Inside Slot Tech Magazine

MAY, 2002

Cover: Popeye was spotted at the recent Western Indian Gaming Conference. Right: Popeye and friends at G2E.

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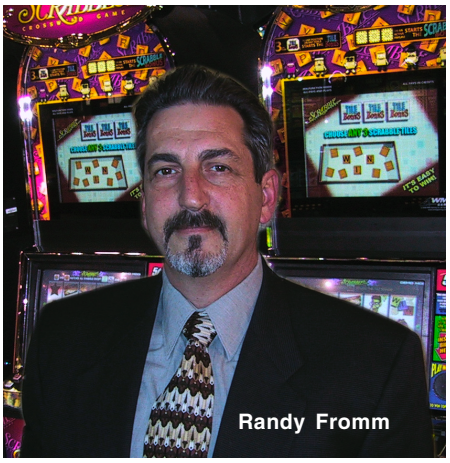
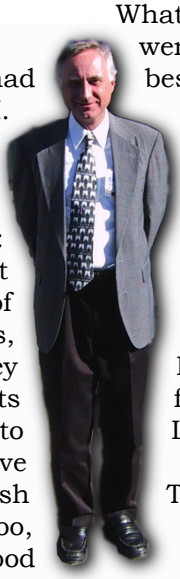


Dear Randy,



Just a note to tell you that I had a great time at TechFest II. The speakers were all fine and I learned a great deal. The best example of this is, with the Mars bill acceptors: at our casino we have about 30 Odyssey machines-half of them would not take bills, then I learned from Rich Raley that we have the wrong belts inside the cash cans. I went to the boss and said, "we have the wrong belts inside the cash cans!" And everyone went, Ooo, Ahh, Stuart might have a good idea! And everyone was amazed. What I didn't tell them was, that I went to TechFest II and I had the best teachers in all the land helping me.

Your magazine and TechFest II has helped me a great deal . You are a wonderful teacher. And I can't wait for TechFest III.

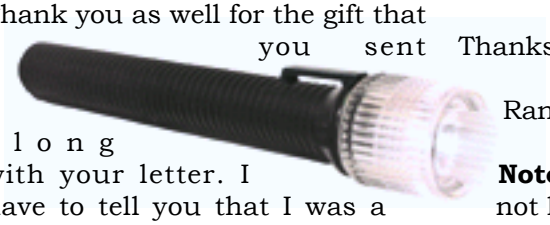
P.S. Thanks for the tour of Las Vegas.

Tom Stuart

Dear Tom,

Thank you for your nice comments about the TechFest. It was nice to meet you there. I'm glad that you enjoyed it and, more importantly, that you've learned something by attending. It's especially nice when you can put that information to good use right away. Of course, you know that I've just blown your cover by publishing your letter, don't you?

Thank you as well for the gift that you sent along with your letter. I have to tell you that I was a little bit apprehensive when I first saw it in my mailbox. The package was almost everything that the postal authorities have told us points to a letter bomb or other terrorist activity: A lumpy package with a hand-lettered address, wrapped in brown paper and sealed with duct tape. If I hadn't recognized your name on the return address label, I would have called the Bomb Squad and they would have destroyed a perfectly good LED flashlight!



I love the flashlight. Thanks. Ironically, I was introduced to the white LED flashlight just last month during a training mission in Cleveland, Ohio. Several of my students had them and I absolutely fell in love with them. Just as ironically, one of my students gave me an LED penlight that I had admired so now I have both types, one for the shirt pocket and one for the toolbox.

Letter bomb or fan mail? You be the judge!

Thanks again and best regards,

Randy Fromm

Note: For those of you that have not had the pleasure of using a white LED flashlight, you owe it to yourself to look into them. They give off a brilliant, blue-white light and last much longer than traditional, incandescent flashlights on a set of batteries. To see the one I received from Tom Stuart, go to http://ccrane.com It's the CC Trek Light.

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

Randy Fromm

Randy Fromm

Randy Fromm's Slot Tech Magazine

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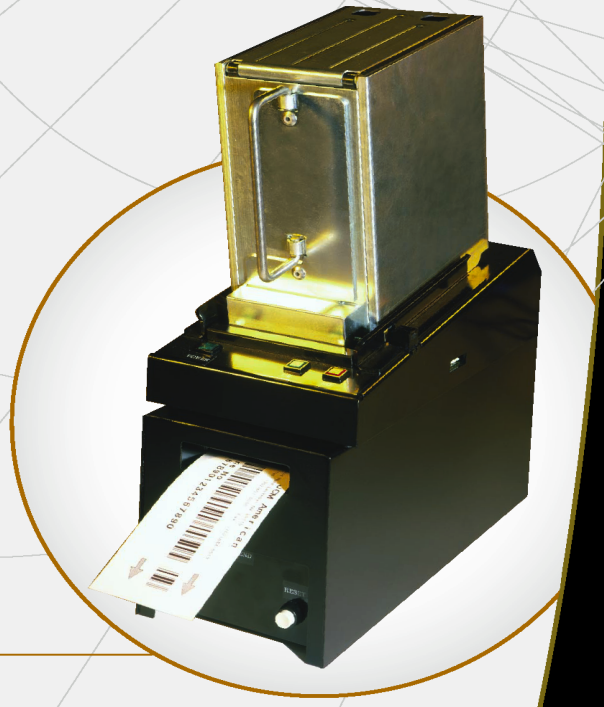

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Homemade Comparitor Air Balancing

By Bart Holden

Let's face it, although casinos generate a ton of revenue, it doesn't exactly flood back down to the slot technician department. This sometimes forces us to operate as carpenters, blacksmiths, engineers, and other various professions to invent and manufacture our own equipment to test and repair slot machines and their associated components.

Building a Test Stand

One such piece of equipment a slot technician can build is a comparitor alignment test station. It requires very minimal cost if any. Generally all of the necessary parts can be found in your shop. Below is the list of required parts.

1. **12 volt dc power supply**
2. **25 volt ac transformer**
3. **High denomination comparitor harness**
4. **Low denomination comparitor harness**
5. **CC-16D comparitor harness**
6. **Two scraps of plywood approximately 10" x 12"**
7. **wood screws**
8. **various connectors**
9. **wire**

Start by connecting the two pieces of plywood perpendicularly using the wood screws. Once you have a sturdy frame, secure the transformer to the base of your newly erected comparitor test station. Next, secure the 12-volt dc power supply to the back of the test station. Now connect the coin in chassis to the front of the station. See figures 1 and 2.

The next step is to connect the wires to your test station. Wire according to schematic 1 or to your particular transformer and power supply. We used a 12 volt Cosel power supply part number MMB50A. While a 12 volt power supply is sufficient, a variable dc power supply would be ideal.

The schematic is drawn only for CC-16D and CC-16D inhibit comparators. You can easily add a CC-32 interface "C" harness from your dc power supply for testing the large denomination comparitor presently installed in IGT S2000 slot machines. Likewise, the new style connector and harness can be added from the 24 VAC transformer for testing the new S2000 CC-16D inhibit interface "C" comparator.

Once you build your comparitor test station to suit your individual needs, you are ready to begin air balanc-

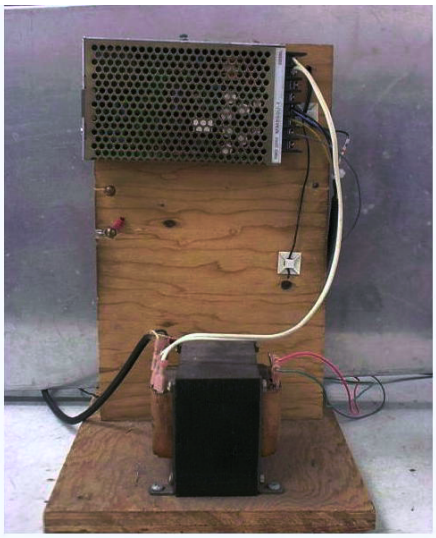


Figure 1

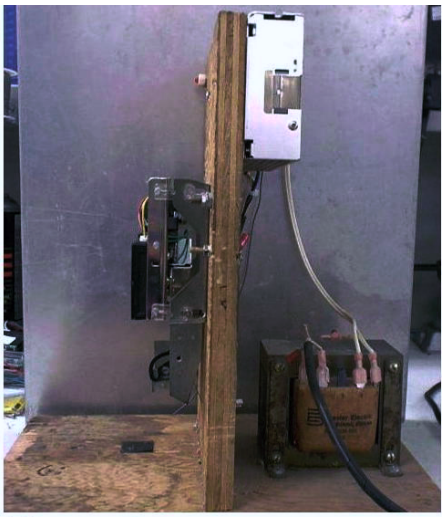


Figure 2

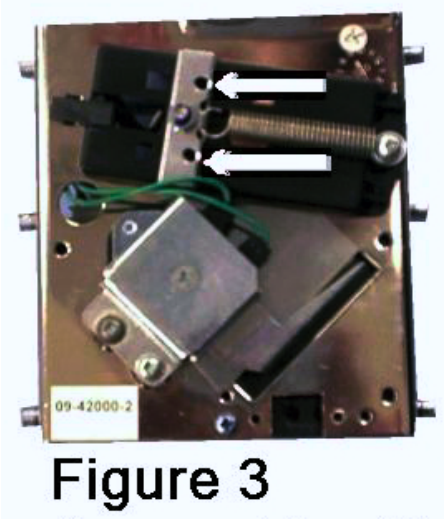


Figure 3

Arrows identify sensor coil adjustment screws.

Figure 4

A - Rail Insert and Screw
B - Sensitivity Potentiometer

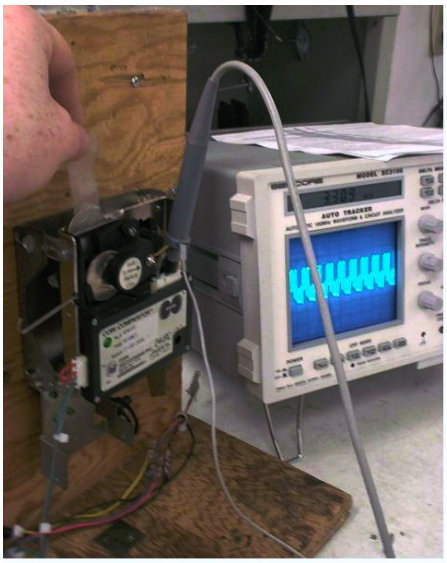


Figure 5

ing your comparitors. As you can see, beauty wasn't one of the objectives we had in mind when building our test stand.

Air Balancing 101

Air balancing is a very important adjustment to make to your comparitors. It is necessary to ensure accurate coin handling. It not only increases acceptance of the appropriate coin or token, it also reduces the chance of slug acceptance.

Air balancing involves adjusting the coil sensor screws to preserve a standardized chamber gap thus aiding metal recognition. It also involves fine-tuning the rail insert adjustment screw to ensure the sample coin and falling coin fully eclipse one another. Last but not least, an adjustment to the sensitivity potentiometer must be made to perfect the

comparitors acceptance versus rejection tolerance.

Air balancing should be performed prior to installing a rebuilt or new comparitor into a game. It is also the proper way to repair a comparitor that is not accepting coins. Adjustments to comparitors should never be made without the proper equipment. For example, adjusting the sensitivity potentiometer at the game could cause the comparitor to accept slugs or other improper coins.

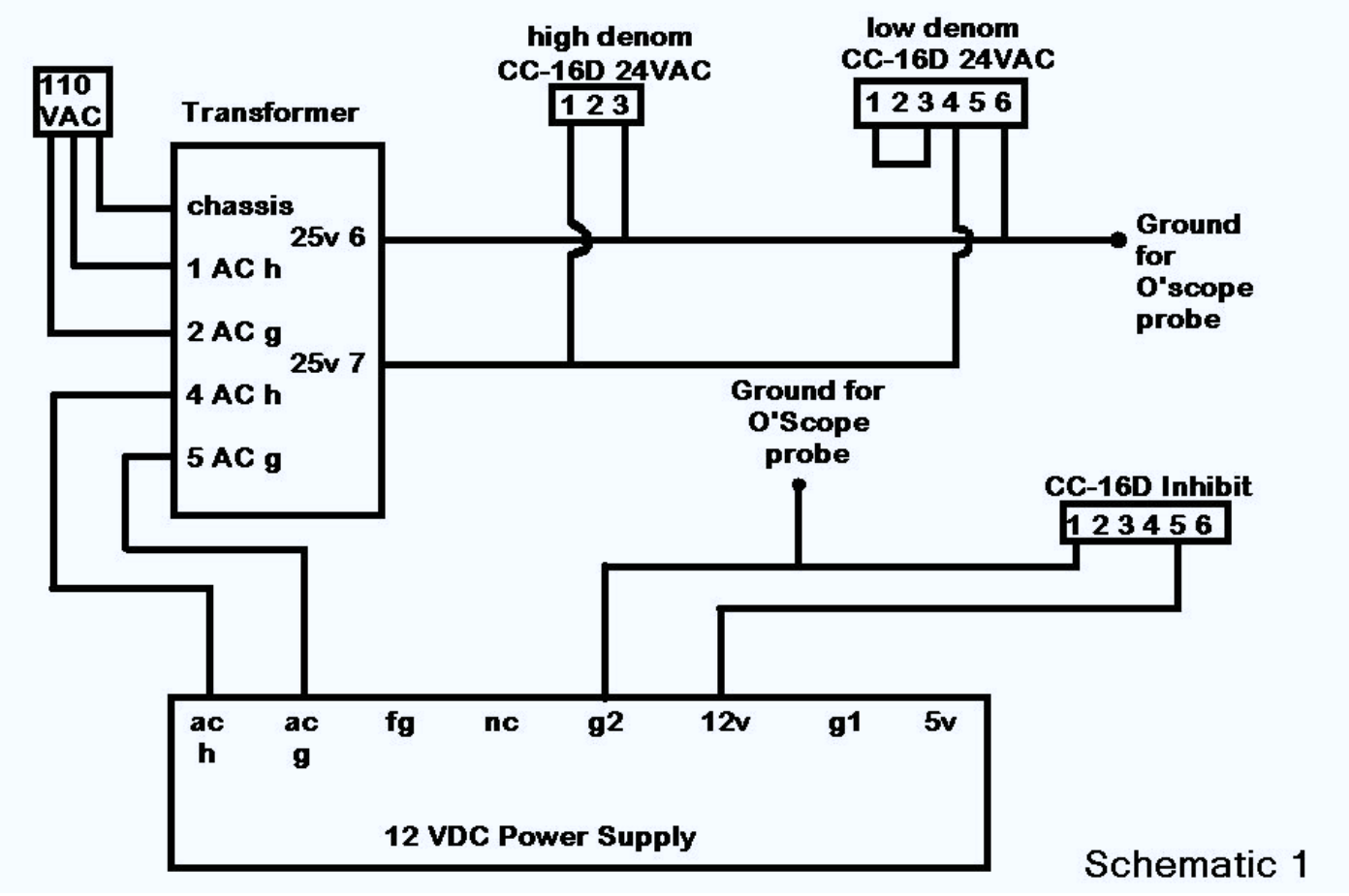
Doing It

The procedure for air balancing a comparitor is relatively painless if you are familiar with the oscilloscope (See Slot Tech Magazine March & April, 2002 for detailed instructions on using the oscilloscope). It involves one test point, one tool, and very little else. Always be certain that the comparitor is clean prior to adjusting. Below is a list of items needed to accomplish the procedure:

1. Plastic tokens (various sizes)
2. Coins and tape (a great substitute for coin sticks)
3. 1/16" hex head screwdriver
4. One homemade test station (preferably a non-attractive one)
5. Oscilloscope

The first steps are to apply the appropriate power source to your comparitor and to set up your oscilloscope. Begin by setting the oscilloscope. Set the Volts/Div to 500mv per division and the Time/Div to 1ms per division. Connect the oscilloscope probe to the proper test point on the comparitor. For CC-16 comparitor, it is pin 4 of connector P2. For the CC-32 it is test point 1 which is located on the circuit board. Look for the loop on a white stand off.

To air null balance the comparitor, place a plastic token in the comparitor sensor coils to imitate actual operating conditions. The plastic token should be approximately the same diameter as the actual coin or token that will be used later as the slot



Schematic 1

The ZT 1200 Bill Acceptor is absolute state-of-the-art in accepting almost every bill every time. It's the solution to unplanned downtime, unhappy customers, and lost revenue. Rugged construction with simple accessibility, easily reconfigured for new bills, extremely difficult to jam, and standard with 4-way currency acceptance.

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machine's sample. Use the 1/16" hex head screwdriver and lightly tighten each Sensor Coil Adjusting Screw until it initially touches against the metal plate stop. The two screws are located on the back of the comparitor. See Figure 3. Next, observing the waveform, alternate tightening each screw until the waveform is at its smallest. This will generally be approximately 100 to 200mv.

Next, perform the rail insert adjustment by carrying out the following: Remove the plastic token and place the actual sample coin in the sample holder. Use your 1/16" hex head screwdriver to turn the rail insert screw, See figure 4, counter clockwise until the rail insert is flush against the comparitor body.

Apply tape to a second, like coin and lower it into the comparitor just as a coin would be inserted in the game. See figure 5. Watch the waveform on your oscilloscope. When the coin comes closest to fully eclipsing the sample coin, your waveform amplitude will be its smallest. Tape the coin here so that you can free your hand for the final rail adjustment. Slowly turn the rail insert adjustment screw clockwise until the waveform amplitude decreases even more.

Finally, we adjust the comparitors sensitivity potentiometer. With the sample coin still in place, adjust the potentiometer fully counter-clockwise. This is the full accept position and therefore all test coins should be accepted. Next, adjust the potentiometer fully clockwise or to the full reject position. Drop test coins and they should all be rejected. Finally, turn the potentiometer a little at a time counter clockwise. After each turn, try dropping coins until the comparitor accepts. Drop a few different denominations coins in to ensure that they are all rejected. This concludes the adjustments.

- Bart Holden
bholden@slot-techs.com

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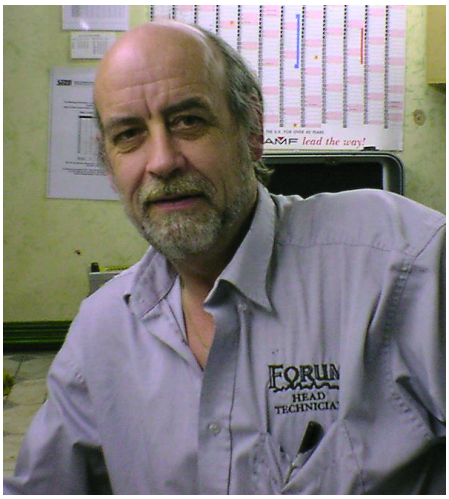
A Plumber's Guide to Fruit Machines - Part 2

By Gordon Lowe

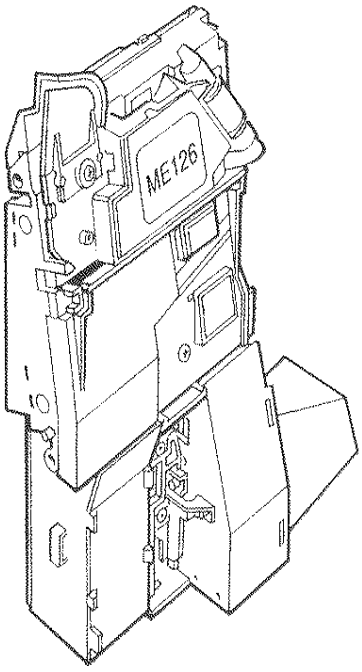


This month's "Plumber's Guide" continues with coin validators.

Section 1.b.
Mars ME/MS100 validators

MS Series, ME Series, Cashflow® 115 & Cashflow® 330/340 series are among those used in our industry. Lets deal with the most common first, those with the prefix MS & ME, for example, MS111, MS115, ME111, ME115, ME126 and so on, (known as the MS100 and ME100 series respectively) they all work on the same principles with the same connection configuration.

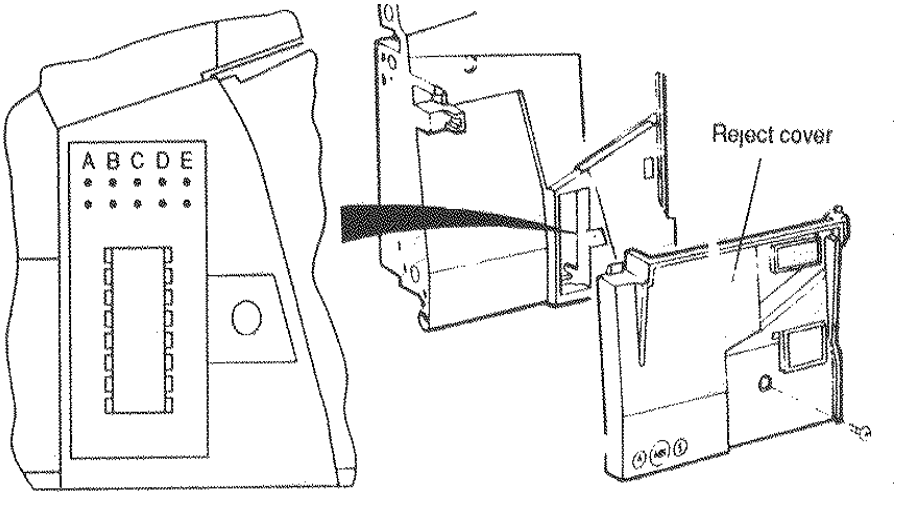
To simplify all these different numbers that you will come across, the "111" validators are one of the first validators fitted with a separator connected, a 3 way sorter is the only type that can be interfaced with the ME/MS111. When configured with a 3-way separator the complete unit then becomes known as a 125. The 126, 129, 126T, 129TS etc. are numbers that identify the particular combination of validator and separator, all use a "115" validator. For example, an ME126T is a combination of an ME115 validator with token capability (the 'T' stands for Token) fitted with a 4-way separator, whilst a MS129 is a MS115 validator with an 8-way separator. (126 = 4 way, 129 = 8 way)



Token acceptance is controlled firstly by the validator having been programmed to handle it. This will be stated on the product label, usually by the suffix T. Even if the validator has a 15-pin connector, this does not mean that token parameters have been programmed into the unit.

Token type is then selected by links that can be seen by removing the reject cover from the validator (see figure 1). Contacting your token supplier or one of Mars' agents will provide you with advice as to which links to remove or replace for your particular token type. If all else fails, try removing or replacing all 4 links A to D.

Do not alter the state of link E. This is used to locate which

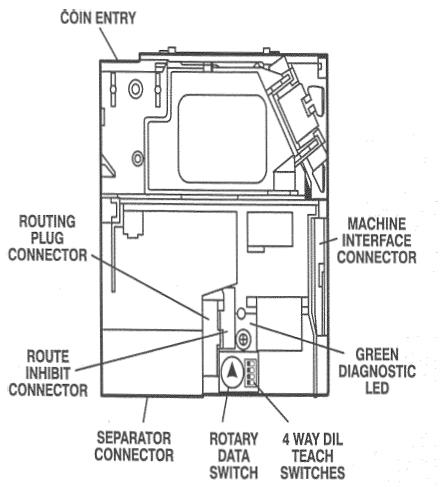


area all the coin parameters are programmed into in the bi-polar PROM found beneath these links.

A little bit of useless information (unless you have the equipment to program these validators) the bi-polar PROM is programmed to the required coin parameters of the particular validator it is in and is therefore dedicated to that validator. The reason for this is that no two units will be identical due to variances within manufacturing, age, wear & tear etc. Do not try swapping this PROM into another validator. It will not work! Also note that once programmed, the PROM cannot be redone with new settings. It has to be replaced.

ME versus MS

The main difference is that the ME replaced the MS, due to advancement and results in higher security of the coins inserted. Connection to the mechanism remains the same and one should remain compatible with the other when changing, but beware! This can result in coins being routed to the wrong channels. Always check when swapping over validators. It is best to exchange ME with ME and MS with MS, although if routing of the coins alters, this can be put right by reconfiguring the routing plug (dealt with later in this Plumber's Guide, Section 1.g).



Section 1.c. Mars Cashflow 115 (126 & 129) validator

The new generation of similar external design to the ME & MS series validators using the same mounting requirements, the main advances on this type of coin mechanism are:

1. the ability to handle up to 16 different coin types (the industry is already allowing for a £5 and £10 coin)
2. a wide selection of token types pre-programmed into the validator
3. the ability to teach the unit a particular token type
4. a route inhibit connector (see below)

Although this validator is a jump in technological advancement, the electrical connection to the host machine remains the same as the earlier ME/MS series. Direct replacement should be possible, providing any separator fitted is compatible to the validator (CF126 & CF129 in the case of Cashflow® separators). Here it must be noted that ME/MS separators are not interchangeable with the Cashflow® . When used to replace ME/MS validators, the Cashflow® must be configured in parallel mode (as opposed to serial). This will enable the validator to operate as normal (See 'Serial' operation of validators). The validator would normally be supplied in parallel output or auto mode (setting F) so no further action would be required.

It is also worth noting the Cashflow's green LED. This is not just a power on light but a diagnostic aid used: a. when setting up the validator for Binary coded output b. enabling or disabling the acceptance of coins or tokens c. operating the self-teach for token types

The 'Route Inhibit Connector' is a new addition, the purpose of which is to provide an input to the validator from external level switches (such as hopper full or tube level full). This in turn will inhibit the original exit route of the coin and re-route it to another designated path, for example, the cash box.

A request to Mars® Electronics or one of its authorised agents for 'The Cashflow® 126 starter guide' will provide information in much more depth should you wish to do more than simply install the validator.

Section 1.d. Mars connection information

Connection to the validator is made via a 13, 15 or 17 pin connector as shown in Table 1. The 13 pins always remain the same. Where there are 15 pins, the extra pins (1 at the top and 1 at the bottom) are utilised to handle the token.

Table 1

Connection information of validators to host machine

Coin A o/p	5p	1						
Coin B o/p	TKN	2	1					
Common i/p		3	2	1				
Coin F o/p	£1	4	3	2				
Keyway		5	4	3				
Coin E o/p	50p	6	5	4				
Coin D o/p	20p	7	6	5				
Keyway or Select		8	7	6		13 way connector	15 way connector	17 way connector
Coin C o/p	10p	9	8	7				
Coin C inhibit		10	9	8				
plus 12 volt		11	10	9				
0 volt supply		12	11	10				
Coin D inhibit		13	12	11				
Coin E inhibit		14	13	12				
Coin F inhibit		15	14	13				
Coin B inhibit		16	15					
Coin A inhibit		17						

Where the mech has this facility, the pin at the top (now pin 1) becomes the token output line while the pin at the bottom (now pin 15) is the inhibit line to enable or disable the acceptance of the token (Coin B).

The £2 coin has now been set as an industry standard allocated to line E, which was the 50p line. The reason for this is that the ME series validators have a 4th (piezo) sensor fitted for higher security on lines E & F only. It must also be noted that only a Mars authorised agent will have the capability of programming these validators to utilize the 4th sensor (i.e. MES in Farnborough or Eurocoin). Whilst on this subject, programming of the MS series validators for the £2 coin is NOT recommended due to the technology at the time these first came into production. To utilize the £2 on the ME validators, a separate PCB will be required which will pulse 4 times on the 50p line (control boards of this type are being marketed from many suppliers). The reasoning behind pulsing on the 50p line (as opposed to twice on the £1 line) is to keep the host machines internal calculations correct in the case of "hopper" payout systems.

In the case of 17 pins, the principle is exactly the same. The top pin now becomes pin 1 and is the output line for the 5p (Coin A) pin 17 being the enable/disable line for the 5p.

Note that the location keyways where the pin is absent on the mech always remains in the same position. That is to say, the pin immediately above the topmost keyway is always the coin F (£1) output line and the pin above this the common input line. Sounds confusing? Not really. Examination of Table 1 should be self-explanatory.

At this point, I feel it is necessary to explain the location of coin types and their allocation to connection pins. These will not always be a set coin as described above, i.e. £1 coin output on pin 2 (13-way connector). The coin allocated to an output or inhibit pin is dependant on how the validator has been programmed. It is possible to program any coin to any location, as discussed previously

when referring to reprogramming the 50p line with the £2 coin. For this reason, you will find that validator technical manuals will describe the coin outputs and inputs as coins A through to F.

The normal allocation is as follows: A = 5p, B = Token, C = 10p, D = 20p, E = 50p & F = £1. Remember this may not be the case in every situation.

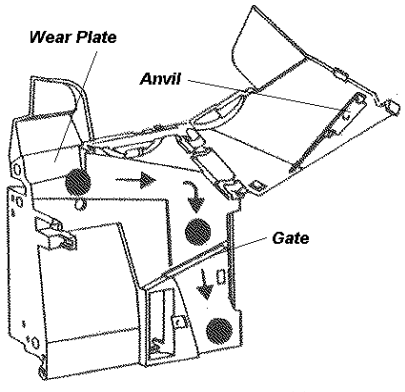
Further connection info:

Inhibit Lines: These lines are used to enable or disable the acceptance of any individual coin type. When these lines are pulled down to 0 volt (ground) then acceptance is enabled. In other words, the coin type is accepted through the validator. If the line is held high (around 2 volt or higher) then the coin type will be rejected. Disconnection of the wire connection to an inhibit pin will also result in coin rejection.

Control of these inhibit lines is taken over by the main microprocessor control within the host machine, although as can be noted from the above, should you wish for some reason to stop the machine from accepting a particular coin (for example, a flood of fake 50p coins) then the simple removal of the connection wire to the 50p inhibit pin will result in all 50p coins being rejected, genuine as well as fake.

Output Lines: Each of the output lines will give a logic pulse out when a particular coin has been accepted by the validator as a genuine coin. This pulse is then dealt with by the host machine's microprocessor. The pulse out is dependent on the "Common" input pin (pin 1 in the case of a 13-way connector). In other words, if the common input pin is at +12 volts (and this is usually the case) then every time a coin is accepted, a positive pulse is given out at that particular coin's output line. When the "Common" input is at 0 volt then outputs will be low.

From this, it can be seen that when looking for a fault in the area of rejecting or robbing a particular coin, these are the connections to examine first. For example: a validator will not accept the £1 coin. Check for good electrical connection to the £1 inhibit line (pin 13 on a 13 way). In the case of it accepting a £1 coin but it not being registered on the host machine, then check connection to the £1 output line (pin 2 on 13-way connector). More help on fault finding will be presented later in this series.

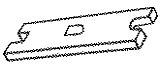


The 12 volt & 0 volt pins are the power supply for the validator, without which no operation is possible.

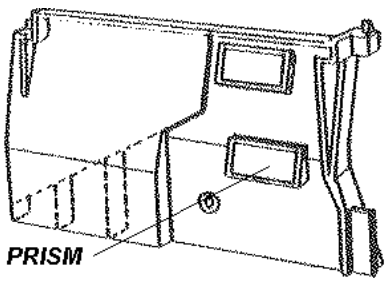
Section 1.e. Mars® ME/ MS100 series servicing

User serviceable parts on these validators is limited to the replacement of the wear plate or entry liner and the anvil. Except for the reject plate, there are no other replacement parts readily available. The wear plate is the first surface that the coin hits as it enters the validator. Because of this, a groove develops over a period of time which has a tendency to slow the coin and can result in a higher coin reject rate than what should be expected. Replacement of this plate is a 5 second job and costs pennies. If you suspect this is causing a problem, change it.

The same comments can be made of the anvil but here it must be noted that there is an intentional indentation to break the coin's momentum. It is rare for this part to require replacement. What usually happens is when it does fail, it breaks in two.



The side plates are not a part to fail, with the exception of the prism dropping out and usually getting lost (commonly due to mishandling). This will result in complete failure to accept any coin. All you can do is replace the



entire plate but mind that you use the correct type. Some of the older MS mechs have only a single prism. These are marked "type 2 or 3." The ME have a double prism, type 5. If you order a type 5, you will find it suitable for all types. Do not forget to check the correct reject path (front or bottom) A, B or C.

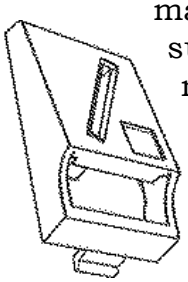
A & B are both bottom reject, B being rejected slightly further back and not found on AWP's (more commonly found in Change Machines) C being front reject (see illustration).

Dirt build up is a common problem with most validators, although it is surprising how much can accumulate before a serious rejection problem shows up. This is one area often found to be neglected, resulting in loss of machine takings. This shows up first with bad £1 coin acceptance, as the speed at which the coin goes through the validator is critical, dirt can slow this down dramatically. Using a "foaming cleanser" to clear heavy dirt build-up on Mars validators is recommended and is available from most suppliers of spares. Do not use any abrasives or solvent based products.

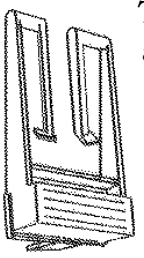
Note: Foaming Cleanser is not recommended for use on Coin Controls validators.

Other hints & tips:

1. Check the Mars® bezel for wear. A badly worn bezel can reduce machine takings dramatically. The casual player will not continue trying to insert a coin when it keeps sticking in the entry.

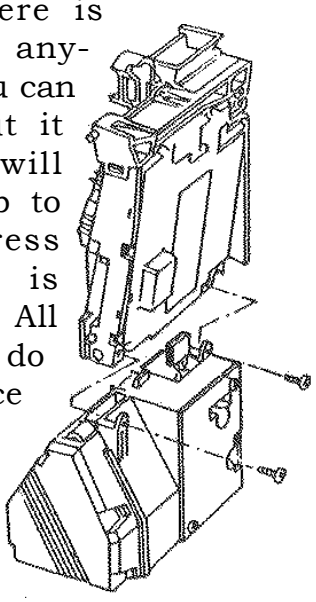


2. Watch for the lugs on the orange bezel button. They snap off with age and will hold the Mars® mech open just enough to reject all coins. Take the bezel off and remove the broken lugs. Put it back together again and it will still work despite being minus the lugs. Better still, replace the bezel button.



3. Keep a stock of Mars® mounting clips, particularly the top. They snap easily.

4. Beware of snapping the separator mounting lugs when removing. Once broken, there is little, if anything you can do about it that will stand up to the stress that is present. All you can do is replace the separator, ensuring that you use the correct screws for the job. The usual cause behind these lugs breaking is that someone has replaced the screws with ones that are too large, resulting in weakening of the plastic.



- Gordon Lowe
glowe@slot-techs.com

To be continued next month

Olson's Repair Log

By Olson Jake

Here is a collection of miscellaneous symptoms and solutions, mostly on monitors.

Princeton Monitor EO900
Problem: Green power led is on. No screen or picture
Solution:
Replace
C821-47uf@160v
C906-220@16v
C438-100uf@200v
C437-470uf@25v
C445-100uf@25v

Princeton monitor EO50
Problem: No power. No green LED. Screen dark.
Solution:
Replace
C445-100uf@25v
C438-100uf@200v
C304-220uf@25v
Q408-High speed switch transistor, ECG 2388

Princeton monitor EO90
Problem: Power green LED on. Screen dark. No raster. No high voltage Sencore PR 570 - Current power reading about 10 & up to 21.
Solution:
Replace
C945-470uf@25v. This capacitor dead short.

Princeton monitor EO90
Problem: No green power LED, screen dark, no raster, no high voltage Sencore PR570 - Current power reading 0
Solution:
Replace
C945-470uf@25v
C758-10uf@100v
(both dead short)

Princeton monitor EO90
Problem: Green power LED on, no raster or picture Sencore PR570 - Current power reading, no -12 volt to deflection circuit
Solution:
Replace
C951 and C952, causing no -12 volt, both caps should be dead short

Kristel monitor 48CM
Problem: Vertical off frequency - won't lock in
Solution:
Check vertical output @ pin 6 of IC801. If missing, change it. Shorted IC causes vertical to roll.

Kristel monitor 48CM
Problem: DEAD, No picture, no sound, screen dark.
Solution:
Hooked power to Sencore PR570 and current/power indicator fluctuating numbers back and forth, which indicated the horizontal section was shorted. Checked horizontal output transistor with DMM and showed shorted, everything that connected to it was OK.

Kristel monitor 48CM
Problem: Screen keeps shutting down, power reset and screen will return.
Solution:
Replace
C513 - 100uf@25v,
C514 - 100uf@25v,
C616 - 100uf@25v,
check C522 - 47uf@160v for short, also check IC602, 12 volt regulator replace if shorted.

Kristel monitor 48CM
Problem: Monitor comes on for a moment, and then shuts off. No reading on Sencore PR570 when power applied.
Solution:
Replace
C513 - 100uf@25v
C616 - 100uf@25v.
Both found dead short.

Kristel monitor 48CM
Problem: Monitor DEAD, no picture, no raster, no high voltage.
Solution:
Replace
C513 - 100uf@25v
C514 - 100uf@25v
C616 - 100uf@25v
C803 - 220uf@25v
C522 - 47uf@160v
IC 602 (12volt regulator)
Check C522 capacitor, and IC 602 before replacing.

Wells Gardner color 15" model 17K3004
Problem: Has narrow screen.
Solution:
Replace
C726 and C727 - 10uf@50v

Atronic (green) button board
Problem: No LED on comparitor / not accepting coins
Solution: Transistor (T2) on green button board shorted, transistor manufacturer number BC338 cross into ECG 123AP. Replacing the transistor will clear the problem.

Bally Gamemaker - Bartop power supply
Problem: No power to monitor.
Solution: Check caps C7, C8, C9, C10 and usually C12 and C13 are shorted. Also, replace PC1 optoisolator IC (ECG 3041) on the power control board, replace C101-100uf@25v, and C103 - 4.7uf@50v. Checking and replacing these capacitors and ICs will clear the no DC power problem.

Bally Game 5500 Power Supply
Problem: No -12 volt or missing power out
Solution:
check IC1 for open, and SCR1
Replace
C8 — 220uf@25v
C16 — 2200uf@10v
C22 — 1500uf@10v
C15 — 1500uf@10v
C12 — 1500uf@10v
C13 — 1500uf@10v
C18 — 330uf@16v
C14 — 1000uf@16v
C19 — 330uf@16v

All these capacitors are rated at 105 degree temperature. In the same power supply, a large blue capacitor rated at 22000uf@50v should be changed out every three years. Should there be a power supply failure, check this cap. First, disconnect the 500 ohm resistor and then check. When replaced, filter capacitor, 2200uf@50v, C3 (220uf@25v) needs to be replaced also.

Kristel Monitor 48CM
Problem: Monitor dead
Solution: Power PR570 (Sencore) was used to analyze this problem. When power was applied with this machine, the power and current indicator showed only 24 when it should be reading around about 40 and above. This 24 indicates that there is current flowing through but not enough to light the screen.

Further test indicated 88volt is present at cathode of D508. Looking at the schematic and checking voltage at pin 1 of IC201, found 12volt missing. That led to the 12-volt regulator being open. The regulator IC 502 checks good when tested with DMM and comparing reading with good known one, both had the same reading. Replacing with a good regulator brought the 12 volts and the screen back. This indicates that when the reading is taken it checks good but when power is applied, the regulator breaks down, causing no 12 volts and no raster.

Kristel monitor 48CM
Problem: Vertical off frequency — won't lock in
Solution: Check vertical output at pin 6 of IC 801, if missing change it. Shorted chip cause vertical to roll.

Kristel monitor 48CM
Problem: Vertical collapse or horizontal white line across the screen.
Solution: Check IC 801 for cold solder (crack around the solder pins). This will cause the white line across the screen or check for shorted vertical IC.

Bally Gamemaker — Bartop — Power supply
Problem: No raster on monitor. All LEDs lit on processor board. Reset LED is also lit.
Solution:
Replace
C101—100uf@50v,
C103 — 4.7uf@50v,
IC1 replaced witb ECG 7096
PC1 replaced with ECG 3041.

R3 will burn or open if C101 is shorted. Resistor should be 47 ohm 1/4 watt 5% tolerance.

- Olson Jake
ojake@slot-techs.com

SLOT TECH MAGAZINE

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TechFest I and II were both sold-out events.

Slot Tech Magazine's

TechFest III

Schedule of Events

Wednesday, August 14th, 2002

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

12:00pm - 1:15pm
Luncheon

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

3:15pm - 3:30pm
Afternoon Coffee Break

3:30pm - 5:30pm
3M Touchsystems - Touchscreen Technology

Thursday, August 15th, 2002

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

12:00pm - 1:15 pm
Luncheon

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

3:15pm - 3:30pm
Afternoon Coffee Break

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

Friday, August 16th, 2002

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

12:00pm - 1:00 pm
Luncheon

1:15pm - 3:15pm
Sencore - Monitor Troubleshooting and Repair - Using sophisticated test equipment to speed through monitor repairs

3:15pm - 3:30pm
Afternoon Coffee Break

3:30pm - 5:30pm
Seiko ticket printers - Printer troubleshooting and repair.

Enrollment Form

TechFest is sponsored by:
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Please complete this enrollment form and return it to Slot Tech Magazine by August 1st, 2002. Enrollment is limited. Do not purchase airline tickets until you have received confirmation of acceptance.

TechFest III will be held August 14 - 16, 2002 in Las Vegas, Nevada. Facility location to be announced. Visit the website at slot-techs.com for the latest details.

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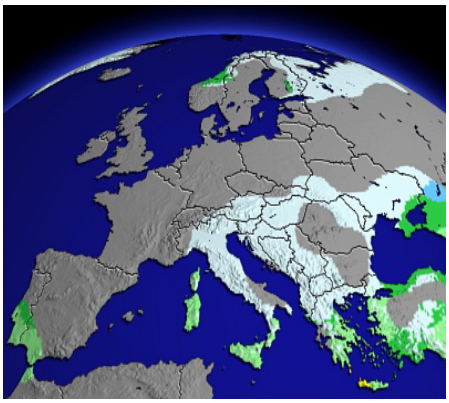
International View

By Martin Dempsey



EGO european gaming organisation

June Dates For First European Casino Summit

Details of the first European Casino Summit have been announced. The event, which is being researched and organised by ATE on behalf of the European Gaming Organisation (EGO), will take place across 27th and 28th June at The Martinez Hotel in Cannes, France. The Summit, which is being targeted at operators, will examine the most important strategic, legislative, regulatory and technological topics facing the global casino industry. Essential issues which will form the basis of the Summit include: effects on employment of the European Social Charter; looking at employment law issues for casinos; nation-centred case studies focusing on changes and potential changes in gambling legislation and licenses; a comparative analysis of how the United States and the United Kingdom are approaching problem gambling. Also, the future of European-based casino resorts; an online and new media platform update; a comprehensive review of player tracking and future payment systems including how cashless payment can be successfully deployed in the battle against money laundering and a new look at branding and promotion for the gaming industry. For more information on the first European Casino Summit contact Suki Scade at ATE on: tel. +44 (0) 20 7713 0302, e-mail sscade@atei.co.uk

Double Dice & Topspinner For Svet Zabavy

Random Runner Classic, Bonus Jackpot 21, Hot Shot ..... Double Dice. After extensive testing Double Dice has shown that it belongs to this series of successful Errèl games for the Czech and Slovak market. The exciting Dice feature certainly contributes to the success of this game. According to the number of the dice, this feature awards a number of mystery wins to the player. Double Dice is available in a 300 and 750 versions. Topspinner is the new game of the Errèl brand for the Czech market, which will be released during this year's Svet Zábavy exhibition. Both top and bottom game are played at the same 4-reel set. For more information about this and other successful games, please visit The Errèl stand at Svet Zábavy 2002 from 25 to 27 April or contact Eddy van der Steen, Marketing Dept, JVH gaming by email at evdsteen@jvh.nl

TCS Gets Czech Approval For TableMax

The TCS group has received approval to sell TableMax TM video card machine into the Czech Republic. The machine brings the electronic dimension, which has proved so popular with TouchBet Roulette to card games, meaning low operating costs for the casino, with added player excitement, reduced intimi-

dation for newer players, and increased discretion for high value players. Each plasma screen has seating for five players who can play on a single table progressive, a local area progressive or a wide area progressive depending on the operator's requirement. The casino is also given the option of changing the game feature and selecting which card game is to be played from a menu of card games. TCS are looking for a similar response from the British Gaming Board who have reviewed the game at their premises in London. For further details of TableMAX please go to http://www.tcsgroup.com and review the entry within the 'Products' section.

TCS' Table Max

HIT Casinos Introduces State Fair Game To Slovenia

HIT Casino Park and Casino Perla customers will be the first in Slovenia to play IGT's State Fair game. Slovenian gamers will enjoy the game's unique arcade-type bonuses and licensed carnival music, which have proven appeal in many European markets. Casino Perla has just completed a remodel of its casino, which now offers a total of 47 table games and 779 slot machines supported by three restaurants, 105 hotel rooms, a 310 seat conference hall and a 340 seat spectacular hall. IGT shipped 67 of the 86 slots added during the remodel. Perla players will enjoy more interactive games than ever with new bonus concepts like State Fair's Balloon bonus or the Kiss the Frog bonus on the iGame-Plus The Frog Prince game. The order included the fast-action graphics of Super Cherry and IGT's very popular video, Cleopatra. Contact Karen Thompson. Phone +31 23 568 7100.
Email Karen.Thompson@igt.com

British Government Announces Plans To Relax Advertising Laws On Gambling

The response from the DCMS to Sir Alan Budd's Gambling Review Body report has unveiled that the UK gaming and gambling industries are about to benefit from relaxed legal restrictions on the advertising and promotion of gambling products which will allow them to become more visible and accessible and create a fairer and more competitive operating environment. The full potential of the opportunities to be opened

Sir Alan Budd, former Chief Economic Adviser to the Treasury and Head of the Government Economic Service.

up to the industry will be unveiled at a two-day conference from ATEI and ICE organisers, ATE, entitled 'Marketing & Advertising for Gaming, Casino and Betting post-Budd'. The event - which is aimed at board / senior management level as well as marketing / business development professionals throughout the casino, betting, bingo, coin-operated amusements and broader leisure sectors - takes place on 8th and 9th July 2002 at the Chelsea Village, London. The conference is believed to be the first of its kind with ATE Marketing & Commercial Director, Julian Graves acclaiming it as a 'vital first step' towards taking full advantage of impending deregulation. For more information on the Marketing & Advertising for Gaming, Casino and Betting post-Budd Conference and sponsorship opportunities contact Suki Scade at ATE on: tel. +44 (0) 20 7713 0302, e-mail sscade@atei.co.uk

Always-Burning-Ultra-Hot & Moorhuhn In Prague

After the sweeping success of the Always Hot three-reel slot at the Svet Zabavy 2001 in Prague, Novomatic Group of Companies and its subsidiary Austrian Gaming Industries (AGI) are going to prove at this year´s World of Entertainment held from 25.-27. April that the game can be faster, hotter and more exciting yet.

Besides the sensational new edition of Always Hot, its successors Burning Hot and Ultra Hot are already much in demand and will be on show both in a reel and in a video slot version. Ultra Hot will additionally be presented in a brand-new streamline cabinet. The elegant slim design of the Streamline Series allows operators to install approximately 40 per cent more machines on a given 100 square meter casino floor space. Also available in these extremely space-saving streamline cabinets, the original Moorhuhn reel and video machines are set to conquer the casinos of the future EU Member States.

In acknowledgement of the increasing importance of these markets, Multiplayer and Touchbet'Roulette installations will also be presented at the show, after these gaming systems with more than 1000 terminals have gone into operation within only one year in Great Britain alone. For further information contact Karl Neidel.
Tel. +43 2252 606 ext. 242.
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G2E to Feature Latest Tech Gadgets

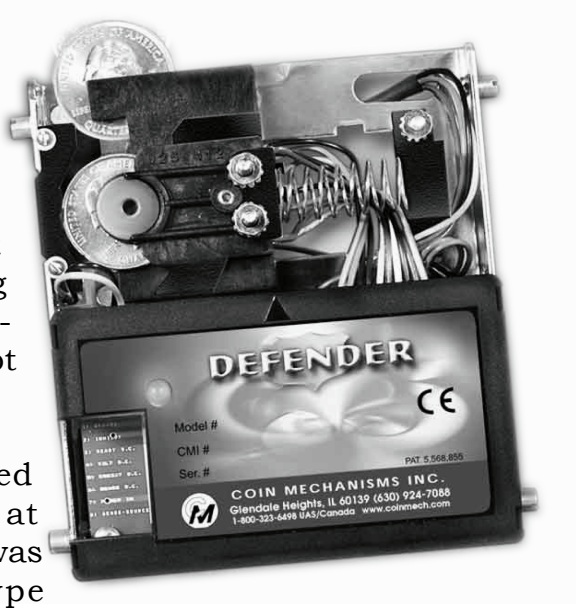
Coin Mechanisms, Inc., Advances the Science of Security

When the engineering experts at Coin Mechanisms, Inc., innovated high security coin validation systems more than 20 years ago, little did they realize that the concept of coin comparing would play an increasingly critical role in the 21st century world of gaming.

With the launch of DEFENDER at Global Gaming Expo 2001, Coin Mechanisms once again met the need for a high security coin acceptor to protect slot machines from engineered cheating tools. Coin Mechanisms' newest product platform designed in collaboration with major OEM manufacturers, DEFENDER incorporates numerous sensors and sophisticated timing algorithms to prevent criminals from entering the mechanism and placing false credits on the slot machine.

"DEFENDER was greeted with great enthusiasm at last year's G2E when it was introduced in prototype form," said Rick Currie, vice president, marketing & sales, Coin Mechanisms. "This year's G2E will see the introduction of the DEFENDER as a full production product that has been submitted to various regulatory agencies. Beta tests are on-going with major casino operators and orders will be taken at G2E 2002."

Coin Mechanisms created DEFENDER to protect slot machines from a new generation of well-educated professional criminals who target specific sub-systems within the machine. "The new threat to these machines is no longer a simple coin on a string, but sophisticated tools developed by intelligent, daring people who want to put up illegitimate credits or obtain unlawful payouts," said Currie. "These criminals have created an entirely new requirement for security within a slot machine."



DEFENDER, the newest member of the Comparitor(r) line of products, offers high security protection for non-marked coins and tokens.

Coin Mechanisms also innovated the Intelligent Comparitor® and SmartMark® token system which together provide the highest level of security now used in casinos worldwide and employs a proprietary bar code style marking on the token which can be read by the comparitor.

"Technicians and slot mangers alike will discover a new range of Comparitor® products at G2E that aren't their father's comparitor," said Currie. These include Coin Mechanisms' newest model

Micro Comparitor® designed to validate the new euro currency. "G2E entertains hundreds of senior level European buyers who will be particularly interested in the Micro Comparitor® range for euro currency and the SmartMark® system of euro denominated tokens," said Currie.

The final new "gadget" to be displayed at G2E 2002 will be the System Plus Management Tool Kit, introduced to support the Intelligent Comparitor® product platform. The kit consists of a laptop computer with software utilities that make diagnosis and maintenance of the Intelligent Comparitor® a service function easily performed by a casino technician. It includes a digital oscilloscope, a software library for maintenance and adjustment, and a suite of other diagnostic tools. The tool kit also includes a hand-held programming device for updating the Intelligent Comparitor® at the slot machine and a secure encryption device that allows software file exchange between the casino and Coin Mechanisms via the Internet.

"Coin Mechanisms has a global product line and a global customer base," said Currie. "Global Gaming Expo offers us the best opportunity to showcase our new products and services to the greatest number of senior level individuals with the greatest purchasing power."

Sencore, Inc., Helps Slot Technicians Brighten the Picture

My picture just doesn't look right." "The colors are off." "The picture is faded and dim." These are all complaints that most people in the monitor service business have heard all too often - especially if the unit has recently been serviced and is now a dreaded rework. Where does a technician start with a problem like this? How bright is bright enough?

"In the past with an NTSC standard television, most professional technicians could align a TV by eye and get a satisfactory picture," said Don Multerer, gaming account manager, Sencore, Inc. "But today there are HDTVs in showrooms; large-screen TVs in conference rooms, and high-resolution computer monitors on the desk of almost every person who works in an office. Can these sets be adjusted by eye? The manufacturer is certainly not aligning these higher resolution displays by eye. Couple that with the fact that users of the displays are more demanding and you have a need to accurately align displays."

To help technicians make precise adjustments, Sencore

Analyzing a display with Sencore's new CP291 Color Analyzer which tests for proper color balance. The CP291 will be available at G2E 2002.

developed the CP291 Portable Color Analyzer. Launching at G2E 2002, the CP291 allows technicians to quickly test and accurately align video displays and adjust brightness or color for the best possible image.

"Introducing the CP291 Portable Color Analyzer at G2E is a natural because the show is an opportunity for us to sell more equipment to technicians who are still checking monitors by eye," said Multerer. "Technicians from all over the world will see our new products in one place - at our booth - and have the opportunity to talk with Sencore designers and engineers about products and systems that meet their special needs. G2E is an opportunity to be where the customers are."

Multerer notes that there are 10 steps to perform a color temperature adjustment with the Sencore CP291.

1. Preset the user brightness and contrast controls to midrange.
2. Preset the cutoff/bias controls to minimum.
3. Preset the drive/gain, ABL, and sub-contrast controls to their center positions.
4. Determine the chromaticity coordinates to which the display is to be adjusted. Reference the chromaticity chart for the x, y coordinates of the desired color temperature (for example, D6500).
5. Display a 100% white window pattern and attach the CP291 color pod over the white window. Adjust the screen control to achieve a luminance of 1-3 foot-lamberts.
6. Adjust the cutoff/bias controls for only the two weaker colors to achieve the x and y color coordinates of the desired color temperature (the control for the strongest color should remain at minimum).
7. Adjust the contrast control to maximum, then adjust the screen control to achieve a luminance of 30 foot-lamberts. Note: If the CRT cannot achieve 30 foot-lamberts, test the CRT with the CR7000 Beam-Rite(tm).
8. Adjust the drive/gain controls to achieve the desired x and y color coordinates.
9. While adjusting the contrast control from 2 to 30 foot-lamberts, check that the color temperature does not change more than 200° Kelvin. If it does, repeat the cutoff/bias adjustment at low luminance and the drive/gain adjustment at high luminance.
10. Display a Staircase pattern and adjust the screen control until the second bar on the left can just barely be distinguished from the first bar (the first bar should be totally black).

To learn more about G2E 2002, which takes place on September 17 - 19 at the Las Vegas Convention Center, or to pre-register, visit www.globalgamingexpo.com.

Introduction to Microprocessors

Understanding the Design of the Test Fixture

By Herschel Peeler

While some assemblies, like coin comparators, hoppers, and coin-in optics, can be tested with static testers (switches and LEDs), some require a live stream of signals. Seven-segment, and dot matrix, display assemblies, for instance, require a serial stream of data and clock signals for operation. These require a dynamic test fixture design. The first part of this series gave you an idea of what the circuit looks like. This one will show you how the microprocessor works. Later articles will give an example of application.

The microprocessor used in the Telpar printer controller board is the 8031. This guy has been around the gaming industry for a long time. The IGT 8032 games (IGT S-Plus, IGT Player's Edge) used these devices. Turn off the television, pour yourself a cup of java, and sit down at your favorite reading table. Here comes the scoop on how the microprocessor really works.

MCS-51 Processor Family

All of these have the same basic engine that drives them. At the heart of each is the MCS-51 processor. They all run on about the same instruction set, with minor variations that go along with whatever makes that device unique.

Within any given type there will be slight modifications in the part number that indicate special features. An H in the part number (8751H-10) indicates it is a Higher speed device. The dash number after the H indicates its top speed in MHz. A "C" in the part number (80C51) indicates the device is a CMOS version of the basic part, and is able to operate on very low supply current. (Otherwise, the devices are NMOS.)

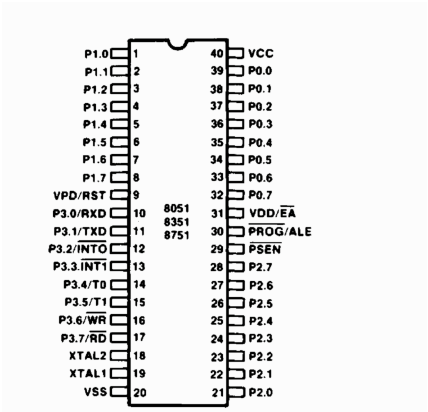
On the Mask Programmed devices there is usually a second manufacturer's part number on the device that identifies which program has been put into it. These may not be interchanged with another device having a different manufacturer's part number. (NOTE: In some machines the differences may be minor, and the difference may only reflect a different revision of the same machine. These may, or may not, be interchangeable.)

On most of the devices the I/O lines may have two functions. A given Parallel port may be used as a parallel port, or be part of a bus structure to interface to peripheral IC's. Each use has a separate strobe coming out of the MPU used to latch the function.

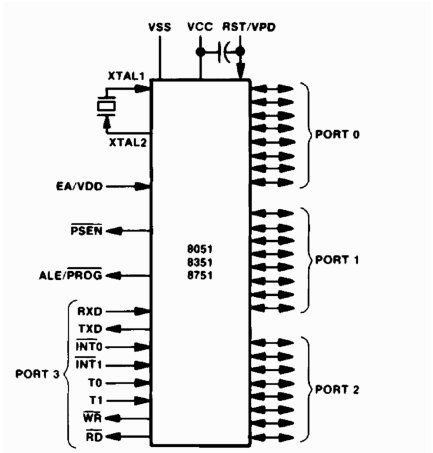
They are capable of referencing 64K of external memory, or more if you are creative. Almost all of the devices are ca-

MCS-51 Family

8031 ROM-less version, 128 bytes of RAM
8032 ROM-less version, 256 bytes of RAM
8051 4K of ROM (Mask Programmed at the factory), 128 bytes of RAM
8052 8K of ROM (Mask Programmed at the factory), 256 bytes of RAM
8751 with 4K of EPROM, 128 bytes of RAM
8752 with 8K of EPROM, 256 bytes of RAM



8051 Microcomputer Pinout Diagram



8051 Microcomputer Logic Symbol

pable of referencing external memory even if they have their own internal memory. With this in mind, it is worth noting that a programmed device may be substituted for a ROM-less version by hard wiring this pin (EA, External Access) in the External state. This is worth making note of because programmed devices are available of the surplus market for under $2.00. This is an excellent price for those small projects.

Probably the most powerful feature of the MCS-51 devices is the instruction set. There is subset of instructions for manipulating individual bits in RAM. This is a Boolean Processor that views a section of RAM as 218 bit-addressable locations. Most devices also have a built in serial I/O port that makes building this chip into a complete peripheral.

INPUT PINS

RESET - Active High. Must be high for at least 1 us. This pin has a passive pull down resistor, making it functional with a small capacitor to VCC. After reset goes away, execution starts at address 0000.
EA - Active low. External Access. Forces memory references to go to external memory. A low on this pin makes memory references go to external RAM and EPROM, and Ports are used as Address and Data lines (as does our design). A high makes these ports programmable 8-bit ports.

OUTPUT PINS

ALE - Address Latch Enable. Active high. Used to latch the lower 8 address bits on external memory references.
PSEN - Active low. Program Store Enable. Used to read external program memory. For devices with external EPROM, use PSEN to strobe EPROM.

XTAL1 - Input to the oscillator.
XTAL2 - Output of the oscillator.

VSS - GND
VCC - +5 VDC

PORT 0 - Open Drain, bi-directional port. Port 0 is also used as the multiplexed Data Bus and Lower Address lines on devices that reference external memory.
PORT 1 - Bi-directional I/O port with internal pull-up resistors.
PORT 2 - Bi-directional I/O port with internal pull-up resistors, and the upper 8 address lines for external references to memory.
PORT 3 - Bi-directional I/O port with internal pull-up resistors, or a serial I/O port. It also contains the RD and WR strobes for references to external memory, Timer inputs, and INT0, INT1 inputs.

Instruction cycle time is 1/12 that of the clock frequency. A 12 MHz clock yields a 1 us instruction cycle on the simple single byte op codes (16 MHz - .75 us.) Operating frequency range - 0.5 MHz to 16 MHz, depending on the device.

Internal registers:
PC - Program counter, 16 bits (64K).
IR - Instruction register.
DP - 16 bit Data Pointer (DPH, DPL).
SP - 16 bit Stack Pointer.
PSW - Processor Status Word.
PCON - Power Control, available on some models.
TMOD - Timer / Counter Mode Control.
TCON - Timer / Counter Control Register.
SCON - Serial Control.
A - 8 bit Accumulator.

B register - 8-bit addressable register.

Working registers - There are four banks of eight working registers set up in the lower addresses of RAM. Two bits in the PSW select which bank of eight registers is to be referenced.

Memory Address configuration of RAM

Internal RAM of the 8031 has multiple uses. Lower addresses are used as registers for the processor. Internal RAM from address 00 to FF (hexadecimal) is organized as four banks of eight registers. Some instructions reference these as bytes of data. Some may reference these as individual bits of data, each with a unique address. The register bank arrangement makes programming in subroutines a programmer's dream, and is one reason why these microprocessors are so popular in many industries.

Register banks:
Bank 0. Hex Address 00 to 07.
Bank 1. Hex Address 08 to 0F.
Bank 2. Hex Address 10 to 17.
Bank 3. Hex Address 18 to 1F.

Bit addressable locations are shown in table 1 above. Other registers of the microprocessor are also bit-addressable. This lets the programmer analyze any bit of a register with only a few instructions. These are shown in table 2.

Continued next month

Bit Addressable Locations **Table 1**

Addr	7	6	5	4	3	2	1	0
20	07	06	05	04	03	02	01	00
21	0F	0E	0D	0C	0B	0A	09	08
22	17	16	15	14	13	12	11	10
23	1F	1E	1D	1C	1B	1A	19	18
24	27	26	25	24	23	22	21	20
24	2F	2E	2D	2C	2B	2A	29	28
26	37	36	35	34	33	32	31	30
27	3F	3E	3D	3C	3B	3A	39	38
28	47	46	45	44	43	42	41	40
29	4F	4E	4D	4C	4B	4A	49	48
2A	57	56	55	54	53	52	51	50
2B	5F	5E	5D	5C	5B	5A	59	58
2C	67	66	65	64	63	62	61	60
2D	6F	6E	6D	6C	6B	6A	69	68
2E	77	76	75	74	73	72	71	70
2F	7F	7E	7D	7C	7B	7A	79	78

Table 2
Bit addressable locations

Bit addressable locations
80 Port 0, bit 0.
81 Port 0, bit 1.
82 Port 0, bit 2.
83 Port 0, bit 3.
84 Port 0, bit 4.
85 Port 0, bit 5.
86 Port 0, bit 6.
87 Port 0, bit 7.
88 Timer 0 Interrupt. Type control bit.
89 Timer 0 Interrupt. Edge Flag.
8A Timer 1 Interrupt. Type control bit.
8B Timer 1 Interrupt. Edge Flag.
8C Timer 0 Run Control Bit.
8D Timer 0 Overflow Flag.
8E Timer 1 Run Control Bit.
8F Timer 1 Overflow Flag.
90 Port 1, bit 0.
91 Port 1, bit 1.
92 Port 1, bit 2.
93 Port 1, bit 3.
94 Port 1, bit 4.
95 Port 1, bit 5.
96 Port 1, bit 6.
97 Port 1, bit 7.
98 (SCON.0) Receive Interrupt Flag.
99 (SCON.1) Transmit Interrupt Flag.
9A (SCON.2) Receive Register, bit 8.
9B (SCON.3) Transmit Register, bit 8.
9C (SCON.4) Receiver Enable.
9D (SCON.5) Serial Mode Control bit 2.
9E (SCON.6) Serial Mode Control bit 1.

9F (SCON.7) Serial Mode Control bit 0.
2 1 0
0 0 0 Mode 0. Shift Register Mode. Freq = OSC/12.
0 0 1 Mode 1. 8 bit UART, variable baud rate.
0 1 0 Mode 2. 9 bit UART, Freq = OSC/64 or /32.
0 1 1 Mode 3. 9 bit UART variable baud rate.
1 0 0 (n/u)
1 0 1 Mode 1. RCV Int will not be activated if a valid stop bit is not received.
1 1 0 Mode 2. RCV INT is not activated if the 9th bit is a 0.
1 1 1 Mode 3. RCV INT is not activated if the 9th bit is a 0.

Table 2 (Cont.)
Bit addressable locations

A0	Port 2, bit 0.
A1	Port 2, bit 1.
A2	Port 2, bit 2.
A3	Port 2, bit 3.
A4	Port 2, bit 4.
A5	Port 2, bit 5.
A6	Port 2, bit 6.
A7	Port 2, bit 7.
A8	(Enable External Interrupt 0.
A9	Enable Timer Interrupt 0.
AA	Enable External Interrupt 1.
AB	Enable Timer Interrupt 1.
AC	Enable Serial Port Interrupt.
AD	.
AE	.
AF	Enable all Interrupts.
B0	Port 3, bit 0. Serial Port Receive pin.
B1	Port 3, bit 1. Serial Port Transmit pin.
B2	Port 3, bit 2. Interrupt 0 input pin.
B3	Port 3, bit 3. Interrupt 1 input pin.
B4	Port 3, bit 4. Timer / Counter 0 External interrupt flag.
B5	Port 3, bit 5. Timer / Counter 1 External interrupt flag.
B6	Port 3, bit 6. Write data for external references.
B7	Port 3, bit 7. Read data for external references.
B8	Priority of External Interrupt 0.
B9	Priority of Timer 0 Interrupt.
BA	Priority of External Interrupt 1.
BB	Priority of Timer 1 Interrupt.
BC	Priority of Serial Interrupt.
D0	PSW, bit 0. Parity Flag.
D1	PSW, bit 1. (n/u)
D2	PSW, bit 2. Overflow Flag.
D3	PSW, bit 3. Register Bank Select 0.
D4	PSW, bit 4. Register Bank Select 1.
D5	PSW, bit 5. Flag 0.
D6	PSW, bit 6. Aux Carry.
D7	PSW, bit 7. Carry.
E0	Accumulator, bit 0.
E1	Accumulator, bit 1.
E2	Accumulator, bit 2.
E3	Accumulator, bit 3.
E4	Accumulator, bit 4.
E5	Accumulator, bit 5.
E6	Accumulator, bit 6.
E7	Accumulator, bit 7.
F0	Multiplication Register, Bit 0. (B register)
F1	Multiplication Register, Bit 1. (B register)
F2	Multiplication Register, Bit 2. (B register)
F3	Multiplication Register, Bit 3. (B register)
F4	Multiplication Register, Bit 4. (B register)
F5	Multiplication Register, Bit 5. (B register)
F6	Multiplication Register, Bit 6. (B register)
F7	Multiplication Register, Bit 7. (B register)

Table 3
Byte addressable locations

Byte addressable locations	
80	Port 0 (P0).
81	Stack Pointer (SP).
82	Data Pointer, Low byte (DPL).
83	Data Pointer, High byte (DPH).
88	Timer Register (TCON).
89	Timer Mode Register (TMOD).
8A	Timer 0, Low byte (TL0).
8B	Timer 1, Low byte (TL1).
8C	Timer 0, High byte (TH0).
8D	Timer 1, High byte (TH1).
90	Port 1 (P1).
98	Serial Port Control Register (SCON).
99	Serial Port Data Buffer (SBUF).
A0	Port 2 (P2).
A8	Interrupt Enable Register (IE).
B0	Port 3 (P3).
B8	Interrupt Priority Register (IP).
D0	Program Status Word (PSW).
E0	Accumulator direct Address (ACC).
F0	B register direct Address (B).

Port 0 (when not being used as an 8 bit I/O)

7	6	5	4	3	2	1	0
AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0

Port 2 (when not being used as an 8 bit I/O)

7	6	5	4	3	2	1	0
A15	A14	A13	A12	A11	A10	A9	A8

Port 3 Serial I/O configuration

7	6	5	4	3	2	1	0
3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0

Port 3 Serial I/O configuration

7	6	5	4	3	2	1	0
RD	WR	T1	T0	INT1	INT0	TXD	RXD

Table 4 - The Ports

Feeling Insecure?

By Ken Locke

Having passed more air traffic control towers than most have telephone poles, I know how to get off an airplane. I consider the 'fasten seat belt' sign a mere suggestion as we approach the gate in Las Vegas' McCarran Airport. Gathering my gear and powering up my cell phone long before the FAA rules mandate, I ready myself to disembark this flying tin can and get to the next casino install. Do my fellow air travelers move with the same sense of purpose and alacrity? HELL, NO!

I am flummoxed at the vast number of air travelers that are taken totally by surprise that it's time get off the aircraft. GET YOUR STUFF AND GET OUT!

… Breathe.. I am ok. Really. Half way up the jet way, I appeal to my Buddha nature and center my thoughts. As the sense of Nirvana settles into me, I take notice of the simple things like the slot machines jingling profitably on the concourse. Slots are such a fixture in Nevada that they are, quite literally, the first thing any visitor will see. And the tintinnabulation of shining little coins is the first thing we hear. Coins, my friends, are where it all began.

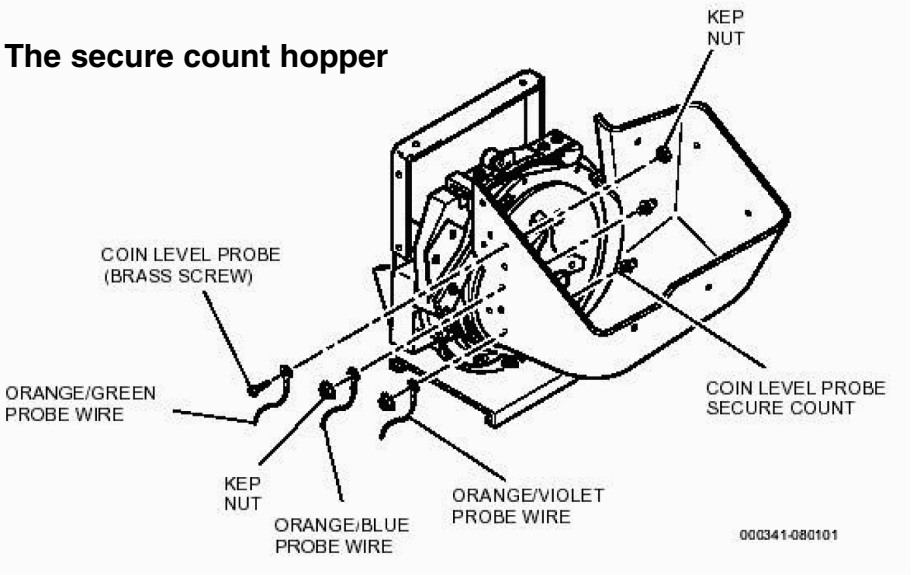
While your humble correspondent usually walks along the razor's edge of gaming technology, there is something to be said about sticking with basics. At the behest of a devoted reader, we're going to have a little chat about hoppers. It's all very Zen.

Bill Frinzely at the Reno-Tahoe International airport was the inspiration for the preceding rant and this month's piece on the relatively new Secure Count Hopper. Anything for the fans, so here goes.

The secure count version of both AC (8032) and DC (i960) hoppers has been out since early in 1999. They really hit the market without a lot of fanfare. In fact, I had not seen one myself until they appeared in a machine during an install later that summer. So we scrambled to find out all we could on the new hopper. We pestered every engineer in our path until we found a kindly sage named Voytek. No, he's not a ferengi. He is Polish. He is the king of Coin In/Coin Out at IGT and a totally gnarly surfer.

Here's what we found out: The International Game Tech-

The secure count hopper



nology secure count hopper is a newly designed coin-out mechanism. Let's start with the new optics.

The optic assembly is a custom dual opto-interrupter module. This means that a "smarter-eye" has replaced the traditional emitter-receiver optic pair. Originally, a light emitting diode would project a single beam into a light sensitive transistor. As a coin passed over the knife, it would push up a spring-loaded rocker arm that would in turn move an optic flag to block this beam. This would send a count signal to processor.

Not a bad way to count coins. Then the bad guys figured out that with the use of an optic wand (a.k.a. monkey paw) they could effectively blind the receiver. This meant that the hopper motor continued to crank out coins while the optics never counted them. As long as the evildoer allowed a count signal every seven seconds or so, the machine would never know the difference.

To counter this cheat, IGT placed a plastic cowling over the top of the optics assembly to block entry of the wand. The real problem then became wear and tear. The spring on the rocker arm needs to be at such a tension as to recoil the optic flag away from the optics. Not tight enough and it tends to bounce and cause false count signals resulting in hopper short pays.

Further, a ridged coin like a quarter, pressed between the rocker and knife caused a good deal of erosion to the knife. Wear to such a degree would actually let the coin duck under the rocker and out of the machine without being counted. Improvements were definitely needed.

At a glance you can tell the new from the old quickly by noticing the lack of a large rocker arm and six wires instead of four protruding from the optics. This are indicated as Vcc, cathode A, cathode B (See J1 on the schematic diagram for the hopper controller, page 32).

In the new optic either side of the pair can act as an emitter or receiver and switch back and forth at intervals. This is done while the double optic pair shines a constant beam but this time the microprocessor will toggle to observe each input approximately one hundred times every 50 milliseconds. If the cheater blinds the emitter when it was acting as a receiver, it will hard tilt the machine and activate a status LED located on the back of the hopper (more on these in a sec).

Through this sampling the hopper can also determine width of a given coin, by sensing its leading and trailing edge. So what good is that? The green LED located on the "smart board" will flash in preset codes to indicate what sort of tampering may have taken place.

ONE FLASH = The optics have been flooded with light.

TWO FLASHES = An object was inserted into the optics in the reverse direction.

THREE FLASHES = The time interval of the coin entering and exiting the optics was too short.

FOUR FLASHES = The time interval of the coin entering and exiting the optics was too long.

If any one of these conditions occurs, the secure count hopper will turn the hopper motor off and send a tilt message to the processor and along SAS communication.

Our friend the Surfing Pole goes on to mention that the advantage of the secure count hopper is the new direct coin count system, which replaces the mechanical lever action coin detect. The optics assembly was moved to the same side of the main housing as the coin. In this way, the coin itself is passed through the optics, rather than a plastic flag. A smaller stabilizing arm is used to guide the coin gently into the optics and there is much less punishment to the knife. This probably comes as huge disappointment to those techs who

NOTES:
(UNLESS OTHERWISE SPECIFIED)

1) ALL THROUGH HOLE RESISTORS EXPRESSED IN OH S 1/4W 5%
   ALL SURFACE OUNT RESISTORS EXPRESSED IN OH S 1/10W 5%
2) ALL CAPACITORS EXPRESSED IN ICROFARADS
3) ALL 14 PIN ICS, PIN 14 IS PWR, PIN 7 IS GND.
   ALL 16 PIN ICS, PIN 16 IS PWR, PIN 8 IS GND.
   ALL 20 PIN ICS, PIN 20 IS PWR, PIN 10 IS GND.
   ALL 32 PIN ICS, PIN 32 IS PWR, PIN 16 IS GND.

REVISIONS				
REV	ECO	DESCRIPTION	BY/DATE	CHK/DATE
EA		PROTOTYPE RELEASE	dwl/09APR99	
A	5054	PRODUCTION RELEASE	dwl/03FEB99	

OPTICS INTERFACE

HOPPER LEVEL
MULTI 1-2
SINGLE 2-3

HOPPER TYPE
SIDE
ESC

MACHINE INTERFACE

POWER SUPPLY

FAIL SAFE

TO MOTOR

for i960

E ORY BYTE 28020070

ON FWD	ON REV	OFF (BRAKED)
0 1 1 = 3	0 0 1 = 1	X X 0 = 0 or 1 X X = 4
BRAKE	BRAKE	BRAKE
DIRECTION	DIRECTION	DIRECTION
SAFETY	SAFETY	SAFETY

E ORY BYTE 28020030

B7 = Hopper-full (empty=0 full=1)
B6 = Hoppert motion detect
B5 = Coin-out

E ORY BYTE 28020032

B2 = Hopper reversibility detect
(1=reverse allowed)

BOARD LOGIC SIGNALS

ON FWD	ON REV	OFF (BRAKED)
1 0 0	1 1 0	X X 1 or 0 X X
BRAKE	BRAKE	BRAKE
DIRECTION	DIRECTION	DIRECTION
SAFETY	SAFETY	SAFETY

INTERNATIONAL GAME TECHNOLOGY
9295 PROTOTYPE DRIVE RENO, NV 89511

TITLE
SCHEMATIC, DC
SECURE COUNT CONTROLLER

DWG. SIZE	DWG. NO.	REV LTR
C	769 225 14	A

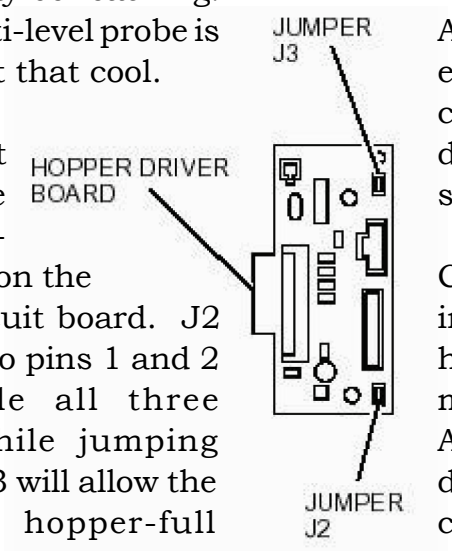
DRAWN	DATE	CHECKED	DATE	APPROVED	DATE	SCALE	SHT 1 OF 1
David Loar	07JAN99					NONE	

DWG NO. 769 225 14

think it is cool to dangle twenty spare hopper knives on their tool belt. You guys will just have to switch to a sexier cologne.

Lastly, we got ourselves some new probes. "Half-full" and "nearly empty" probes are placed strategically up the side of the bowl. As the coin level falls, a signal is sent to indicate its state. Ideally this was probably designed to facilitate preemptive coin fills but there's a tiny little flaw. Umm.. These new probe signals don't really go anywhere. That is to say, there is no outward indication on the machine that the hopper is nearly empty or half full. The old Spintek hoppers had a similar system that would light an LED on the candle but no such thing exists on an IGT machine.

These signals do get sent through SAS but very few host systems are set to detect these specific signals. One could surmise that it may come across as a coin-out jam but that may be reaching. So, the multi-level probe is cool but not that cool.



Notice that there are some jumpers located on the printed circuit board. J2 connected to pins 1 and 2 will enable all three probes, while jumping pins 2 and 3 will allow the traditional hopper-full probe only. Jumper J3 set to pins 1 and 2 will be set for side eject, while pins 2 and 3 set it to escalator mode.

Check out IGT Customer Notification 3377, 21 Dec 01. Under rare circumstances, when the secure count hopper is set to enable all three probes, it will lock up in the middle of a payout and cause a small headache. Switching it back to the traditional mode should fix the problem. Newer game releases have resolved the issue.

Other customer notifications specific to the secure count hopper include CN 1968. The Allegro motor driver IC is put into a "sleep" state when the "BRAKE" and the "ENABLE" inputs to the IC are at any time both high. The "sleep" mode turns off all four driver transistors allowing the motor to coast to a stop inhibited only by the friction of the load.

Some 960 I/O boards output a logical "high" on both the BRAKE and ENABLE inputs at the end of a payout causing the motor driver IC to go to sleep.

CN2018 is similar in that when a DC hopper is commanded to stop, the Allegro DC motor driver integrated circuit's pulse width modulates the residual motor current to ground and +25VDC. The Autek power supply cannot accommodate this "back-fed" current and it causes the power supply to go into a shutdown mode. This, in turn, shuts down the machine. So that's bad.

CN 3065 deals with the microprocessor on the AC secure count hopper board. It does not take it very well when the Vcc voltage falls to less than 4.5 VDC, which can occur during low line or brownout conditions.

CN1922 provides information on the retrofitting kit for upright units, while CN 3018 is for slants and bar tops.

Do my transportation woes have anything to do with secure count hoppers? No, but I just had to get it out. Thanks for shoulder. *sniff.. group hug*

Ken Locke is a Technical Trainer with the Gaming Systems Department of International Game Technology in Reno, NV. He has traveled to gaming jurisdictions throughout the world to train casino personnel on nearly all aspects of slot operations.

Currently, he works on the new EZ Pay Ticket-In Ticket-Out installation team. Contact him at Ken.Locke@igt.com

Blanking

There is a great deal of timing going on in the operation of a monitor. There are specific times when specific things are happening. One of these is the retrace time. For example, the electron beams begin at the left edge of the CRT. When the electron beams reach the far right edge of the screen, it is time to initiate the horizontal retrace. The horizontal retrace quickly brings the beams back to the left edge of the screen.

However, we don't want to draw a line on the screen during the horizontal retrace. If we did, we would see a diagonal white line between the two parallel lines of raster. This would cause the image to look all washed out. To prevent this, there is a circuit in the monitor called the blanking circuit. The purpose of the blanking circuit is to turn off all three electron guns during the retrace time. When the blanking circuit is on, the electron guns are turned off.

Because the horizontal deflection circuit is operating so much faster than the vertical deflection circuit, an interesting but hidden phenomenon occurs during the vertical retrace. As the magnetic field in the vertical deflection coils reverses polarity (to begin each field at the top of the CRT) the quickly scanning horizontal deflection circuit actually makes the beam move back and forth a dozen or so times before the beams reach the top of the screen. Turning up the brightness will often reveal these hidden "vertical retrace lines" that zigzag their way across the screen. This is actually the path the beams take as they make their way from the bottom of the screen back to the top. These lines are normally hidden from view; they are concealed by the blanking circuit as it is activated during the vertical retrace. Remember the blanking circuit turns off all three electron guns during the retrace time. If you see these vertical retrace lines, you may have a problem with the blanking circuit.

Blanking failure causes white, vertical retrace lines to appear on the screen.

Let's take a look at a couple of examples of blanking circuits. These are two different approaches used to accomplish the same task.

Turn Off the Outputs

This technique kills the video output transistors by removing their base bias. Check out the video output transistors, X103, X106 and X109. Notice that all three of the base leads are tied together. Follow this connection and it leads to the collector of X304, the blanking transistor. This is an NPN transistor with a grounded emitter. It is a classic "ground switch" configuration.

The blanking transistor is turned on during both the vertical retrace and the horizontal retrace. In other words, when the beam is at the right edge of the screen, the blanking transistor is turned on just before the retrace begins, and remains turned on until the magnetic field in the yoke has reset to the left edge of the screen at which time the blanking transistor is turned off. Likewise, when the beam is at the bottom edge of the screen, the blanking transistor is turned on just before the retrace begins, and remains turned on until the magnetic field in the yoke has reset to the top edge of the screen at which time the blanking transistor is turned off.

So here's the deal: The video output transistors are NPN transistors. In order for an NPN transistor to turn on, the base has to be .7 volt higher (more positive) than the emitter. Our little ground switch, the blanking transistor, drags all three of the base leads to ground which, as we all know, is zero volts. This simultaneously turns off all three video output transistors and their associated electron guns thus accomplishing the blanking procedure. Pretty cool, huh?

Kill the Inputs

Another technique is to attenuate the video inputs. In this case, transistors Q1, Q2 and Q3 are the video input transistors. Technically speaking, these transistors are not acting as video amplifiers. They are impedance matching transistors that convert the high impedance input used in video games to the low impedance input of the video amplifier IC.

The output of this first stage comes off the emitter of the transistor and is passed through a 150 ohm resistor and a 10 microfarad capacitor to the input of the video amplifier IC.

Okay, try to follow me here. See the three diodes, D5, D6 and D7? The anodes of these diodes are

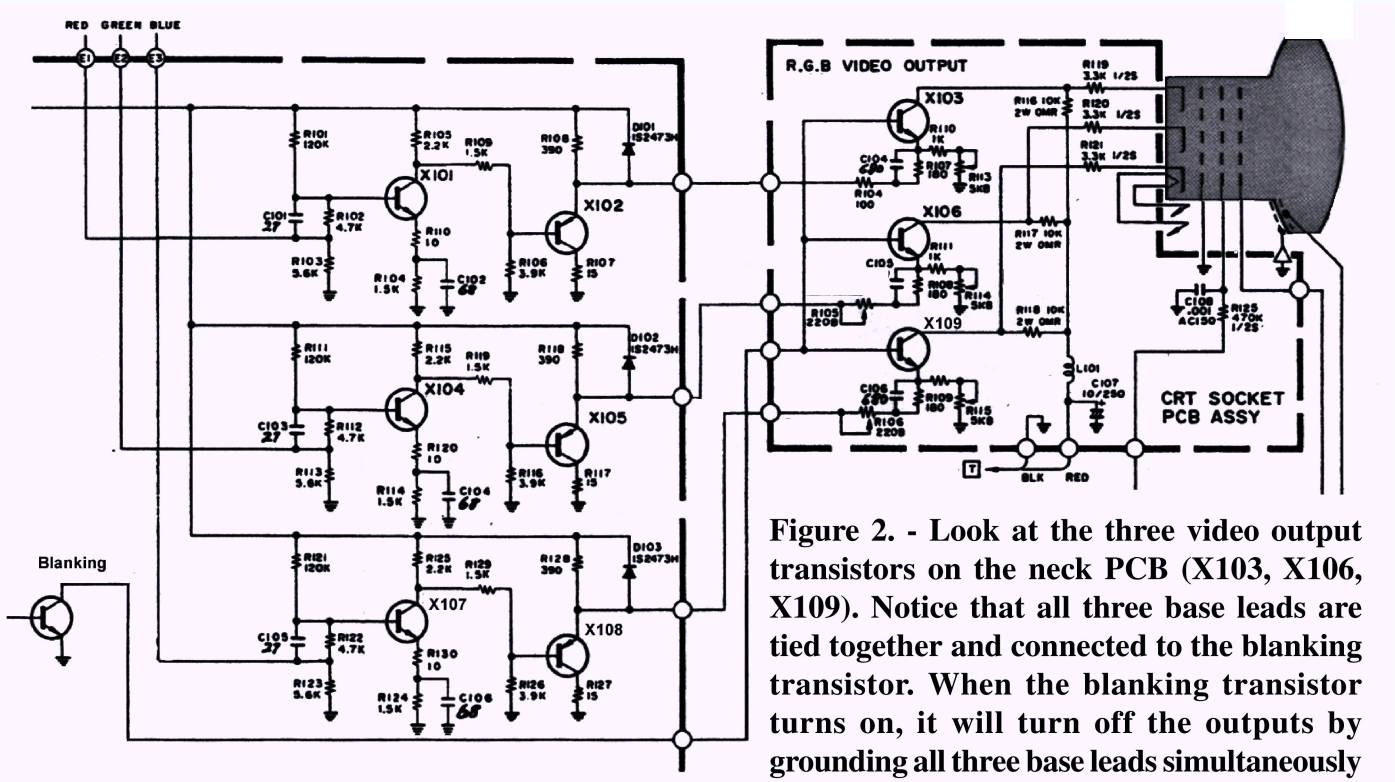
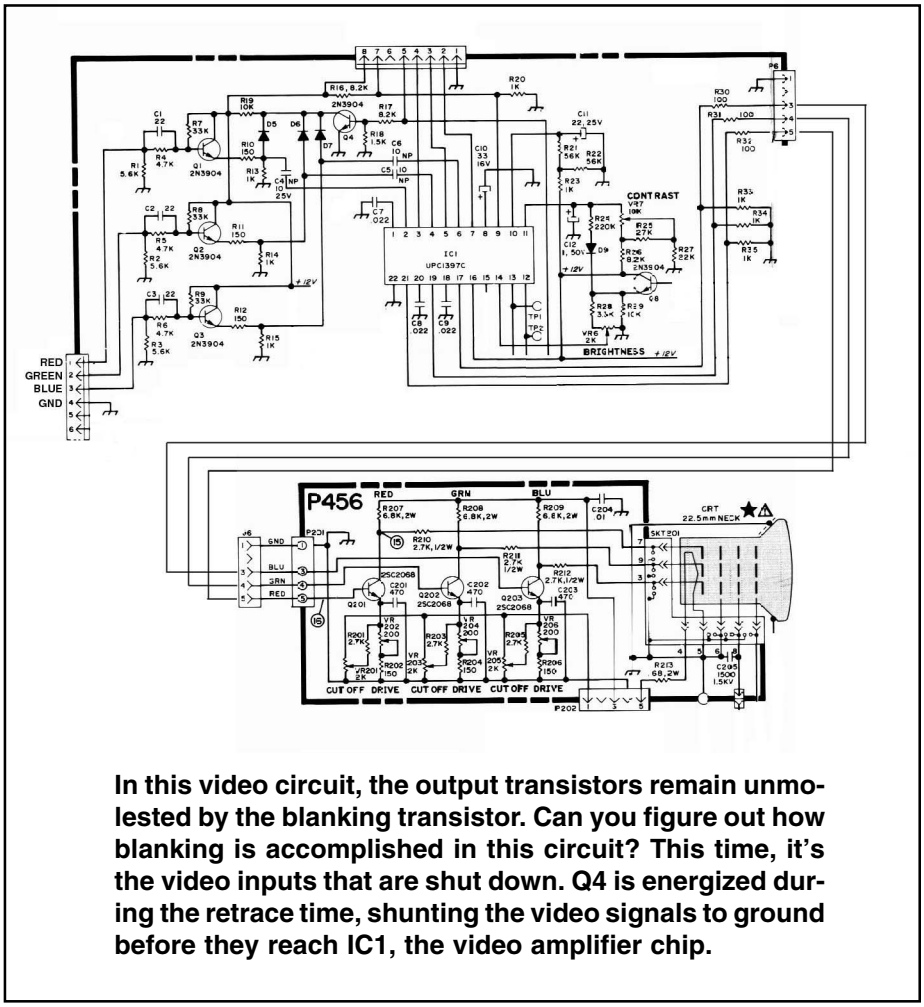


Figure 2. - Look at the three video output transistors on the neck PCB (X103, X106, X109). Notice that all three base leads are tied together and connected to the blanking transistor. When the blanking transistor turns on, it will turn off the outputs by grounding all three base leads simultaneously

each connected to the red, green and blue video signals, just after the impedance matching transistors but BEFORE the inputs of the video amplifier IC. Notice that the cathodes of all three of these diodes are tied together and connected to . . . could it be . . .? Our old friend the ground switch! There it is, Q4.

As previously described, Q4 is activated during retrace. When the transistor is turned on, the video signals are shunted through the diodes, to ground. This clamps the video to a level of around .7 volt. The IC is looking for something close to a volt before you'll see any appreciable electron gun emission so clamping the video at .7 volt effectively accomplishes blanking.

The blanking circuit will differ between monitor designs. The common thread here is that regardless of how it is accomplished, blanking must somehow control all the video circuits simultaneously. If the blanking transistor is not labeled on the schematic diagram, what you are looking for is some commonality between the three video circuits whether it is at the input or at the output.



In this video circuit, the output transistors remain unmolested by the blanking transistor. Can you figure out how blanking is accomplished in this circuit? This time, it's the video inputs that are shut down. Q4 is energized during the retrace time, shunting the video signals to ground before they reach IC1, the video amplifier chip.

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