manager that I would be troubleshooting the game for a while. I returned to the game with the meter and a fellow slot technician.

We took a voltage check on the faulty machine and a good one. The faulty game had approximately a 4 volt differential. Normally the voltage to the switch is 7 to 10 volts DC until the switch is depressed and reads 0 volts. The faulty switches only had 5 to 5.6 volts. This led us to believe that we had a problem with the Central Processing Unit (CPU) or in the vicinity of the power supply or motherboard.

We closed the games and made our way to the shop with the CPU in hand. We were extremely confident that we had uncovered the machines weak link. We plugged the CPU into our tester and performed the necessary soft ram clear. The CPU functioned properly in the tester's self-test. It also played without any problems.

We returned to the floor and reinstalled the CPU. We decided that prior to removing the motherboard or power supply, we would swap the main button harness that plugs into the top of the power supply. Rather than install a new harness, we opted to cut a few tie wraps and disconnect a few switches from the good game to make the known good harness reach to the bad game. We powered up the game and

entered the self-test. Again the game did not function and instead we saw and smelled that slot tech cuisine. That's right, we let the smoke out. We cooked some electrons. We were baking gaming chip cookies.

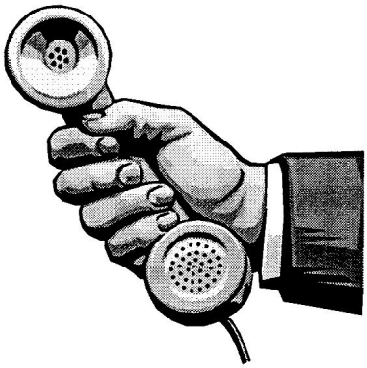
We turned off the power and began our search for the origin of the blaze. Of course, the not so reliable sniffer couldn't pinpoint the culprit. That is until I opened the CPU and realized I was definitely closing in. I inspected the component side and didn't immediately see anything wrong. I removed the processor board from the tray to expose the solder connections. I found the problem. The triac transistor labeled Q6 was damaged. Once I saw the damage on the solder side, I was able to recognize the damage on the component side. The transistor cracked at the seam and actually broke into three pieces when I touched it. I was off to the shop with the CPU again.

I searched our component bins and located a replacement part. It was a 0.8 amp 200 volt TRIAC part number 482-021-91. This is a common component found on the CPU (For more about TRAICs, see Slot Tech Magazine, May, 2001). I replaced the TRIAC and verified that the CPU again worked in the tester. I checked the technical manual and found that Q6 is located in the change switch circuit. This only added to the problem. The TRIAC went out with a functional button panel attached to the game. What could this mean? Was the game that I was using as a model also faulty?

We returned to the floor joined by a third technician and our tech manager who was now thinking that I must have been milking this problem. Questions began to fly. Did You check all the switches? Did you verify the CPU in the tester? Did you check the fuses? Several hours into the problem, with my nerves a little on edge, this was an unwelcome sound. It was one of those moments when you want to take a step back and invite your magically enlightened co-workers to repair the game.

Instead I answered yes to the plethora of questions and opened the floor for new suggestions. And a worthy suggestion materialized before me. I had overlooked something during my troubleshooting. Perhaps the candle light was shorted causing the TRIAC to go bad on the processor board. This sounded like a legitimate theory. We inspected the light and disconnected it. We powered up the game and

Your Future Is Our Focus at WHOLESALE ELECTRONICS



WE ARE AS CLOSE AS THE PHONE

Outstanding Customer Service is just a phone call away.

Let Your Fingers do the work, Give us a call.

Call Now for Our 2001 Gaming Catalog

WHOLESALE ELECTRONICS

East Coast
Toll Free Phone: (800) 222-2899
Fax: (302) 328-4547

www.wholesaleworldwide.com
E-mail: info@wholesaleworldwide.com

West Coast
Toll Free Phone: (800) 233-5668
Fax: (775) 826-7571

before we could test it, the scent of electronic incense again filled the poker room. The TRIAC never stood a chance.

I returned to the shop to repair the CPU a second and final time. I now had the equivalent to a college degree at Q6 replacement.

Back at the games, I decided to open a third game to triple check my wiring. This game differed as well. The change switch was the last switch in the series and therefore required only two wires on the button and both games had a third. Each game had an extra 7 volt line from the light connected to the microswitch. I corrected the variation and powered up the machine. The absence of smoke was a welcomed sight but to my dismay, the monitor had completely given out on me. No matter how much I adjusted the controls, I was stuck with a double image. This seemed like a great point to take a break from the faulty machine and move on to a more difficult task of repairing this monitor.

I used my limited monitor knowledge to troubleshoot the problem in the shop. To make a long story short, three hours later I replaced the H card on the 1492 Ceronix board and the problem was gone. I never could have repaired this monitor without the useful information contained in the early issues of Slot Tech Magazine. Yes, that was a shameless plug. I returned the monitor to the game and had just enough time to clean up my mess and sign out for the day.

By the way, that night I had nightmares about poker games. I returned to work the following morning and peered around the corner hoping to see the game in working condition. It was of course still not working.

I began the day by changing out the power supply and motherboard with good ones. This seemed like the next logical step considering the lower voltage at the microswitches. The new power supply and motherboard did not work. Now having pretty much changed everything except for the other major components and their associated wiring, I decided to see if the game otherwise functioned properly.

The coin lockout worked in diagnostics. I couldn't check much more in diagnostics, considering that you need a functional deal/draw button to scroll through the different outputs. I closed the door and attempted to drop coins in and it wouldn't accept. No coins were registered on the game but it wouldn't accept coins. I tried again in diagnostics and it worked. I also noticed that with the door closed my bill acceptor was not lighting although it cycled correctly and readied up. There was more to my problem than I had originally noticed.

At this point I began disconnecting every harness from the power supply accept the monitor, motherboard power harness, and the button panel harness. I place the game in self-test mode and the buttons worked on the input test. One by one I plugged in the harnesses and tested the buttons awaiting a failure. Once I plugged the Bill Validator power harness into the power supply, the buttons failed.

With a grin on my face, I began disconnecting the harness at different points until the problem went away. I got past the harness and the BV power supply, to the BV assembly before the problem recurred. Was it the head or the transport? I inspected the unit and found that the cashbox optics retainer, a metal clip used to hold the optics harness close to the unit to prevent it from getting closed in the door, had been forced in with the BV assembly. It was shorted to the solder connections on the transport causing all sorts of problems and teaching me an important lesson in troubleshooting. I had been so preoccupied with the buttons as the only problem that I had overlooked other symptoms that might have led to an earlier repair.
Once again, I reigned victorious but at the cost of my sanity.

- Bart Holden
bholden@slot-techs.com

ICE 2002 will be bigger than ever before. It will also include totally new areas that are vital to the future of your business. Visit **www.ice-london.co.uk** and you'll find everything you need – the new *i-gaming zone*, the new *Components Zone*, the new *Recruitment Village*, exhibitor list, special rate hotels, travel guides and the fastest way to pre-register. Or telephone:+44 (0)870 429 4620 fax:+44 (0)870 429 4621.

THE INTERNATIONAL CASINO EXHIBITION
EARLS COURT, LONDON
22-24 JAN 2002

ATE
An ATE **Exhibition**

Sponsored by
EGO
european gaming organisation

Mikohn's CasinoLink

By Kevin Noble

Last month, we took our first look at Mikohn's CasinoLink. This month, it's time to take a look at troubleshooting.

Troubleshooting

Problem: no heartbeat
Solution: SMIB not running, bad or wrong EPROM, or UART is latched or bad

Problem: SMIB stays in no DCU communication mode
Solution: DCU not working correctly, bad connection

Problem: SMIB waiting to be assigned mode
Solution: DCU's machine properties incorrect, not receiving properties from the system, bad DID, DID not in system, IOC down

Problem: All SMIB's with constant communication errors
Solution: Bad SMIB's on a line

Problem: SMIB's on a channel loosing communication
Solution: A bad SMIB causing miss communication for the others

Problem: SMIB not getting data from game
Solution: Game type dipswitch setting set wrong, bad harness

Problem: PTM not communicating, C1 error on display
Solution: PTM PCB board broken or cracked, PTM harness bad, loose connection, or unplugged, and SMIB not working or unplugged.

Problem: Scrolling on DCU's is slow and idle state, which means the green light, is off
Solution: Power off DCU for 5 seconds, and turn back off

Problem: Too many messages in the SYSCOMM Process
Solution: Type in "w" and press enter to display back-up messages

Problem: SMIB displays different symbols, display only half working
Solution: Ribbon cable on the back of the display or on the PTM not fully plugged in, PTM is grounding out on the metal cabinet.

Problem: Display is scrolling to fast
Solution: The system has lost communications to the central site, quit all process and reboot the system.

Problem: There is no display, and the PTM is not working
Solution: The SMIB led's #1, #4, and #7 are blinking together and the rest are off, the SMIB power supply is bad and needs replacing.

Problem: "Chip bad bad chip" message appears
Solution: DID bad and needs replacing, PTM EPROM defective

Problem: Waiting for SMIB message
Solution: bad connection on the harness, bad DID, or bad SMIB board

Problem: Insert card messages
Solution: Loose PTM bracket, and or connection

Problem: DID not showing on display
Solution: Communication line not connected or bad J5 connector

Problem: System is showing power fail or no communication
Solution: Check the harness from the SMIB to the motherboard

Problem: All DCU lights out
Solution: Check power, and connections, swaps DCU to see if problem still exists.

Problem: DCU shows "POLL OFF", transmit and receive are not flashing normal
Solution: The connection between the DCU and IOC is bad; SYSCOMM processes are not running correctly

Problem: DCU shows IOC down, and the transmit and receive lights are not normal
Solution: The connection between the DCU and IOC is bad, rocket port connection bad

Problem: All DCUs are "POLL OFF" and IOC down
Solution: Transmit and receive lights are not normal, and the IOC is running correctly, then central site is down

Problem: IOC has no power, IOC PC fault, and some or all processes fail
Solution: Check the power supply, memory, hard disk, then try IOC swap for a known good one, or IOC power fail is needed.

Problem: IOC is down, and "POLL OFF" is on some or all of the DCUs
Solution: Power fail at the site, or central site is down
Problem: Alarms on the IOC are running away
Solution: Possible a bad switch, SMIB board is bad, wire shorting

Problem: The display is showing mixed messages
Solution: Pull the RAM (U4) on the SMIB board, and reseat the chip and power back up. The display will come back to "WELCOME TO MIKOHN CASINOLINK"

Problem: The DCU's receive light on constantly
Solution: The communication chip for that channel was blown. The channel was reconnected and it continued to blow. You have to remove the bank out on the floor, replacing the DCU communication chip. When bringing one game up at a time until all the games were communication. When a game that was bad was plugged in, it brought the rest of the bank down. The SMIB's communication chip needs replacing. Check the communication chip by feeling it with your finger; these chips get hot enough to burn your finger.

Problem: Blank display screen
Solution: The PTM's EPROM version 1.3 was burnt out.

Problem: No SMIB meters
Solution: U13 and U14 needs replacing

Problem: Casino link is missing a certain process on the screen.
Solution: Type in "q" for quit, and retype in the missing process that was disabled.

Problem: No player tracking points would register for a certain game on the floor
Solution: The flags are needed to be programmed from the central site.

Problem: "BAD ID CHIP" message
Solution: When the SMIB resets, it tries to read the DID number from the chip if:

(a) If you can get the DID on the PTM display it's a problem with the central site,
(b) If you cannot get the DID number on the PTM display, it must be replaced and the new DID number must be notified of the change to the central site.

Problem: The DID is not found in MCONFIG process
Solution: If the DID was changed and not reported to the central site, the bin file must be cleared of the old hexadecimal number at the central site, and replaced with the new hexadecimal number.

Problem: On the DCU's display panel, all the machines for that channel are correct, but old DIDs are present (called ghost machines). Example the display reads 25, 2, 0. The 2 represent 2 machines not found, but 25 represent the right amount of games for that channel.
Solution: The DCU RAM birth is needed to clear the two games; this process is best to do when the casino is at its lowest peak time.

Mikohn Facts

"POLL OFF" – means the DCU's memory is full of messages and it is not able to talk to the floor any more.

"IOC DOWN" – means the DCU cannot send its messages to the IOC

When communication is lost between the SMIB board and the DCU, the SMIB continues to collect data and stores up to 250 messages. Any new messages after that will be discarded.

When the message "WELCOME TO THE MIKOHN CASINOLINK" appears on the display, there is really no problem. This is the default message stored in the SMIB EPROM. This message will be displayed until the SMIB receives new display files from the system.

On the Bally 6000 reel games the "M" code displays "M00." This means the buffer on the MPU board was filled. A partial clear is needed to allow the games exception codes to be displayed. All alarms still work and will be displayed to surveillance.

(*) If this star symbol is visible after the scrolling message, or after the DID hexadecimal on the display, this means the SMIB is not receiving messages from the DCU.

(.) If the dot appears after the DID hexadecimal, this indicates the SMIB is in auto ID process.

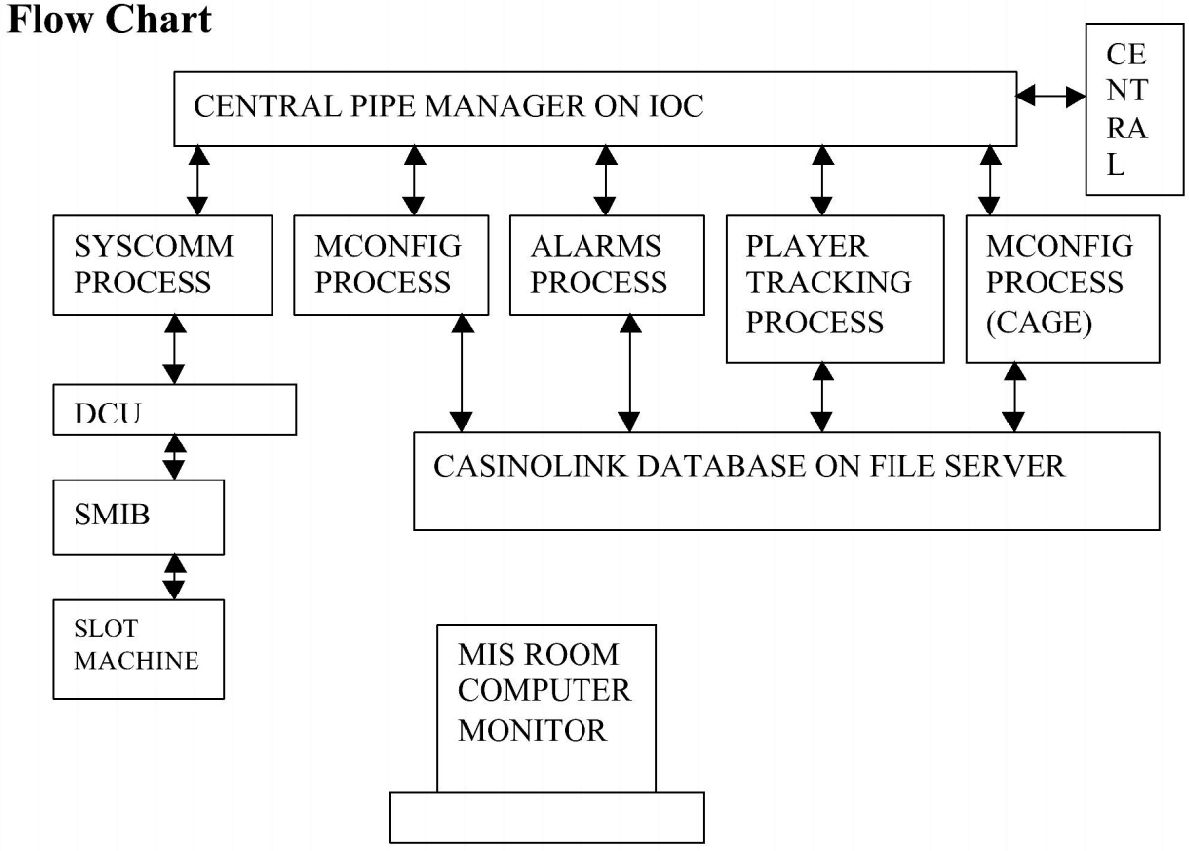
When the DCU receives permission from the system to allow the SMIB to log on, the DCU will assign a SMIB an address. Communication is then established and a default message appears until communications has been linked.

The DCU's communication chips are U34, U33, U32 and U31. Each channel has its own.

The PTM Error Codes

98 "M" CODES
1 COIN IN JAM
2 COIN OUT JAM
3 STACKER JAM
4 HOPPER EMPTY
5 BILL JAM
6 REEL TILT
10 POWER FAIL
11 RAM BIRTH
12 SERIAL # CHANGE
20 DROP FULL
22 POWER UP RESET
23 RESET DURING PAY
24 POWER UP RESET
25 BV RESET
26 OVERPAY
27 HP JACKPOT
28 INVALID COIN IN
29 COIN IN REVERSE
2A HOPPER JAM
2B DOOR OPEN
2C MSG CENTER FAIL
2D SERVICE REQUEST
2E GAME RESET
50 REEL TILT #1
51 REEL TILT #2
52 REEL TILT #3
53 REEL TILT #4
54 REEL TILT
5A CASH BOX REMOVED
5B CASH BOX INSTALLED
5C CASH BOX FULL
5D STACKER ERROR
5E STACKER WORKING
60 GAME DOOR OPEN
61 GAME DOOR CLOSED
70 BILL ACCEPT FAILURE
71 BILL ACCEPT COMM.
72 BILL RETURNED
73 HARD METER FAILURE
74 JP RESET
75 GENERAL TILT
76 EXTRA COIN PAID
77 DIVERTOR FAILURE
78 GAME OPTIONS CHANGE
79 METER MISMATCH

Flow Chart



7A DOOR SW. FAULT
7C GAME NOT RESPONDING
7D GAME RESPONDING
A0 RAM ERROR
A1 EPROM ERROR
A2 EEPROM ERROR
DA INVALID GAME
DB KEY ACTIVATED
DC COIN IN OPTIC FAULT

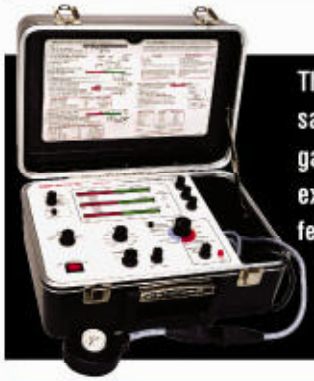
98 CARD "S" ERRORS
B0 GAME NOT RESPONDING
B1 GAME RESPONDING
10 POWER FAIL
11 RAM BIRTH
12 SERIAL # CHANGED
13 SMIB OFF LINE
14 SMIB CAN READ ID
15 RAM CHECK ERROR
16 METERS LOST
17 METERS FIXED
18 DCU TX PURGED
19 DCU TX FULL
1A ROM CHKSUM CHANGE
1C DCU TX CORRUPT
1D BILL METERS LOST
1E NO GAME TYPE SET
30 PTM NOT RESPONDING
31 PTM RESPONDING
32 PTM RX OVERFLOW
33 PTM CS FAILURE
34 PTM VERSION CHANGE
35 PTM CARD ABANDONED
40 DCU NOT RESPONDING
41 DCU CRC FAILURES
42 DCU RX OVERFLOW
43 DCU NOT ACKNOWLEDGED
44 DCU TOO MANY COMMUNICATION ERRORS
45 GAME TOO ACTIVE
47 BILL METERS FIXED
48 SMIB RESET
49 SMIB ONLINE
5A SMIB LOST DCU COMMUNICATIONS
5B MACHINE PROPERTIES CORRUPT
5C WATCHDOG RESET
5E ROM SIG MISMATCH
5F ROM SIG LOST
60 ROM SIG DISAGREEMENT
61 DENOM MISMATCH
62 SDB CORRUPT
A0 RAM ERROR
A1 EPROM ERROR
A2 EEPROM ERROR
A3 BATTERY LOW ERROR

Gaming Solutions From
SENCORE
Sencore Analyzers Offer The Ability To Troubleshoot Any Game, Putting You Back In The Revenue In Half The Time!

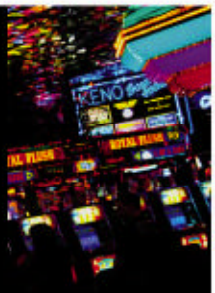
The LC103 ReZolver™ analyzes all capacitors and coils in any game's switch mode power supply (SMPS) with the push of one button . . . IN-CIRCUIT!

On-Site Training
Call Us About Custom On-Site Training For Groups Of 12 Slot Techs Or More!

The CM125 "Pix Pak"™ gets any video game monitor (RGB format) back in action faster using industry standard analyzing test signals for super-fast signal tracing and troubleshooting.



The CR7000 "BEAMRITE"™ safely analyzes all video game CRTs. Plus an exclusive reactivation feature extends CRT life for longer floor time and more revenue.



Please contact us about your surveillance, engineering, and attractions test equipment needs.

SENCORE
1-800-736-2673
www.sencore.com • e-mail: sales@sencore.com

Overview

I have been exposed to the Mikohn's Casino link system coming on three years now, and by no means am I an expert on this system. We do not have access to the accounting or report writing, and the central site set ups but far as a technician's point of view for the set ups, repairs, technical support, and troubleshooting, the system has its good points and bad points like every other system we use in the gaming industry.

One of the good things about the system is that the technical support hotline is 24 hours. When you cannot access the soft meters, the Mikohn systems reads the CPU board's meters so you can have a accurate account of coin in, out, drop, and all bill meters. The DCU RAM clear and the IOC power fail procedures are pretty simple to do. Troubleshooting problems is not to hard either with all the LEDs on the DCUs and SMIB boards that make good reference points for troubleshooting. The parts are easily repairable, along with the floor layout set-up.

Learning the Casino Link computer comes with experience and exposure to the system, through faults and guidance from the central site technicians. Some things that I find as a technician that could be improved is when taking meters, the number scroll too fast, especially for me. I am not used of writing six, seven, or eight figure numbers all at once. They should utilize the keypad. With some games, the 99 cards has to be constantly taken out and re-inserted just to get the last 4 numbers of your meter. Just think of doing this for every coin meter and bill meter. The best way to beat this was to take the soft meters first and then verify the numbers against the Mikohn's.

Other little things about the system are with so many different sites hooked up to the Casino Link system, weekly maintenance is needed at the central location to stop the system from crashing. During a power fail or when the system goes down, on all the Bally reel games, you must check for those infamous "M00" codes. Some can be reset just by opening and closing the main door, which starts the "M" codes to work, or by doing a partial clear. This is always a pain in the butt because now the gaming commission needs to be present. We are constantly monitoring the DCU lights and monitor for any errors and system problems.

Overall, a couple of minor improvements for the technicians and the system will be very tech friendly. So when it's all said and done, you can say an accounting system, is an accounting system, is an accounting system. They just go about doing things a little differently with the same goal in mind. I would like to thank the slot technicians that I work with, management, central, and Mikohn's Casino Link technical support for helping me bring this to you.

- Kevin Noble
knoble@slot-techs.com

MicroTouch®

You Know Our Touchscreens!

If you're involved with designing, servicing, and maintaining touch gaming machines, you know all about MicroTouch capacitive touchscreens…or do you?

Did you know that:

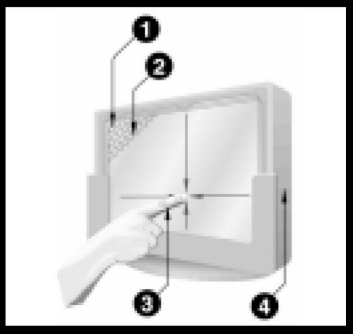
- Over 90% of all touch gaming machines rely on MicroTouch's capacitive touchscreens, worldwide.
- Capacitive touch technology is the most reliable touchscreen on the market, tested to over 225 million touches without failure
- Based on extensive field experience, there's negligible maintenance required and less machine downtime with MicroTouch touchscreens.
- Capacitive touch technology is unaffected by on-screen contaminants, such as spilled liquids, dust, and dirt.
- ClearTek® 3000 capacitive has antibacterial characteristics called "CleanScreen," which controls the growth of bacteria and other microorganisms on the surface of the touchscreen.

MicroTouch has been changing the way casino and bartop video games have been played for nearly 20 years. And, it's all due to the durability and reliability of MicroTouch capacitive technology.

MicroTouch — Keeping you in the know.

Visit www.microtouch.com/touch90 for information about MicroTouch touchscreens and to receive your free TouchJacks CD game.

How ClearTek Capacitive Touchscreens work

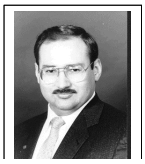


Voltage is applied to the screen **(1)** and the electrode pattern uniformly distributes the low-voltage field **(2)** over the conductive layer. When a finger touches the screen **(3)**, it "capacitively couples" with the voltage field, drawing a minute amount of current to the point of contact. The current flow from each corner is proportional to the distance from the corner to the finger. The controller simply calculates the flow proportions to locate the touch **(4)**.

Preparing for the Risks of Thermal Printer Failures on Coinless Slot Systems

Jeff Paunicka

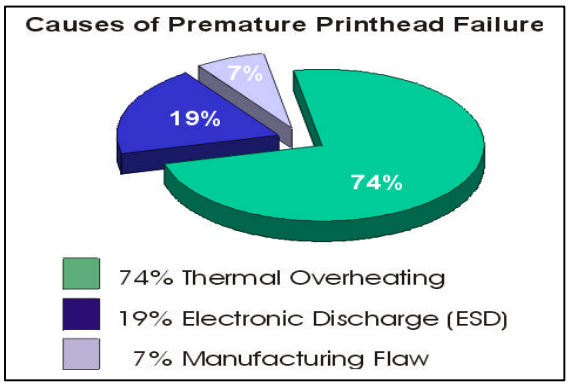
Guest Columnist



Now that many casinos are considering coinless slot machines, slot managers are becoming more aware of the importance of the thermal printers role in the slot systems and maintenance programs to protect their investments. There are simple steps to prolong the life and optimize performance of their thermal printheads and reduce costly service calls

Thermal printers are taking a major role in the production of "take-out" tickets for the payouts. The coinless systems increase the efficiency of the casino operations by reducing the overhead required to handle the coins, but the proper operations of the thermal printer becomes more critical for the system to work as designed.

Dirty printheads result in misprints, misreads, premature head wear, downtime and player discontent. In bar code printers, the main cause of premature printhead failure is the thermal printhead overheating due to a buildup of residue and other contaminants. This creates a baked-on coating that heat produced by the pixels on the printhead



cannot penetrate. The trapped heat, or latent heat, burns out the pixels on the printhead. This is known as "pixel failure". With bar code thermal printers, failure of only two dots can either make the symbologies very difficult to read or render the printhead useless for the printing of accurate bar codes. This would mean that a player *must* go to cashier with the poorly printed barcode for redemption before playing another machine.

Slot Department maintenance can have a direct and dramatic affect on the productive life of a printhead. According to a leading thermal printer manufacturer, having a regularly scheduled preventative maintenance program can decrease the number of printhead failures by 80%. Other than the cost of replacing the head, there are the not-so-hidden costs of neglect, which include lost production, player and cashier dissatisfaction, frequent service calls, and premature equipment replacement

Preventative Maintenance

What can you do to reduce the risk of this sort of damage to your equipment? Establish a cleaning program using a product designed specifically for your equipment. Cleaning should be convenient for operators and scheduled at consistent intervals, ie. when you change ticket stock for example. This does not replace the scheduled service checkups this equipment needs, but it will greatly reduce unexpected and unproductive downtime

What sort of cleaning products are available, and how do you select a reliable source that provides a consistently good product?

Presaturated cleaning cards – soft spun-woven material saturated with 99.9% isopropyl alcohol -- come in standard sizes. Slot operators simply feed the card through the printer as you would any ticket stock, and it will remove contaminants from the printhead, guide paths, and rollers. They don't have to worry about messy chemical spills or damage to the printhead, an advantage over the old "swab" method.

Thermal printer cleaning pens, which also look like marking pens, also contain 99.9% isopropyl alcohol and are designed to clean easily accessed thermal printheads. They are also ideal for cleaning the printer when the printhead is removed for scheduled maintenance.

When selecting a vendor, look for a company with a responsive engineering department that is willing to work with you to provide the most effective product for your application needs. Request product samples from the vendor.

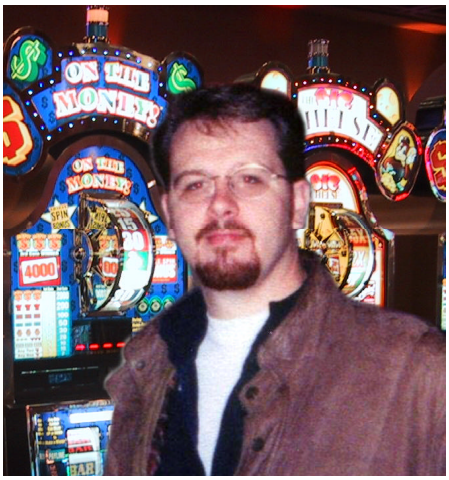
With casinos tightening their financial belts, smart operators are finding that it is better to invest in quality cleaning products now rather than take a hit in the capital equipment budget down the road. By following a regular maintenance schedule, you will extend the life of your slot machine thermal printer and ensure optimal performance.

About the Author

Jeffrey Paunicka is the President of *INSIGHT3*, South Bend Indiana USA. He holds a degree in Chemistry from John Carroll University and a Masters in Business Administration from the University of Notre Dame. The company can be reached at (800)949-0361

Complex Peripherals

By Ken Locke



Algorithmic coding, hexadecimal data packages, DUARTs and QUARTs and primary and secondary SAS protocols. Sounds about as complex as a Tom Clancy plot on LSD, but that's exactly what's on my mind. And, since you you're probably sitting on the can as you read this, I can assume I have your full and complete intellectual attention.

It is simple enough to understand that simple peripherals need only an 'on' or an 'off' to be noticed by a 80960 microprocessor. Last month we discovered what kind of signals are considered simple. Coin-in, coin-out, handle, candle, player panel switches and meters are among them. The list goes on and on.

What about the more sophisticated stuff that adorns today's slots? Bill validators and touchscreen communication boards are hardly new, but they communicate with our processor in a very unique way. They are complex processing units in and of themselves and in large part can act independently from the slot machine entirely.

Vacuum florescent displays and the new thermal ticket printers complete the list of complex peripherals. Most techs are familiar with the fundamental operation and basic care and feeding of most these external devices. Many times however, board level repair and detailed theory is reserved for the skills and education of bench technicians. Even then, is it practical to pay this guy $25 per hour for eight hours for a part that is more cheaply replaced?

At any rate, to understand where we are going with all this, it is important to know where we've been. In the old S-Plus/PE Plus platforms we might have run across something called a UART. UARTs (Universal Asynchronous Receiver Transmitters) or SIO's (Serial Input Output) or ACIA's (Asynchronous Communication Interface Adapters) as they are sometimes called. These are used to send data serially over one single line per direction.

Generally, for organized communication between a processor and multiple external devices, a clock pulse is needed to keep things in order. This UART however, doesn't need no stinking clock. Because it does not share a data line with anything else, dedicated signals for each device just comes pouring in regardless of synchronization. When we added both the bill acceptor and player tracking ports to the slot machine, we needed two separate channels for communication. So DUARTs or Dual Universal Asynchronous Receiver Transmitters were installed.

That Was Then. This Is Now.

Touchscreen communication boards transmit complicated data to the processor. They compute how much electricity must be applied to the screen, how much current must be drawn from the screen by the human finger, sufficient to trigger a signal that must translate further to an XY coordinate. That coordinate, in turn, equals a command to the processor, all within a couple of microseconds. I'd say that was a complex device, wouldn't you?

VFDs on the S2000s and the new thermal printers all communicate in this way. Chuck in a few fancy-shmancy player tracker systems, wide-area progressives and EZ Pay, and this shiny box becomes Chatty Cathy.

So along comes the Quad Universal Asynchronous Receiver/Transmitter or QUART. This relatively new component has four distinct communications channels. There two on each of the 80960 based processor boards for a grand total of eight channels. The best way to get a look at them is via the Communication Channel Analyzer.

For whatever reason, this option is only available on IGT's video product line. However, this can be a very effective tool to troubleshooting everything from the player tracker system to a thermal printer. To get a look at this little understood option, press the operator's test switch on the processor, enter the Diagnostics menu and select Comm. Channel Analyzer (see figure 1).

Notice the channels one through eight displayed in the lower right. There is some very cool stuff here. Select channel five.

A series of scrolling hexadecimal codes in blue immediately begin scrolling in the top cell. It is labeled Netplex Ver. 5. The Netplex is nothing more than the communications protocol from the main processor to its assigned complex peripherals. What you're seeing here on the screen is the processor periodically communicating with these peripherals in the machine. This usually comes in the form of a Cyclical Redundancy Check or CRC. This is the machine's nice way of saying "Hey. Are you the same bill validator I had a few microseconds ago?"

Further inspection reveals a repeating pattern of subsets indicated in yellow. 02, 03, 04 come just following a stream of data (trust me they're yellow).

Try this…touch the lower part of the screen briefly and then quickly hit the Start/Stop button. Once the display has stopped push Page Up until you can identify a significantly longer stream of blue hex code. A yellow '03' should follow that stream. A little logic (and confirmation from some firmware buddies of mine) dictates that 03 represent our touchscreen communication board.

Additionally, 04 denotes the bill acceptor and 02 our thermal ticket printer. All qualify as complex peripherals and they all talk on the Netplex.

Next, touch the bottom cell so that it too is highlighted purple. Now, take a look at yet another communications channel. All we need to know is which one. Channel 2 is usual reserved for a Bally Miser system, Channel 3 is used for Acres, CDS and various other player tracking applications. Channel 8 is standard for wide-area progressives and the new EZ Pay ticket-in, ticket out system.

Again, we see a stream of data packages that represent some form of communication, this time from the machine to a host system. If any of you are now thinking I am about to tell you how to convert hexadecimal code into ASCII to some semblance of human

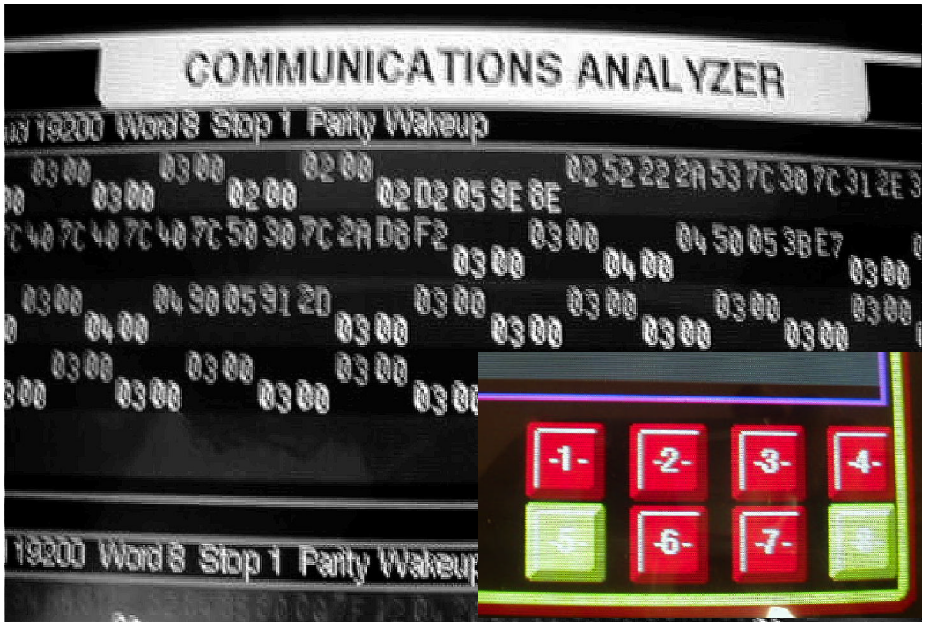
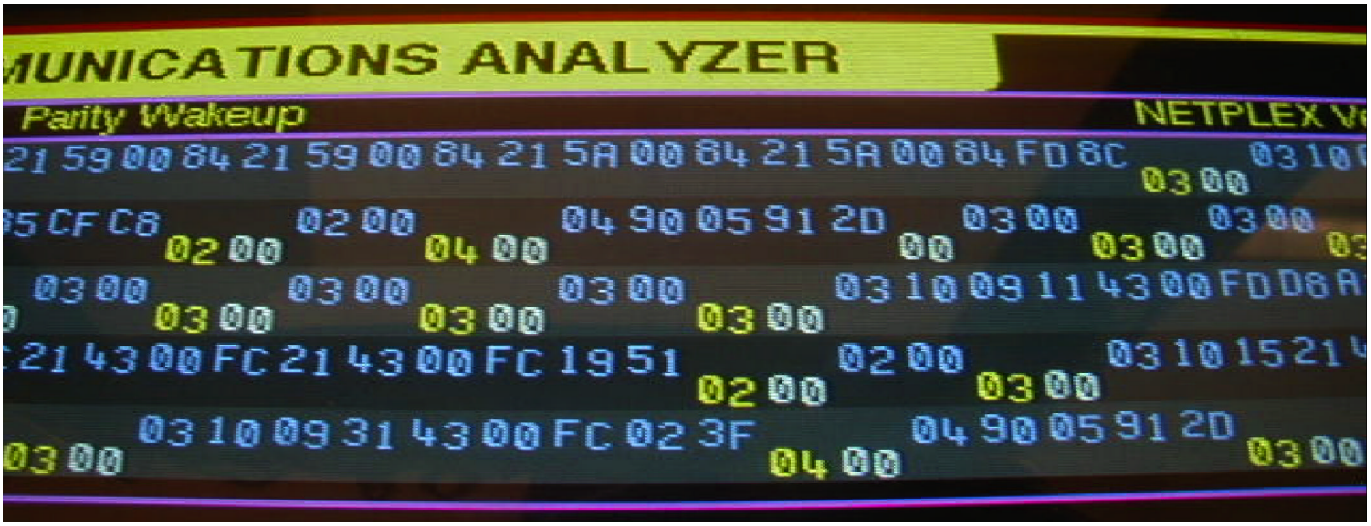


Figure 1 - Shaky screen shot of the Communications Analyzer
I hope Santa brought Ken Locke a tripod for Christmas - ed.



recognition, think again pal. I might as well try to snatch a baked ham from Oprah's dinner plate. It'd take a lot guts and even if I succeed I will probably lose a couple of fingers. Okay, bad analogy but it would be really, really difficult is all I am trying to say.

Where was I? Oh yes, data streams. Is it important to know precisely what is being communicated? No, only that it is happening in the first place. Can you troubleshoot communication on the QUARTS? To some degree, however, it would be only internal to the machine. Exit the Comm. Channel Analyzer, back out of the Diagnostics and then down to Set-Ups and select Machine Set Ups. Depending your version of firmware you should see an option labeled Auto Config Netplex.

It is here we can give all the aforementioned digital doohickeys the quintessential kick in the tushy. A Netplex auto-configure, in essence, forces the processor to go out and shake hands with the BV, printer, et al. If we discern from either machine performance or an educated glance at the analyzer that one them is giving us problems, an auto-configure may be just the cure. Auto-configures are also done upon power up, but considering that new 960 platforms take from one to four minutes to fully boot up, it would mean more machine down time. Besides, there's all that coffee to drink and cigarettes to smoke back in the shop. A tech has to have his priorities.

In other news, I want to say thanks to all the techs at Viejas Casino in San Diego for their enthusiasm and hospitality during my last visit in December. A good time was had by all and I hope to see you all again very soon. Keep those e-mails pouring in. I love hearing from you.

- Ken Locke
ken.locke@igt.com

Atronic at ICE 2002

At the ICE 2002 Atronic International will present a wide range of new games, accessories and signage, this time on an even bigger booth than ever before.

The products on display will include some of Atronic's most popular Cashline video slots like the famous THREE WISHES, CHICKENDALES or CRAZY FRUITS as well as many brand-new Cashline games such as BABOOSHKA, a Russian theme based on the famous Matryoshka dolls with stunning graphics and great sound arrangements. Players can experience an exciting base game and two bonus screens, the Babooshka Collect bonus and the Red Babooshka Roulette bonus.

One of the major highlights will be the new SPHINX II game. Better and more captivating than ever, SPHINX II is the logical evolution of Atronic's already legendary SPHINX game, featuring fantastic sounds, enhanced graphics and new bonus features. SPHINX II comes with an amazing three-tiered bonus – the Reels of Ra, the Sphinx Chamber AND, in case of playing double bet – the mysterious and exciting Tutenchamun's Treasure bonus.

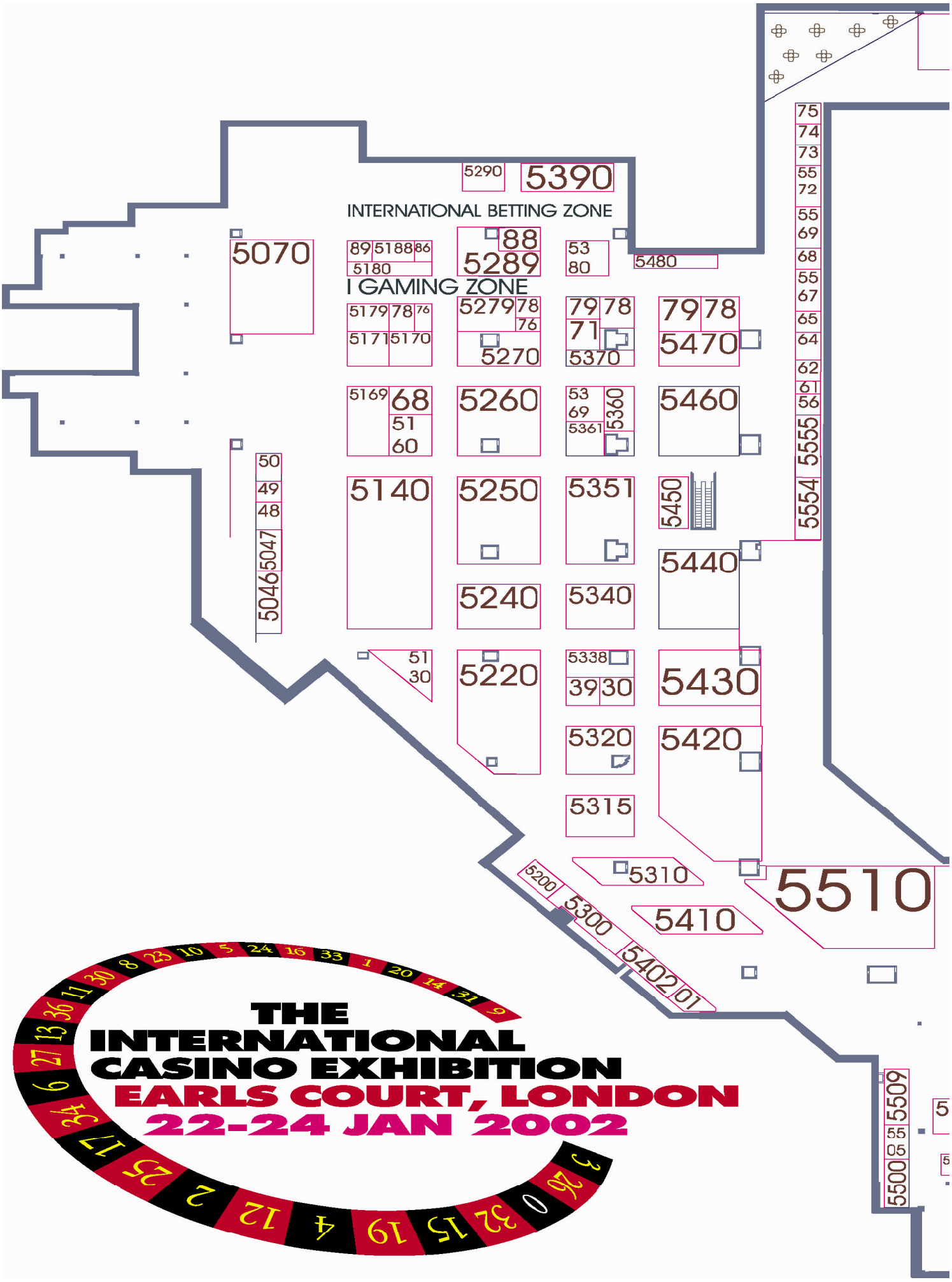
Fun and music combine in BEETLES UNPLUGGED with a base game featuring the fabulous Beetles band jamming away on many different tunes. The wild symbol doubles the prize in any winning combination and during the free game bonus all prizes are tripled while the bonus may be won again during the free games.

A real attraction will be Atronic's TITAN, the world's only oversized video machine featuring all of Atronic's successful CASHLINE games.

The company will furthermore unveil several brand new games, which will have a premier at ICE 2002. And, typically for Atronic, there will be some real highlights and surprises. During Atronic's traditional happy hour visitors can enjoy a cool drink and a chat in a relaxed atmosphere. Additionally, a lottery with will take place every day of the show with lots of valuable prizes.

Visit Atronic at stand # 5140

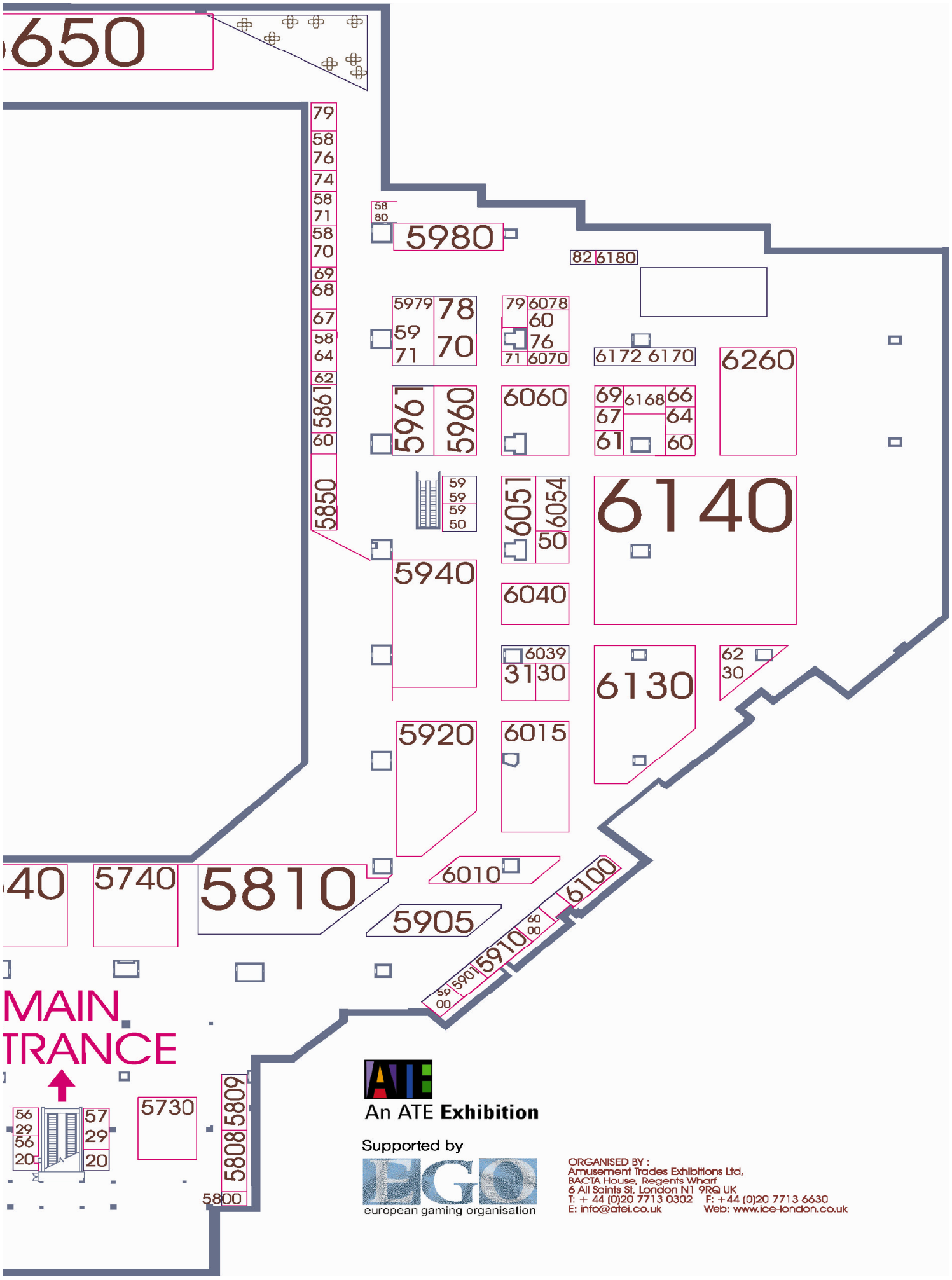
Atronic International GmbH
Borsigstrasse 26
32312 Luebbecke
Germany
Fax +49 (0) 5741/273-727



THE INTERNATIONAL CASINO EXHIBITION

EARLS COURT, LONDON

22-24 JAN 2002


650
79
58
76
74
58
71
58
70
69
68
67
58
64
62
5861
60
5850
58
80
5980
82 6180
5979
78
59
71
70
79 6078
60
76
71 6070
6172 6170
6260
5961
5960
6060
69
67
61
6168
66
64
60
59
59
59
50
6051
6054
50
6140
5940
6040
6039
31 30
6130
62
30
5920
6015
40
5740
5810
6010
6100
5905
60
00
5910
59
00
5901
MAIN
TRANCE
56
29
56
20
57
29
20
5730
5809
5808
5800
An ATE Exhibition
Supported by
european gaming organisation
ORGANISED BY :
Amusement Trades Exhibitions Ltd,
BACTA House, Regents Wharf
6 All Saints St, London N1 9RQ UK
T: + 44 (0)20 7713 0302 F: +44 (0)20 7713 6630
E: info@atei.co.uk Web: www.ice-london.co.uk

Bally Gaming and Systems to Showcase 29 Slot Titles at ICE Trade Show in London

What do a crusty sailor with an appetite for spinach, a vivacious Roaring '20s flapper with a flair for adventure, a blonde-haired career woman with a bumbling husband, a world-famous icon of beauty and sophistication and two American musical legends all have in common? They're just a few of the 29 inventive game titles that Alliance Gaming Corporation's Bally Gaming and Systems unit will premier at the prestigious International Casino Exhibition (ICE) in London January 22- 24, 2002 at Earls Court.

ICE, one of the world's largest gaming trade shows, is an ideal showcase for Bally Gaming to debut a variety of new video titles and a large selection of reel-spinning games to the growing European casino industry. These new and updated games feature well-known licensed titles such as Ray Charles™, Popeye®, Betty Boop™, Frankie and Annette's Beach Party™, Blondie® and Andy Capp™.

Also debuting at ICE will be the first in a series of sophisticated games created under an exclusive licensing agreement with Playboy Enterprises International, Inc. The first Playboy game will be displayed on an S6000 machine targeting high-end reel-spinning players.

"These new games have a creative edge to them that we feel will give the European market a new level of entertainment on the gaming floor," said George Steiner, Manager Director of Bally Gaming's European operations. "Our game developers have been hard at work and we now feel we have the variety across all platforms that will appeal to all segments of the international market."

In the category of licensed games, Bally Gaming plans to leverage the global popularity of such well-known cartoon characters as Popeye The Sailor Man, Betty Boop, Blondie and Andy Capp. These beloved comic-strip characters now come to life like never before thanks to the company's unique new Evolution Series (EVO™) video and hybrid reel-spinning devices. This breakthrough technology, based on the highly stable Microsoft® Windows NT® Embedded software platform, offers an unsurpassed interactive gaming experience, with crisp graphics, superior audio and the ability to rapidly develop and deploy an array of innovative game titles to the European market.

In the new Popeye EVO VIDEO and EVO HYBRID machines, for example, Popeye and his famous cast of lovable supporting characters – including Olive Oyl, Brutus, Wimpy and Swee'Pea – are brought to life in vivid cinematic style. The game's primary bonus round features an interactive high-seas battle with authentic dialogue and sound effects, culminating in a climactic shipboard slugfest between the courageous Popeye and the bullying Brutus.

Sharing the technologically advanced EVO spotlight with the feisty Popeye at ICE are two of the world's most popular comic strip heroines: Betty Boop and Blondie. In Hollywood Betty Boop™, the shapely flapper with the giggly voice stars in a series of animated back-lot adventures that include being shot from a cannon and taming a ferocious tiger. And in the Blondie Double Feature™ EVO VIDEO, Blondie and Dagwood Bumstead entertain players in the bonus round with their own hilarious domestic misadventures, such as Dagwood's classic run-in with the

mailman and Blondie's love for shopping.

Also debuting at ICE in London are unique video games with a decidedly upbeat musical theme. Two new Ray Charles games – America The Beautiful™ and What'd I Pay™ – spotlight the rich graphic detail, dynamic sound and enhanced interactive capabilities of the EVO platform. The What'd I Pay EVO VIDEO pays tribute to Mr. Charles' legendary singing career, assisted by "The Paylettes," gorgeous stage companions who help convey the sights and sounds of a classic Ray Charles concert experience. America The Beautiful is a new EVO HYBRID game that combines classic reel-spinning action with EVO's advanced interactive video technology. The game stars Mr. Charles in a stirring on-screen performance of his beloved musical classic. In addition, the America The Beautiful game will feature audio-assist and Braille functions for the visually impaired.

Another classic musical tribute is Frankie & Annette's Beach Party™, an EVO VIDEO game featuring America's favorite teen sweethearts, Frankie Avalon and Annette Funicello. Thirty-five years later, the twosome is back in a tuneful takeoff of their immensely popular beach party movies, such as "Beach Party," "Beach Blanket Bingo" and "How To Stuff A Wild Bikini." The lively bonus round features Frankie and Annette judging a swinging 1960s beach dance contest, complete with actual film footage of "groovy" dance steps.

Bally Gaming will also use the ICE show to introduce a variety of other exciting video and reel-spinning game titles to the European market. These include popular stateside reel-spinning games such as Hot Lines™, Bonus Line™, Bonus Times™, Bonus Frenzy™, Rapid Double Jackpot™, Super Blazing 7s™ and At The Hop™. Other video titles slated for introduction include The Heist™, Texas Cash™, Platypus™, Play the Market™, Money Poppers™, 99 Bottle of Beer™, Run the Table™, Soap Opera™ and Cash Encounters™. Additionally, a new near-area progressive reel-spinning game with a high-mounted roulette wheel, appropriately called "Monte Carlo," captures all the sophisticated jet-setting action of Monaco's exclusive gaming salons.

Rounding out the new Europe-bound offerings from Bally Gaming are three new "bar top" video poker games: No Faces Pay The Aces™, Triple Chance Poker™ and Improve Your Hand Poker™. Each of these games play like standard video poker games, but offer players a variety of exciting features, such as player-selectable auto hold, multiple hands and paytables and lucrative top awards.

In addition to the variety of offerings from Bally Gaming, the company's SDS® slot accounting system from Bally Systems will be on display with a variety of new features showcased for the first time in Europe.

Bally Gaming and Systems, a wholly owned business unit of Las Vegas-based Alliance Gaming Corporation, designs, manufactures, operates and distributes advanced gaming devices and systems worldwide. Additional information on Bally Gaming and Systems can be found at www.ballygaming.com.

Betty Boop™ © 2001 King Features Syndicate, Inc/ Fleischer Studios, Inc. ™ Hearst Holdings, Inc. / Fleischer Studios, Inc.
Blondie™ © 2000 King Features Syndicate, Inc / Hearst Holdings, Inc.
Popeye® © 2001 King Features Syndicate, Inc / ™Hearst Holdings, Inc.
Ray Charles™ Andy Capp ©2001 M.G.N. LTD.
© 2001 Playboy

Slot Tech Product Announcement

WMS Gaming Selects Coin Mechanism's MC-40 for Use in Slot Machines

Coin Mechanisms, Inc. has announced that WMS Gaming has selected its model MC-40 Micro Comparitor® for use in its slot machines. WMS made its selection based upon extensive co-development, testing, and evaluation.

The MC-40 is a microprocessor controlled coin validator that features on-board credit optics. Its updated coin path geometry eliminates "shingling." Sophisticated timing algorithms monitor the passage of each coin, confirming validation and acceptance and eliminating the risk of stolen coins or false tilts. Dynamic accept gate timing allows the MC-40 to adjust automatically for the diameter of the coin selected for validation.

Additionally, the MC-40 features optic emulation. The MC-40 bypasses the credit optic assembly supplied in WMS machines and outputs a simulated signal that the machine's MPU can process. This permits the MC-40 to control both the validation of coins and tokens and the issuance of credits to the gaming device…all without modification to the machine's firmware! The MC-40 will not only be supplied in WMS slot machines as original equipment, but also can be purchased as an upgrade for existing installed gaming machines.

Coin Mechanisms, Inc. is the market leader in supplying coin validation devices to the global gaming machine industry. Its Coin Comparitor® and Micro Comparitor® platforms are offered as standard original equipment by every manufacturer of regulated gaming machines. Its Intelligent Comparitor®, used as part of the SmartMark security system, is the market leader in high security applications utilizing optical recognition of gaming tokens. The recently introduced DEFENDER Series offers the highest level of security yet offered for non-optically marked coins and tokens.

Coin Mechanisms, Inc. sells to original equipment manufacturers, distributors, and directly to casinos. With its headquarters outside of Chicago, it offers field support through sales offices in Montreal, Sydney, and Johannesburg and through its European sales agent, Eurocoin Ltd., in London.

Contact:
Richard H. Currie
Coin Mechanisms, Inc.
800 Regency Drive
Glendale Heights, IL 60139
Toll Free 800-323-6498
Tel. 630-924-7070
Fax 630-924-7088

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

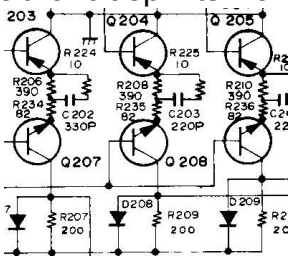
This relatively inexpensive piece of test equipment is easy to operate. Casino School students learn to use the digital multimeter to perform tests and measurements that will pinpoint the cause of a failure down to a single component.

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.

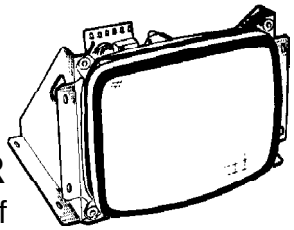
SCHEMATIC DIAGRAMS

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

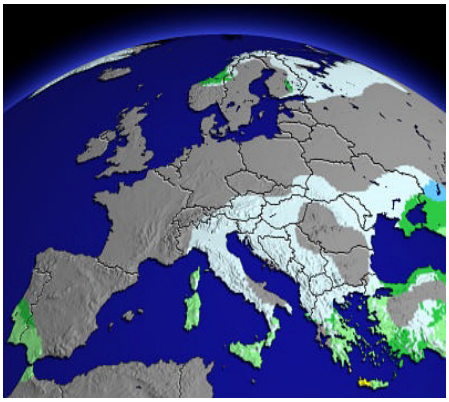
The monitors used in video slots are designed for quick, easy, and safe repair. Students will learn the theory of operation of all types of monitors and how to repair monitors down to the component level. Of course, monitor safety will also be discussed.

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

Randy Fromm's Casino School 1944 Falmouth Dr. El Cajon, CA 92020-2827
tel.619.593.6131 fax.619.593.6132 e-mail CasinoSchool@randyfromm.com
For a complete brochure, visit the website at: slot-techs.com

International View

By Martin Dempsey



New Stella AWP machine For The Czech Republic - NIGHTLIFE

STELLA INTERNATIONAL proudly presents the release of its new AWP machine for the Czech Republic, NIGHTLIFE. With a maximum win of 300 credits NIGHTLIFE targets visitors to pubs. NIGHTLIFE features a basic game with one winline, two different stakes and the question mark as Criss Cross symbol. The club game plays with 5 winlines, 2 different stakes and a special wild symbol. As well as the 750 version NIGHTLIFE DE LUXE, firstly presented at the "World of Entertainment" show in Prague in May, this game concept fascinates with its exciting features as Respin, multiple and repeated wins and the dynamic risk ladder up to a maximum win of 300. The possibility of risking half win will inspire the player. NIGHTLIFE will be presented by STELLA INTERNATIONAL at the IMA 2001 trade show from 15th to 18th of January 2002 in Nuremberg (hall 1, stand no. C65) and at the ATEI 2002 trade show from 22nd to 24th of January in London (stand no. 810). At the IMA and the ATEI trade shows in January STELLA INTERNATIONAL will also present all current AWP games for the Eastern European markets, the latest AWP machines for the Spanish market and Fun games for the German market.

Increase In Gaming Machine Prize Levels

At the recent BACTA Convention in London, the Rt Hon Richard Caborn, Minister for Sport announced an increase in prize levels for gaming machines. The jackpot for all cash AWPs has been increased from £15 to £25. The level for Casino Jackpot Machines has increased from £1,000 to £2,000. There has been no increase in stakes and no increase in the payout for Jackpot Machines in Clubs. Mr Caborn was unable to confirm a timetable for the changes. However, industry speculation would suggest an implementation date of the end of January / beginning of February 2002.

Cliffhanger Has The Edge

Vivid Gaming's latest AWP Cliffhanger is already proving to be another major cashbox success. The game is visually quite different, features a special four-stage main feature, and gets its origins from an extremely successful game platform. For casual players Cliffhanger offers an attractive fun game that is easy on the eye. For regular players the game provides strategy and skill, enabling them to take the higher risks for big cash wins. At the heart of the game is the challenge of climbing the 'feature mountain' to get to top awards, so lighting three Vivid flags from the bonus panel fast-tracks players up the mountain. Vivid stripes on reel bands need to be watched for - they activate a set of Vivid features! Cliffhanger has highly distinctive, quality graphics and audio support and is presented in the stylish New Genesis cabinet with an optional note acceptor. No suspense then, as Vivid Gaming has clearly created yet another game of maximum challenge and enjoyment - not to mention cash box earnings! For further information please contact Peter Davies

at Vivid Gaming. Tel 01283 500066.
E-mail: peter.davies@igt.com

The Netherlands Soon To Enjoy IGT's South Park Game

All the South Park cartoon characters have packed their belongings and moved to Holland - Holland Casino, that is! IGT-Europe b.v., in a cooperative effort with Holland Casino, has recently received regulatory approvals for many IGT game themes, including South Park, to be installed in the Netherlands. With a long list of proven games to choose from, Holland Casino put together an order consisting largely of IGT video games, along with the latest S2000 reels and Vision Series uprights. Dutch players will enjoy a fresh game mix of 181 machines and for added player comfort, one-third of the games will ship as LXS slant tops. The order list looks like a Who's Who of IGT game themes. Nine-line South Park, with an awesome seven bonus games, won't be alone. This year's highly successful 17" iGame-Plus themes Little Green Men, Texas Tea and Cleopatra are due for November installations. To tempt the many Dutch reel players, great new reel games Titanic, Phantom of the Opera and Cigar are on their way in the form of very attractive progressives. So, Kenny, Cartman and the whole South Park gang will debut in Holland Casino soon, complete with enough goofy animation, voice overs and fun bonus features to entertain all of Holland.

The Road To The Holy Grail

Barcrest, the UK's leading manufacturer of gaming machines is delighted to announce the launch of its latest AWP, Monty Python and The Holy Grail. Using the theme of this hilarious film the game features 'Sir Lancelot the Brave', 'Sir Galahad the Pure', 'Sir Robin the Not-quite-so-brave-as-Sir-Lancelot' and the aptly named 'Sir Not-appearing-in-this-fruit-machine'. This latest Barcrest game, in the New Genesis cabinet, incorporates a well proven game platform with the addition of a new name

fill feature to guarantee extra entertainment for players. Feedback indicates the game is popular with casual players in addition to regular players, thus providing greater potential revenue streams in all locations. For more information about Monty Python and The Holy Grail or other Barcrest products a visit to http://www.barcrest.com will be of further help. For further information please contact Rosie Littlewood at Barcrest. Tel + 44 (0)161 339 0212. E-mail rosie.littlewood@igt.com

Maygay Restructures Distribution

Maygay Machines has today announced that Deith Leisure will cease to be a distributor of the company's product as of January 1st, 2002. Dean Harding, Maygay's Sales and Marketing Director, issued a statement saying: "The UK coin-op market is changing virtu-

ally by the day. Within the Maygay Group, we feel that there are too many distributors and sub-distributors, with a vast array of conflicting products. By making this move, we aim to re-focus our remaining distributors and back them fully with a quality product portfolio from our three brands. This is a bold step, but it has been mutually agreed by both Maygay and Deith, for the benefit of both companies. The future of our domestic market requires a fresh approach, and the Maygay Group will, as usual, be at the forefront of positive change." Mr. Harding went on to make it clear that Maygay and Deith will continue to work together to support that product that is out in the field, and that which will be sold between now and the conclusion of their distribution agreement. For further information contact Nick Hardy, Maygay Group Marketing Manager. Telephone: +44 (0)1902 792320. E-mail: nick@maygay.com

Roll Up For Big Shot Club

Big Shot Club is Red Gaming's first feature-packed game for the club market that has gained plenty of attention and interest since its debut at Preview 2002. The game shows the flair and imagination that the Red team has for creating a game that is very original, yet has all the extra 'ingredients' that are essential for Club game success. From game to game players can uses holds, when offered, to gain reel wins, features or entry into the Big Shot main feature. In addition, all winline cherries transfer into the 'cherry gamble', which can produce either a cash win or a chance for a 'Big Shot'. Each spin of the Big Shot Disc provides the player with the opportunity to win cash awards, including the live Cashpot as well as a chance to spin the Jackpot award. Every cash win offers players the chance to gamble for even bigger prizes via the casino roulette style gamble 'odds multiplier'. In addition, there are seven 'super bonus' features that can be activated by four boxed symbols appearing on the reels. The Big Shot Club game is housed in the stylish, distinctive New Genesis cabinet that delivers benefits of both enhanced security and serviceability. For further information, contact Trevor Greenwood, Tel: 0113 225 4444 trevor.greenwood@mediaworkscd.com

Successful G2E For

Mikohn Corporation

Mikohn Corporation has once again been able to present a number of innovative new slot games at the Global Gaming Exhibition. Visitors were treated to a feast of recognition with BATTLESHIP Winning Encounter, RIPLEY'S BELIEVE IT OR NOT! Adventures in Trivia and CLUE(r) Winning Solution, well-known games in a modern version. BATTLESHIP Winning Encounter game is the second version of Battleship. Following the success of the original BATTLESHIP(r) All Aboard slot, Mikohn refreshes the franchise with an all-new interpretation on the world's most popular game of naval strategy. RIPLEY'S BELIEVE IT OR NOT! Adventures in Trivia game is the first knowledge-based slot game to be introduced into the gaming market. This innovative and exciting game gives players the opportunity to test their knowledge to correctly answer entertaining trivia questions in the game's primary bonus feature. The G2E was the first public unveiling of the CLUE Winning Solution video slot game, the second in Mikohn's Think Big! Series. Featuring a knowledge-based trivia bonus, the new offering extends Mikohn's leadership in creating innovative, highly interactive games for the slot floor, which provide players with greater entertainment value.

- Martin Dempsey

MD Associates
Enterprise Centre Melitta
Road Kildare Ireland
Email mdassociates@eircom.net
Phone + 353 (0)45 521190
Fax + 353 (0)45 521198
Mobile + 353 (0)87 2209732

VISIT THE WEBSITE AT
slot-techs.com

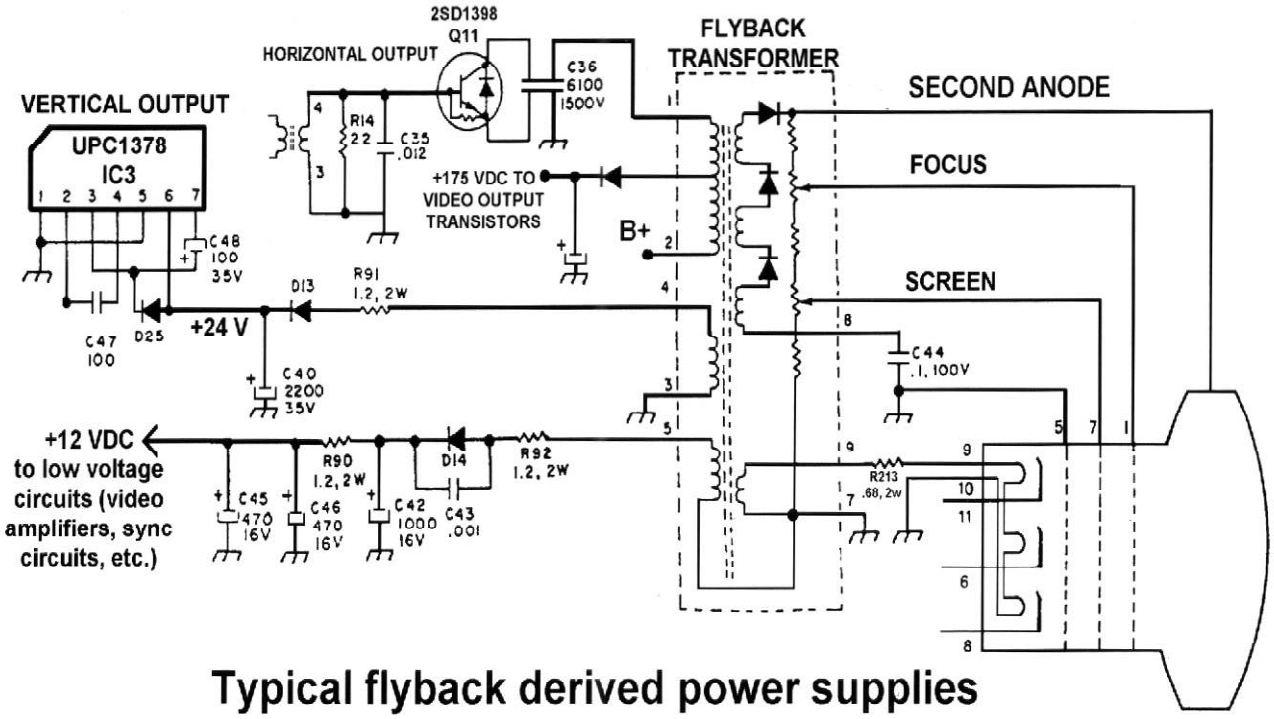
Flyback Derived Power Supplies

At the heart of a monitor's high voltage unit is the "flyback transformer." Like all transformers, the flyback consists of many turns of copper wire wound around a core. Instead of the heavy, laminated iron core that is used in an isolation transformer, the flyback transformer uses a lightweight material called "ferrite." Ferrite is a type of iron impregnated, ceramic material. We can get away with this lighter core material because the flyback transformer operates at a much higher frequency than the 60 hertz operation of the isolation transformer. The flyback transformer in the high voltage unit is driven at approximately 15,750 hertz. That's more that 260 times faster!

Like many transformers, the flyback has more than one winding. The primary winding (the input winding) is used to drive the transformer. This primary winding is also "tapped" at one point to obtain approximately 175 volts. This high frequency, AC output is then rectified with a diode and filtered with an electrolytic capacitor to obtain a +175 VDC power supply. This supply is used to drive the video output transistors on the neck board, which in turn control the electron guns in the CRT.

There are some really high voltage output windings on the flyback transformer. One is the "screen voltage." The screen voltage comes from a high voltage winding on the flyback and is rectified within the EHT unit by a special diode. You cannot see this diode as it is sealed with the flyback in epoxy plastic. The screen voltage is adjustable (generally around +200 VDC - +900 VDC) by a high voltage potentiometer unit that is usually built-in to the EHT unit itself.

Another high voltage output is the "focus" voltage. Like the screen voltage, it is derived from a flyback high voltage winding and diode combination. The focus voltage is also adjustable.



Typical flyback derived power supplies

The highest voltage output of all is the "second anode" or "EHT." This can be as high as 25,000 volts or more and is created through a series of secondary windings and diodes within the high voltage unit. The EHT output is connected through a heavily insulated wire to the second anode of the picture tube.

Low Voltage Power Supplies

Although failure in the high-voltage output windings are a common cause of flyback destruction, there are some low voltage outputs that, while not common failures in and of themselves, are often involved in other monitor failures.

For example, the cathodes in the electron gun assembly in the CRT must be heated. The orange glow you can see in the neck of the picture tube is the "heaters" at work. The heaters are powered by a low voltage winding on the flyback transformer. Just a few turns of wire are all it takes to get enough voltage. The CRT heaters are designed to work on 6.3 VAC.

There are one or two other low voltage windings on the flyback transformer that are rectified and filtered to create low voltage, DC power supplies. These power supplies are generally used by low voltage transistor circuits such as the video amplifiers, the sync amplifiers and the blanking circuits. They are often used to drive the vertical deflection output circuitry as well.

A good example of this is shown in the schematic diagram. In this monitor, the flyback transformer creates two, separate, low voltage power supplies. One is a +12 volt DC power supply that provides power to the video amplifier IC and most of the discrete transistor circuits. The other is a +24 volt DC power supply that powers the vertical output integrated circuit.

Notice the resistors in series with the output side of the power supplies? In the CRT heater circuit, it's R213 (.68 ohm, 2 watts.) In the +12 volt power supply there are two, series resistors. Follow the output of the flyback transformer from pin 5 to the first of the two resistors, R92. After passing through R92, the current is then "rectified" (changed from AC into DC) by diode D14 and "filtered" by capacitor C42. This DC is then passed (in series) through another resistor, R90. The value is the same for both, 1.2 ohms, 2 watts.

The +24 volt DC power supply is much the same. In this case, the flyback output is at pin 4. The AC output of the flyback transformer passes through resistor R91 first before being rectified by diode D13 and filtered by C40 to create +24 volts DC. From there you can see that the output of power supply connects to pin 6, the power input pin of IC3.

So what's the point of these resistors? It's simple, really. The low voltage power supplies are created from just a few turns of wire wound around the ferrite core of the flyback transformer. One turn of wire (or even a fraction of a turn, really) will create a substantial difference in the output voltage. In order to insure sufficient output voltage, there's always a little more on the secondary winding than will actually be needed. A series resistor is added to drop the voltage down to what it should be.

Additionally, the series resistor serves two other functions. One is as an inrush current limiter that protects the diode. The other is that the series resistor serves as a sort of fuse in that if the low-voltage load short-circuits (such as a shorted vertical output device) the resistor will open circuit rather than place an excessive load on the flyback. In fact, some manufacturers use a fusible resistor here specifically for that purpose.

IMPORTANT SERVICE TIP: It is common for these resistors to fail; not just in the example given above but in all types of monitors. When resistors fail, they "open-circuit," cutting off the power to the circuits they're supposed to be driving. It's something that novice technicians often overlook but it's actually one of those simple failures that are a snap to diagnose once you know what to look for.

ANOTHER IMPORTANT SERVICE TIP: Sometimes these resistors fail on their own and all you need to do to fix

the monitor is to replace the resistor. However, an open resistor may be indicative of a shorted or otherwise faulty component somewhere else in the circuit. Logical deduction will often lead you right to a shorted component. Any component (other than a resistor) that's connected to the open resistor on one end and ground on the other is a candidate and should be checked out.

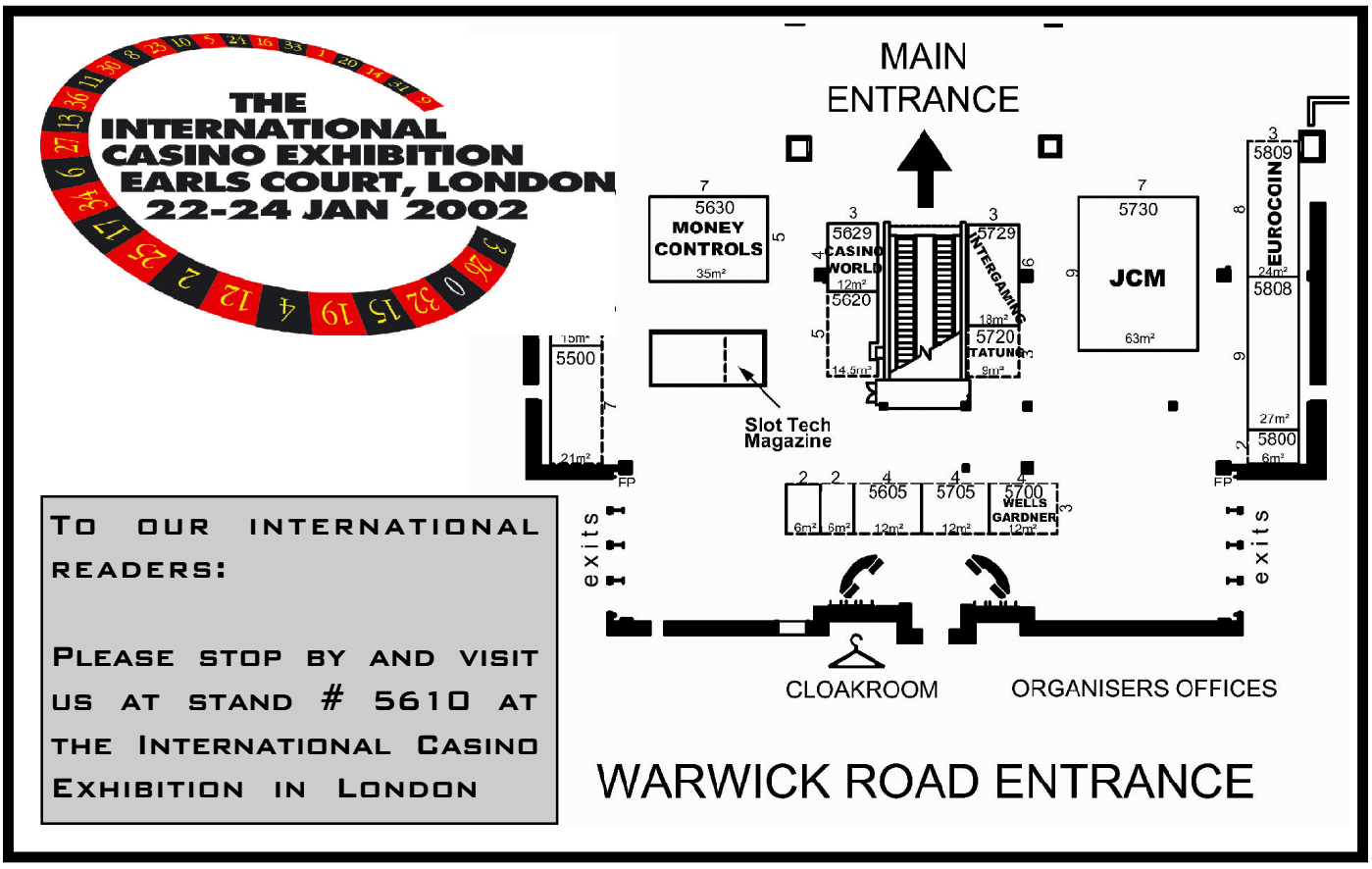
You can easily check for a short circuit by setting your meter to the lowest resistance range, grounding the black meter lead and probing the output side of the power supply with the red lead. A short circuit will be obvious. Naturally, if there's more than one component on the supply line that might cause the short, you must isolate the faulty part. There are usually only one or two components that might be shorted so I generally unsolder and remove the suspected components one at a time and re-check for the short as above. When the short goes away, I know I've found and removed the bad part. Alternatively, some technicians will "clip & lift" an IC pin or unsolder a component leg to isolate the short.

High Voltage Unit Failures

Well, regardless of how the EHT unit works, the important thing for the service tech is "how does it fail?" Fortunately, that's simple. It usually burns up or melts! You will often see the plastic bulging or melted. You also may see the shell of the unit cracked and/or burned.

A bad EHT unit will often take out the horizontal output transistor as well. If you replace a bad horizontal output transistor and the monitor still doesn't work, you may have a bad EHT unit (regardless of wether or not you can see any apparent signs of failure by examining the unit.)

Troubleshooting shortcut to finding a bad EHT unit . . . After replacing a bad horizontal output transistor, listen carefully for the sound of the high voltage coming on when you first fire up the monitor to test it. If you do not immediately hear the high pitched squeal of the high voltage unit or the crackling, static buildup on the picture tube, turn the monitor off at once and touch the horizontal output transistor with your finger. If it's at all hot, the high voltage unit is probably bad. If you turn the monitor off right away, you probably will not damage the transistor.



Understanding Linear Power Supplies - Part 2

Voltage Regulation

So now we're ready to power some cool electronic gizmos with our power supply, right? Well, not exactly. Not yet. We still have another problem we have to take care of. Many types of electronic circuits require a precise, unchanging voltage in order to operate properly. The integrated circuits, for example, might require an exact +5 volts DC to operate. Any fluctuation of more than a quarter of a volt higher or lower and the IC might malfunction. In a monitor, the main power supply has to be exact and unchanging or the size of the picture will change, becoming larger as the power supply voltage rises and shrinking as it falls.

So what might cause the voltage to fluctuate? It's the AC power. If the 120 volt AC input fluctuates, so will the output voltage. Remember that the power transformer just gives us a ratio of input to output. If the input rises, so will the output. A lowered input voltage lowers the output voltage as well.

What we need now is to regulate the power supply. We need to regulate the voltage so that regardless of what happens with the AC power, the output voltage of the power supply will remain constant.

There are a few different types of voltage regulator circuits. Some regulator circuits use a combination of transistors and zener diodes to perform the voltage regulation function. Others use transistors and integrated circuits.

One very popular type of voltage regulator for use in video games (and electronic circuits in general) is the "three terminal regulator." The three terminal regulator is actually an integrated circuit that has all of the voltage regulator functions in a single package. This makes it easy to regulate just about any power supply. You simply connect the unregulated DC to the input of the regulator, and take a regulated DC from the output. The three terminal regulator does all the work of regulating the voltage.

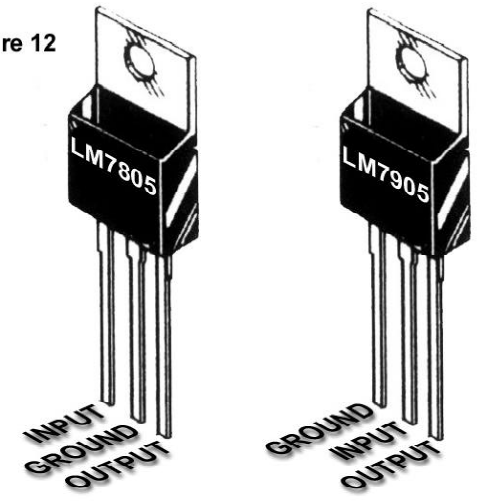
One of the most popular types of three terminal regulators is the LM78XX series. This regulator comes in a TO-220 package. This type of package may be familiar to you as a transistor, SCR or TRIAC. Do not automatically assume that any TO-220 package contains a transistor. It may actually be a voltage regulator. The only way to tell what the part actually is is to look at the part number that's printed on the part itself.

It's just like going to the dairy section of the supermarket to get a carton of milk. All of the milk packages look pretty much the same. The way to tell the difference between regular, low fat and non-fat milk is to read what's printed on the carton itself. The label tells you what's inside.

Three Terminal Regulators

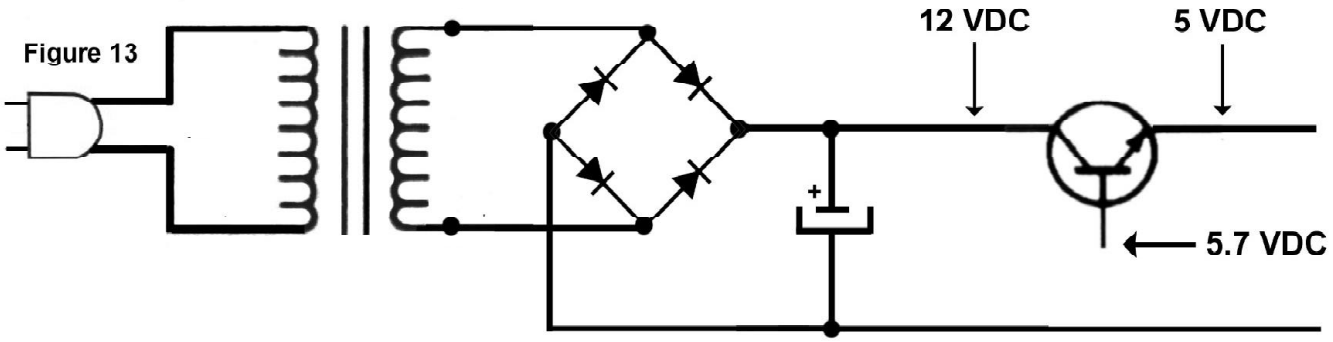
The LM78XX series of three terminal regulators comes in a variety of different output voltages but in games we gen-

Figure 12



One popular type of voltage regulation scheme is the "three terminal regulator." Although this device is housed in a standard, TO-220 package, it is not a transistor. It is an integrated circuit.

Figure 13



In order to get +5 volts out of the emitter of the transistor, the transistor must be turned on about half way. With +5.7 volts on the base, the emitter voltage will be +5 volts DC and will remain at +5 volts DC regardless of any voltage fluctuations at the unregulated input on the collector.

erally see +5, +12, and +15 volts. Notice that these are all positive voltages. The LM78XX series can be used to regulate positive voltages only. A different series of regulators is used to regulate negative power supplies.

The output voltage of the regulator can be determined by looking at the part number that's printed on the device. The output voltage is indicated as the last two digits of the part number, where the "XX" is. Thus an LM7805 is a +5 volt regulator, an LM7812 is a +12 volt regulator, and an LM7815 is a +15 volt regulator.

This makes your job easy when troubleshooting, because you don't have to look up the part number in a data book (reference book of parts and part numbers) to find out what it does and what the output voltage is supposed to be. You know that a type LM7805 is supposed to have a 5 volt output just by looking at the part number.

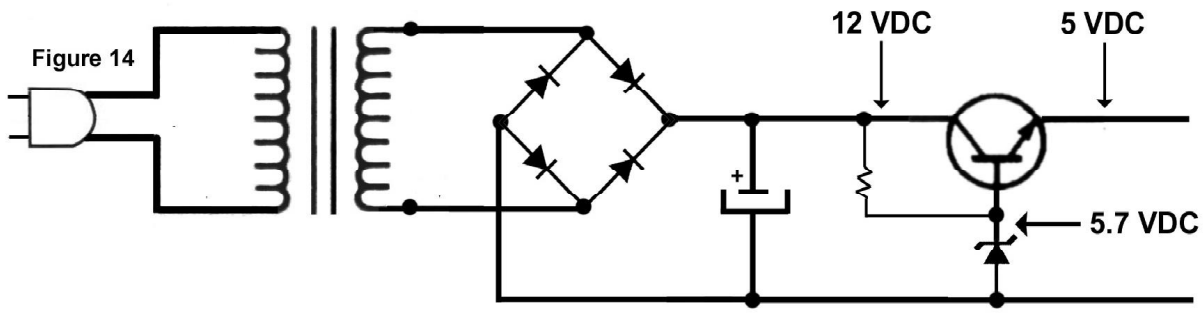
All of the LM78XX series voltage regulators can handle an output current of one amp and all have the same connections. The lead on the left is the input connection and the lead on the right is the output connection. The center lead (which, by the way, is always connected to the metal tab on the top of the package as well. This is true for all TO-220 packages, whether they are regulators or transistors.) is connected to ground.

It's important to know how the leads are arranged. By knowing that the right lead is the output, testing the voltage regulator is a simple matter of measuring the voltage at the output lead. It should be the same as or pretty darn close to the voltage indicated by the last two digits of the part number.

The unregulated DC, which is the input to the regulator, will always be somewhat higher than the regulated output voltage. In order to regulate properly, the unregulated input voltage must be at least 2.5 volts higher than the output voltage. For a +5 volt output, for instance, the input must be at least +7.5 volts or the regulator will drop out of regulation. In fact, the unregulated input voltage always will be substantially higher than the output. Often, the unregulated input to a +5 volt regulator will be somewhere around +10 to +12 volts DC.

There is another series of part numbers that you also will see for positive, three terminal regulators. The LM340T-XX is another version of the LM78XX series. You will see the two used interchangeably. In fact, same regulators actually have both part numbers printed on them. The connections are the same: input on the left, ground in the middle, and the regulated output on the right. The voltage of the LM340T-XX series is shown as the number in place of the "XX." Thus an LM340T 12 is the same as an LM7812. Both are +12 volt regulators.

These regulators are available from a number of different semiconductor manufacturers. Although the basic part number remains the same between them, differ-



Another way to peg the base voltage is with a zener diode. A zener diode is a voltage regulator that keeps the voltage across itself constant in a circuit like this. By using a 5.7 volt zener diode, we can maintain a steady +5.7 volts on the base and an exact +5 volt DC output.

ent manufacturers use different prefix letters in their part numbers. National Semiconductor uses the LM prefix. Motorola uses MC. The two-letter prefix can generally be ignored. Thus an MC7805 is the same as an LM7805.

Regulating negative power supplies requires the use of a negative, three terminal regulator. The LM79XX series is used to regulate negative power supplies. As before, the last two digits of the part number indicate the output voltage. Thus a 7905 is a -5 volt, a 7912 is –12 volt and so on. Another part number you might see for the same type of regulator is LM320-XX. As before, the last two digits indicate the output voltage.

It is very important to note that the connections are different for the negative regulator! The right hand lead is still the output, but the other two leads have been swapped. The left lead is grounded and the middle lead is the unregulated input. Remember that the middle lead is also connected to the tab of the device. This means that the tab has negative voltage on it. In other words, *never assume that the metal tab is ground.*

Series-Pass Regulation

A transistor can be used as a voltage regulator as well. Truth be told, that's what's inside the three-terminal regulators. It's actually a pretty neat technique for voltage regulation.

Typically, the series-pass regulator transistor is an NPN transistor although it is certainly possible to use a PNP transistor instead. We'll discuss the NPN version. The unregulated input is connected to the collector of the

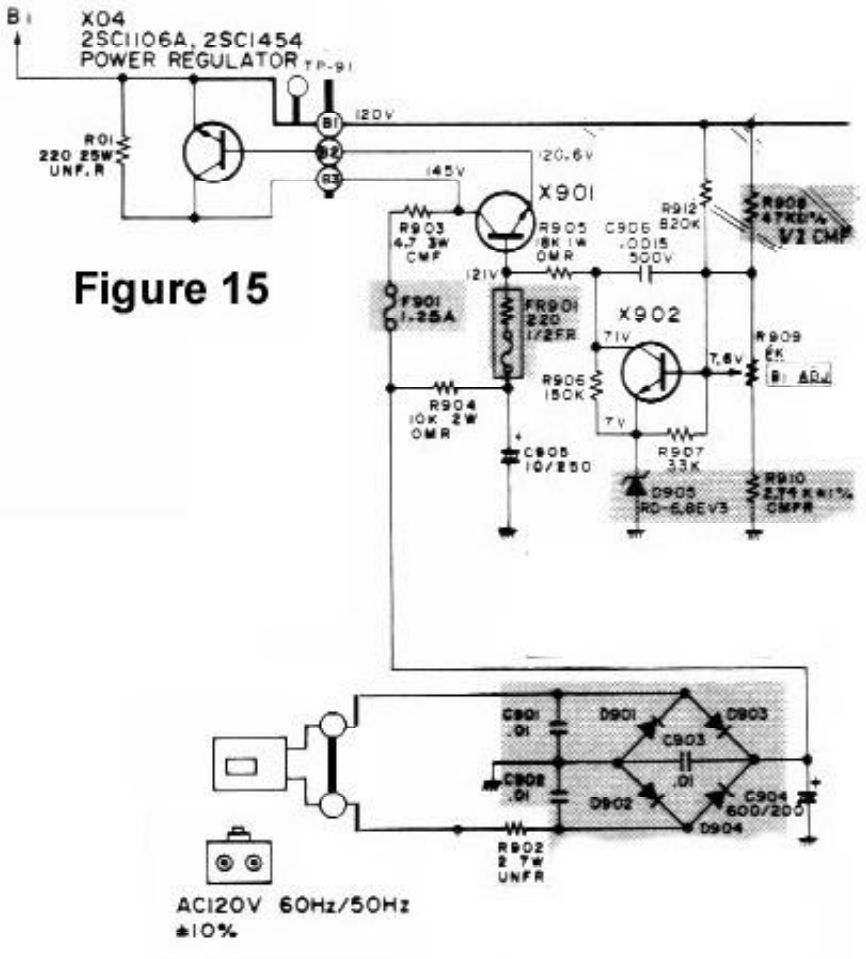


Figure 15

transistor. The emitter is the regulated output.

From our previous discussions, we know that a transistor can function as a switch. When the base of an NPN transistor is approximately .7 volt higher than the emitter, the transistor turns on allowing current to flow between the collector and emitter. Remember, this is known as the "collector current" and it is the main current path through the transistor.

Well a transistor is more than just a switch. In addition to its ability to be totally turned off or totally turned on, a transistor can be partially turned on as well. Refer to the illustration figure 13. Here, we want to create a regulated +5 volt power supply. As with the three terminal regulator, the unregulated input is always somewhat higher than the regulated output will be. Here, it's +12 volts DC.

Let's think about how the transistor can work as a voltage regulator. Suppose the transistor is completely turned off. What will the output voltage be? Zero volts, of course. If the transistor is completely turned off, no current can flow from the collector to the emitter.

What if the transistor is completely turned on? What will the output voltage be? +12 volts DC. When the transistor is completely turned on (saturated) the collector is almost directly connected to the emitter and the +12 volts just shoots right through.

So, in order to get +5 volts out of the emitter of the transistor, the transistor must be turned on about half way. We know that the base is the controlling element of the transistor. How much voltage do you suppose it takes on the base of the transistor to turn it on just enough to get exactly +5 volts out of the emitter? The answer is +5.7 volts DC. With +5.7 volts on the base, the emitter voltage will be +5 volts DC and will remain at +5 volts DC regardless of any voltage fluctuations at the unregulated input on the collector.

Our understanding of this circuit is enhanced with a brief thought experiment. Suppose the output of the power supply was to drop from +5 volts to +4.9 volts DC. The voltage difference between the emitter and base would be .8 volt instead of .7 volt. This would turn the transistor on more, allowing more voltage through and boosting the output voltage. Suppose the output voltage was to rise from +5 volts DC to +5.1 volts DC? The voltage difference would be just .6 volt instead of .7 volt. This would cause the transistor to back off a little, lowering the output voltage.

Of course, whatever it is that provides the base voltage for the series-pass regulator must be regulated itself. If the base voltage fluctuates, the output voltage will too. There are a few ways to accomplish this. One is to use a voltage regulator IC to provide the regulated base voltage. Instead of asking the voltage regulator to handle all of the load current, it is used only to provide just enough current to drive the base. Its regulated output voltage keeps the base voltage at the desired level.

If a higher current supply is needed, a Darlington transistor often is used as the series-pass regulator. In this case, the voltage regulator is set to put +6.4 volts on the base of the transistor. Because this is a Darlington circuit, the base is 1.4 volts higher than the emitter.

Another way to peg the base voltage is with a zener diode as shown in figure 14. A zener diode is a voltage regulator that keeps the voltage across itself constant in a circuit like this. By using a 5.7 volt zener diode, we can maintain a steady +5.7 volts on the base and an exact +5 volt DC output.

Another common technique is to use a Darlington pair in conjunction with another circuit called the "error amplifier" as shown in figure 15. The error amplifier consists of a transistor and a zener diode. The zener diode provides a reference voltage by clamping the emitter at precisely 6.8 volts DC. The base of the error amplifier's transistor is connected through a voltage divider made of a couple of resistors and the voltage adjustment potentiometer. The error amplifier compares the output voltage of the power supply (sampled through the voltage divider) to the reference voltage at the

emitter and adjusts the base voltage of the Darlington transistor accordingly.

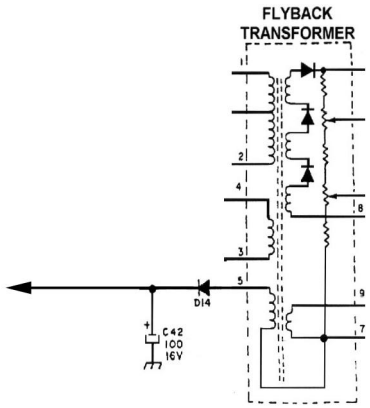
The Power Supply That Isn't

When is a power supply not a power supply? Sometimes, we see a circuit that looks just like a half-wave power supply but actually doesn't power anything at all. We see them often in monitors where they are used to generate a reference voltage.

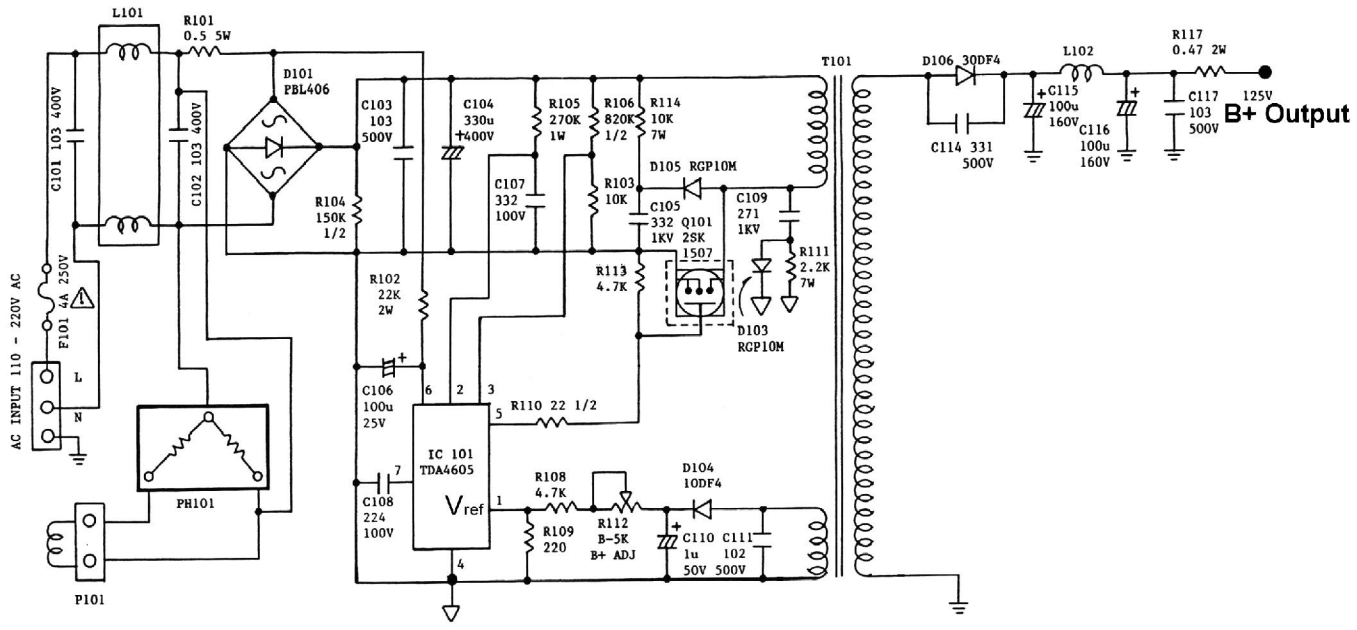
For example, the switched mode power supply in a monitor uses a sensing winding on the power transformer. This provides a method of regulating the output by sensing the magnetic flux of the transformer instead of measuring the output voltage directly.

It looks just like a half-wave power supply but it doesn't actually power anything. The AC output of the sense winding is rectified by a diode and filtered by a capacitor to give a DC reference that is directly related to the output voltage. That is to say, if the output voltage goes down, the sense voltage will fall as well. This will signal the IC to increase the "on" time of the switching transistor and raise the output voltage back up to where it should be. If the output voltage should rise too high, the voltage developed by the sense winding will rise too, signaling the IC to cut back on the amount of time the transistor is allowed to stay on and allowing the voltage to drop back to where it should be.

We see the same type of circuit on the flyback transformer where a sense winding is rectified and filtered to create a DC voltage that is directly related to the EHT. If the EHT rises due to some type of failure, the voltage of the sense winding will rise as well. If sufficiently high, this will trip the x-ray protection circuit, shutting down the high voltage.



Part of the X-Ray protection circuit



The power supply that isn't. In this circuit (a switched-mode power supply from a monitor) take a look at the circuit made from the secondary winding of the transformer, diode D104, and filter capacitor C110. Looks just like a half-wave power supply doesn't it? While this circuit DOES create a DC voltage, it isn't exactly a power supply. It actually creates a DC voltage that is proportional to that of the B+ output. This is the reference voltage that tells the PWM controller IC what's happening at the B+ output without actually touching it. The reference voltage is much lower than the B+ output but more importantly, it is completely isolated from the B+ output.

Subscriptions & Back Issues

Why back issues of Slot Tech Magazine are important to own . . .

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

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

Randy Fromm's

Slot Tech Magazine is published monthly by:

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

Subscription rates:

Domestic (USA)
1 year - $60.00
2 years - $120.00

International
1 year - $120.00
2 years - $240.00

Back Issues

All single issues of Slot Tech Magazine are $10.00/ea. For further details on the contents of each issue, please refer to the website at slot-techs.com

- ☐ **May, 2001**
- ☐ **June, 2001**
- ☐ **July, 2001**
- ☐ **August, 2001**
- ☐ **September, 2001**
- ☐ **October, 2001**
- ☐ **November, 2001**
- ☐ **December, 2001**
- ☐ **January, 2002**

Company Name _____

Contact _____

Address _____

Address _____

City _____ **State/Prov.** _____

Country _____ **Zip/Postal Code** _____

Telephone _____ **Fax** _____

E-mail _____

Type of card: [ ] American Express
[ ] Discover
[ ] MasterCard
[ ] Visa

Account Number: _____

Expiration Date: _____

[ ] 1 year subscription, domestic
[ ] 1 year subscription, foreign
[ ] 2 year subscription, domestic
[ ] 2 year subscription, domestic