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Slot Machine Technology for the International Gaming Industry



Platform Architecture Review, Part 2

Kristel CCFL Inverter Board

Quick, Simple Repairs

Bally Technologies and Ingenio

Yes, another build your own article!

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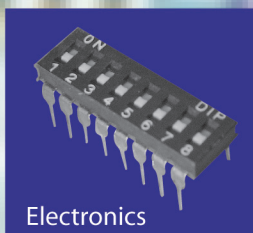
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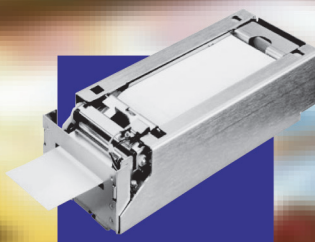
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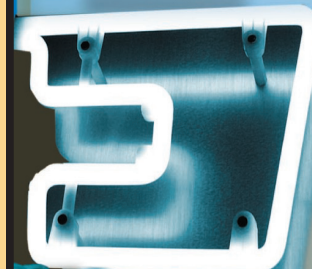
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Innovation through Technology

This month marks our second look into Atronic's e-motion cabinet architecture. We have been examining how boards and connectors interact with each other in general, and also what happens to these components during boot-up and game play. In this month's installment, we'll examine the circuit boards inside the logic box, plus the remaining exterior circuit boards not covered in part one. Michael

Brennan's column begins on page six.

One of the most common faults in LCD monitors is inverter failure. The inverter uses a low voltage DC input and produces a high voltage, high frequency AC output that powers the CCFL lamps in the monitor. Herschel Peeler describes the circuit and provides us with a schematic diagram in his article on the Kristel inverter, beginning on page 17.

Ted Befus has another "Build-It-Yourself" article for us. This month, it's a jackpot reset system that provides a way to reset jackpots (remotely) on a hardware level instead of through the control program. It's a neat solution, constructed in clever way. Ted's article begins on page 32.

In addition, Pat Porath has his Quick and Simple Repairs and yes, there is a handful of press releases from my buddies at FutureLogic, Heber and SmartGames (Russia).

Robert Jewell reminds us of the power-sapping, evil, third harmonic distortion that occurs in a modern casino. We have cover the



subject previously here in the pages of Slot Tech Magazine. This time, Robert shows us some of the real-world loss of efficiency that his casino suffered when large numbers of "bad" machines ganged up to cause his power to degrade. He also describes an easy technique for gauging your efficiency using an ammeter.

Finally, TechFest 14 has been planned for December 5-7 2006. The event will be held at the Pechanga Resort and Casino in Temecula, California. This is a really nice property with a new hotel and meeting room space. I am looking forward to this event. It's only 45 minutes from my home. Sweet!

See you at the casino.

Randy Fromm's Slot Tech Magazine

Editor

Randy Fromm

Technical Writers

Ted Befus

Michael Brennan

Herschel W. Peeler

Pat Porath

John Wilson

International Contributor

Martin Dempsey

Advertising Manager

Dennis Sable

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1944 Falmouth Dr.
El Cajon, CA 92020-2827
tel.619.593.6131
fax.619.593.6132
e-mail

editor@slot-techs.com

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Platform Architecture Review, Part 2

By Michael Brennan

This is the second look into Atronic's e-motion cabinet architecture. We are examining how boards and connectors interact with each other in general, and also what happens to these components during boot-up and game play.

For this month's article, we'll examine the circuit boards inside the logic box, plus the remaining exterior circuit boards not covered in part one.

Hopper Board

First, it is important to note that the hopper board is always present, whether the game is coinless or not, and whether there is a hopper or not. The hopper board has other functionalities even when a hopper is not present.

If the machine has a hopper for coin operation, the hopper board will read the H1 sensors (low and high levels) so it can direct the bowl accordingly. If the sensors reflect that the bowl is low,

the hopper board will send a signal to the main board, which will display a "hopper low" message on-screen. If the hopper is high, no message will appear on-screen, but the coin diverter will trigger a drop.

Troubleshooting wise, the combination of older hopper boards and newer software can possibly cause issues. This was remedied with Ditron boards manufactured after the fortieth week of 2005 (visible on a board sticker).

Also, if you are receiving a lot of "coin jam" or "hopper empty" error messages (and the hopper is not paying out), check the capacitor at C17 for tolerance and aging. The hopper board connectors are explained below.

P1: This RC26 connector snaps into a ribbon cable that transmits communication to and from the signal filter board, along with 5, 12 and 24 volts of power.

P2: A Microfit 12 connector, P2 sends power and control signals (forward and reverse) to the hopper motor. This connector also receives signals from the proximity sensors in the hopper and hopper probes.

P3: Running to the door motor, this connector (a Microfit 14) sends power and control to the motor that adjusts the playfield height. It also receives signals from the door motor sensors.

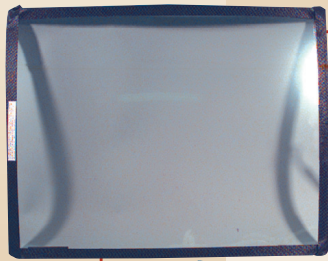
Coin Board

The coin board is only present if the machine is configured for coins. Otherwise, it is omitted from the cabinet.

During normal operation, the coin board waits until a status changes or there is a user interaction. The board works with six optics.

With recent software, it is possible to get a "coin acceptor not connected" on-screen error message in a coin-free game. This occurs because the software looks for a coin acceptor if a certain cable is connected. Specifically, if the cable that would ordinarily run to the coin board at P1 is connected to the signal filter board at P9, you may receive this message. If so, simply disconnect the cable connected to P9 on the signal filter board. Then power cycle the game (no RAM reset needed).

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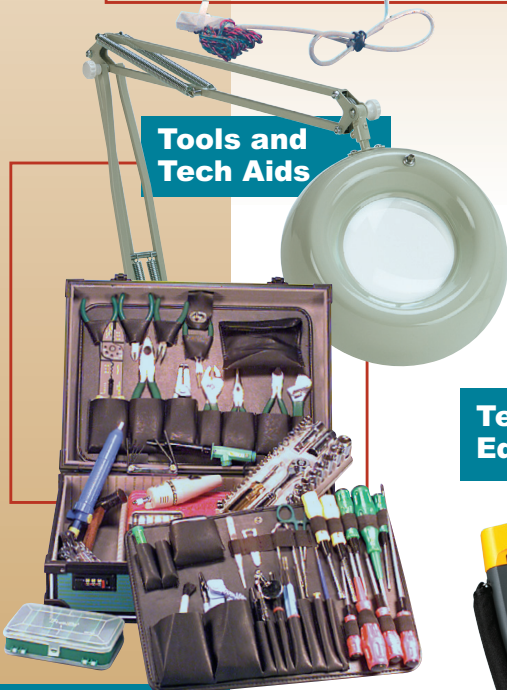


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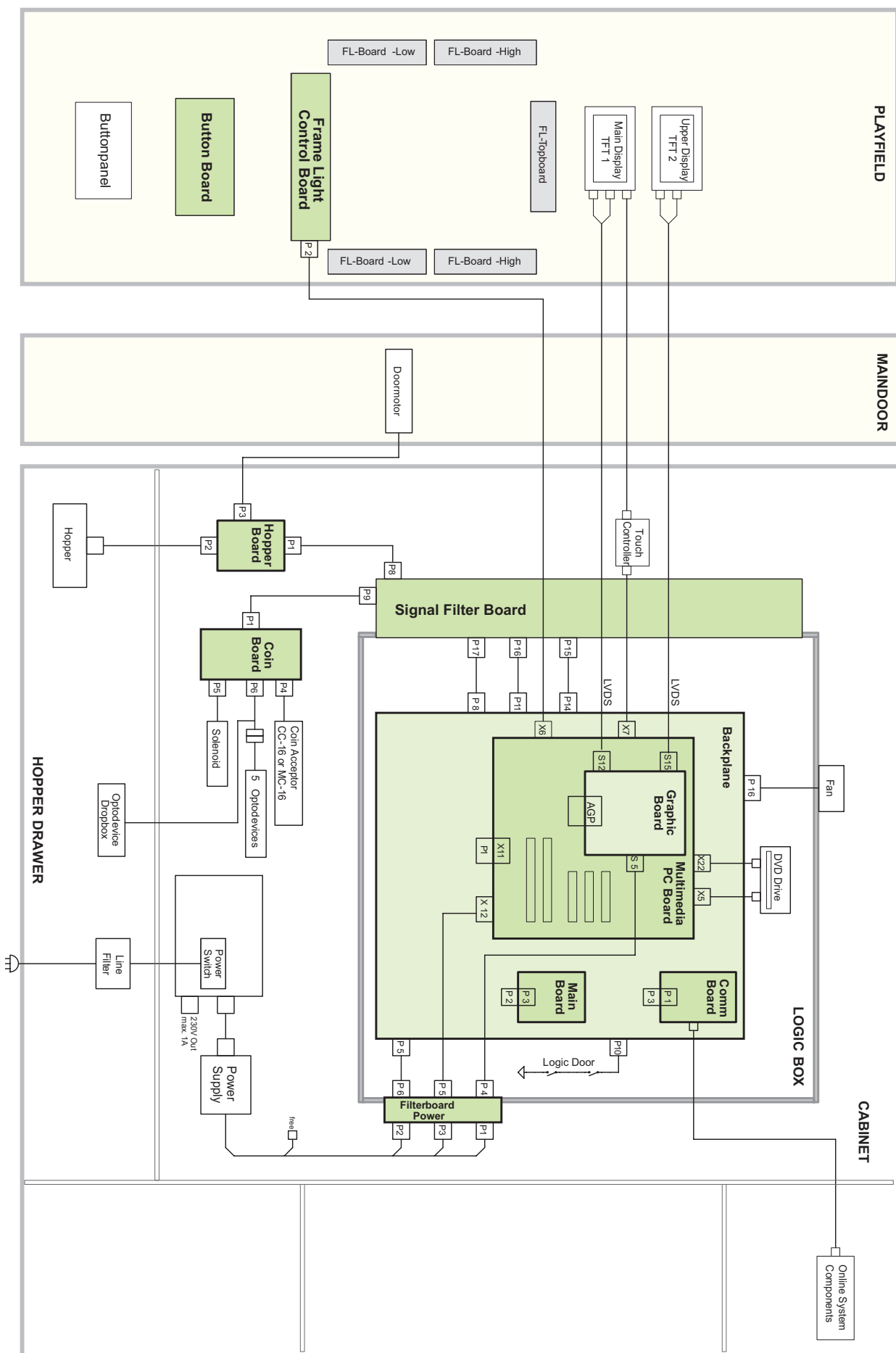
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Atronic Wiring Diagram

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P1: This RC20 ribbon cable runs to the signal filter board at P9, receiving power and SPI communication.

P4: A Microfit 10 connector, P4 is cabled to the coin acceptor, with 12V of power and data.

P5: This Microfit 4 connector runs to the solenoids.

P6: An in-line harness from the opto devices is connected to an RC26 cable that connects here at P6.

Power Filter Board

The power filter board actively filters one-hundred percent of the power that runs to the game's devices. All power goes through this board, then through the logic box to the graphics card, multimedia board and the backplane (which distributes it to other components).

There are three connections on the front of the board and three on the back. All voltages are nested on each connection.

If you are ever replacing the power supply that runs to the power filter board, make sure you remove the right-angle connectors at P1, P2 and P3. If you yank on the cables without disconnecting them, they can pull and break the connectors right off the board.

Backplane

The backplane is a distribution point for DC power and communication. It connects signal lines and

features many large ribbon cable connectors.

P1: P1 is a 64-pin DIN connector with pins in two layers, which interfaces with the multimedia board.

P2: Complete with 128 pins, P2 is a four-layer DIN connector that the main board plugs into, containing a large amount of data and power.

P3: The commboard plugs into this connector, a 96-pin DIN type.

P5: Connecting to the power filter board at P6, P5 receives all the backplane's power.

P8: A Minifit 12 connector, P8 is one of three backplane connectors that plug into the signal filter board. It transfers 5, 12 and 24 volts.

P10: This microfit 4 connector runs to the logic box door.

P11: An RC40 ribbon cable plugs into P11 from the signal filter board. Data regarding the main board I/O, counter board, button board, and coin board run through this connection.

P14: This connector also runs to the signal filter board, routing data for the bill acceptor, top light (candle), speakers, ticket printer and main board I/O.

P16: This Microfit 3 connector links to the cabinet's fan, containing 12 volts of power.

Multimedia

The multimedia board controls all sound and video, offering many interfaces. It has an in-depth role during machine boot-up.

When the e-motion cabinet is powered up, the multimedia board is the first to boot. It controls the cabinet.

From the CD inserted in the drive, the multimedia board loads Microsoft Windows CE, general game graphics and sound, frame light graphics, and the main board interface program (which allows the multimedia board to understand the main board). Information from the CD is downloaded and stored on the board's RAM.

Status information during the boot-up is expressed via loading bars on the game screen. Once all the data is loaded and complete, the multimedia board starts Windows CE and then transfers control of the machine to the main board. Control shifts when the game screens briefly flash white. At this point no peripherals or host systems are talking to the machine. This process is the same for all re-boots.

During game play, the main board will command the multimedia board to play graphics and sounds as needed. If the main board requests graphics or sounds that were not previously downloaded onto the multimedia RAM (like bonus round animations or game menus), the multimedia board will fetch the necessary

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P1	
1	5V
2	5V
3	GND
4	GND
5	NC
6	nH0_RES
7	MISO_HOPP
8	MOSI_HOPP
9	SCK_HOPP
10	nENA_HOPP
11	RXD_HOPP
12	CTS_HOPP
13	TXD_HOPP
14	RTS_HOPP
15	24V
16	24V
17	24V
18	12V
19	12V
20	12V
21	n12V
22	GND
23	GND
24	GND
25	GND
26	GND

P2	
1	M1_FWD
2	M1_REV
3	H1_LL
4	5V
5	GND
6	H1_CNL
7	H1_CNH
8	H1_HL
9	GND
10	H1_DET0
11	H1_DET1
12	H1_DET2

P3	
1	M2_FWD
2	M2_REV
3	H2_LL
4	5V
5	GND
6	H2_CNL
7	H2_CNH
8	H2_HL
9	GND
10	H2_DET0
11	H2_DET1
12	H2_DET2
13	H_INP1
14	H_INP2

Coin Board Connector Pins

P1	
1	5V
2	5V
3	nCN_RES
4	D0_COIN
5	D1_COIN
6	D2_COIN
7	D3_COIN
8	D4_COIN
9	D5_COIN
10	RDWR_CNE
11	RDWR_CN0
12	RDWR_CN1
13	RDWR_CN2
14	24V
15	12V
16	12V
17	GND
18	GND
19	GND
20	GND

P4	
1	GND
2	12V
3	TRIG/VC
4	CREDIT
5	VAL_EN
6	ALARM
7	CV_DET1
8	CV_DET2
9	CV_DET3
10	CV_DET4

P6	
1	OD_INP1
2	OD_PHT1
3	OD_LED1
4	GND
5	OD_INP2
6	OD_PHT2
7	OD_LED2
8	GND
9	OD_INP3
10	OD_PHT3
11	OD_LED3
12	GND
13	OD_INP4
14	OD_PHT4
15	OD_LED4
16	GND
17	OD_INP5
18	OD_PHT5
19	OD_LED5
20	GND
21	OD_INP6
22	OD_PHT6
23	OD_LED6
24	GND
25	NC1
26	NC2

P5	
1	SOL_P
2	SOL_1
3	SOL_2
4	SOL_3

Main Board Connector Pins

P1	
1	nDS
2	nBERR
3	GND
4	DSLK
5	GND
6	FREEZE
7	nRESET
8	DSI
9	VCC
10	DSO

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items from the CD and put them on its RAM. Throughout game play, the multimedia board functions as a slave.

You must keep the multimedia CD in the drive at all times. Damaged or defective discs can significantly slow the loading process.

The multimedia board has a BIOS chip. Be careful when changing out the chip, especially when using a metal screwdriver. There are traces beneath the chip that you can accidentally damage.

Graphic

The graphics board runs the TFT monitors and is a slave to the multimedia board. When the main board tells the multimedia board to show a certain graphic, the multimedia board sorts data (verifying that the correct file is chosen) and then sends this information to the graphics card. Then, the graphics card executes low-end sorting, figuring out the math, pixels and lines necessary to display a graphic. It is an idle component.

Common issues with the graphics card center around the TFT cables that connect to the graphics card, just under the logic box. These connectors can jiggle a bit loose when the main e-motion door is opened and closed, if they are not snapped completely in.

If your e-motion game screen is disrupted by lines or

“snow,” check the connection of the TFT cables to the graphics card. To combat this issue, we have developed an improved graphics card bracket, which includes a locking bar that is affixed to a threaded stud attached to the bracket.

Main

The main board is the command center. It controls the machine, taking all the inputs from all user interfaces and peripherals, and performs functions as needed for game play. It has one main connector, P1, that plugs into the backplane.

During machine startup, the main board takes control of the game from the multimedia board, as explained earlier. When in control, the main board will begin its self tests, like polling peripherals, checking button/switch current states, and more. Then, the main board brings up the game by telling the multimedia board to display graphics.

Next, the main board establishes communication with the commboard. When all of this is complete, the main board will clear any waiting messages and, if all doors are shut, it enters a game-ready state.

If there is previous game information like credits on the game, the main board will look for game information on its non-volatile RAM and load the last game state.

Commboard

The commboard communicates to external devices like accounting systems, player tracking systems and progressives. It's used as a jackpot controller when set up in an Atronic Progressive Link.

During a machine power-up, the commboard begins initializing when the main board boots. The first thing the commboard does is check its rotary switches and dipswitches, to discern the status of certain software options.

Using these settings, the board establishes communication to host systems on channel 1 (accounting or player tracking or both). Next, the commboard checks channel 2 for hosts (TITO). Then it checks the progressive communication channel.

During game play, the accounting or player tracking system will poll the machine (via the commboard) for meters and other information as needed. The commboard handles as much of these requests on its own, in order to free up the main board's processor.

When something occurs (a ticket is inserted, a door opens, there is a hand-pay lock) the main board will send this information to the commboard, which relays the information to the system.

When APL is used, the master commboard handles all the communication to the

slave commboards and all calculations. The master receives coin-in information and calculates the progressive amount of incrementation based on the settings stored on the commboard.

A good example of the commboard's functionality occurs when a player inserts a ticket. Here, the bill validator reads the validation code and holds the ticket in escrow. This information goes to the main board (the ticket is still in escrow), then the main board forwards the validation code to the commboard. The commboard alerts the system that a ticket was inserted, forwarding the validation code.

The system cross-references the validation code with a database, locates the correct amount, and sends this information back to the commboard. The commboard acknowledges receipt and, if everything is OK, the commboard instructs the bill validator (via the main board) to stack the ticket. When this is complete, the main board sends the appropriate credits to the credit meter.

P2: Used for SAS channel 1, P2 is a 1x4 AMP serial port with a TTL interface.

P3: P3 is an in-line 14-pin connector that provides 12 volts for the jackpot trigger device.

P4: Using RS232 interface, P4 is a 2x5 molex connector

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for SAS channel 2 (cashless systems).

P5: P5 is a 1x4 AMP connector for a comm key (ticket in dongle).

P7: A 1x6 AMP connector, P7 is used to interface with an overhead display.

P9: 12 volts of power are distributed from pin 11 of P9, an in-line 14 pin connector.

P10 & P11: These RJ45 connectors are interchangeable (in parallel) and are used for A-Link or Mikohn progressive information (or SAS channel 3). They use an RS485 interface and include A-Link +12 volts on one pin.

P12: This 2x5 molex connector is used for SAS channel 1, RS232 interface.

P13: Used for Bally's ticketing, P13 is a 1x4 AMP connector using TTL protocol.

P14: TTL interface for old DACOM systems is available at P14, a 2x5 molex connector.

P15: A 1x8 configuration, this AMP connector relays information to a jackpot trigger device.

P16: RS422 protocol is used for VLC communication from P16, a 2x8 molex connector.

P19: P19 is a 5-pin molex connector that is used for SAS channel 2, TTL protocol.

Our two-part, in-depth tour through the e-motion cabinet's architecture is complete. It was a journey full of descriptions and

minutiae that was, admittedly, pretty dry. We promise to bring back some levity to the column next month.

- Michael Brennan
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Kristel CCFL Inverter Board

By Herschel Peeler

There are at least four variations on this board, and this may well be only one type of board used in Kristel LCD displays. I have found at least four different boards. This one came to our attention most

recently. The configuration of components used on this board changes with the size of the LCD display in which it is used. Attached is a simplified schematic of the board showing what components change and, as usual, a rundown on how the circuit works.

This board is easiest to identify by the type of IC used as the regulator. A "494" chip is used. The rest of the part

number may vary by manufacturer of IC. TL494, UA494, etc, but it should always have the "494" part in the part number. There is also another board Kristel uses that has an LM393 and an LM358. It isn't hard to tell the two boards apart. It looks like the "494" board is dated around 2003 while the LM393, LM358 board is dates around 2000. The boards are not plug compatible so they really

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can't be confused in application.

Editor's note: Texas Instruments' TL494 is functionally identical to, Fujitsu's MB3759, Sharp's IR3M02, Fairchild's KA7500B and likely a half-dozen others that I have never heard of.

Boards for 18" LCD are easy to spot. There are three connectors going out to the CCFL tubes instead of two used on the 12", 15" and 17" LCD monitors. To distinguish between the others, the part changes so you may have to look closer. I expect the part number on the boards to differ but I don't have that information at my disposal at the time of writing.

The TL494 is a dual channel Switch Mode Power Supply Regulator and that is primarily what the CCFL Inverter is, a power supply. It takes the 12 Volts from the main LCD Controller and steps it up to a high voltage to drive the CCFL Lamps.

Do we need to say a word about CCFLs? Regular Fluorescent lamps have a heater at each end. The gas inside the tube is heated to the ionizing state by the heaters. Once the tube is ionized and conducting it only needs about 50 Volts across it to keep it lit. These are Hot Cathode Fluorescent

lamps. Cold Cathode Fluorescent Lamps (CCFL) do not have a heater at the ends, only a simple terminal point. The gas is raised to the ionized state by injecting a high voltage. It may take 1,000 Volts to get it started then drop down to only needing a few hundred Volts to keep it going. The voltage required depends primarily on the size of the tube. You can buy the tubes based on tube length, diameter and end terminals to connect the wire to. Now back to the regularly scheduled program.

The TL494 has two driving outputs. Each has a Collector and Emitter output. Only one side is shown in the schematic. A more complete schematic would have a second circuit consisting of everything after the "C2" output of the TL494 and below the TL494 except the power coming in, up to F1. There just wasn't room to fit it all on one page. The second side works just like the first side we will describe.

The Emitter output of the TL494 is grounded. The Collector side (C2) is driven low when power to the lamp is being driven. C2 going low forward biases D2 and turns on Q3. Q3 turning on gives power to Q1, Q2 and T1. Q1, Q2 and T1 make an oscillator. T1 is shown in two sections to make it easier to

see how it works. Power being applied starts the oscillator ringing. Q1 and Q2 drive T1 one at a time. The transformer is wound such that Q1 turning on turns on Q2 but turns off Q1. Q2 turning on turns on Q1 and turns off Q2. So once we apply power Q1 and Q2 take turns turning each other on and off. We use the power generated in T1 to generate a high voltage AC that drives the CCFL lamps. Blocking capacitors at the output of the transformer block any stray DC component in the high voltage signal so only AC passes through to the CCFL bulbs.

FAILURE POINT. These blocking caps are a common failure point on all CCFL driver boards. As they start to get leaky, DC strays into the CCFLs shortening their life. This may also be one cause of excess current being drawn by the CCFL tubes themselves.

On the return side of the CCFL tubes there is a resistor (R1 in this drawing) that develops a voltage depending on the current through the tube. As the tube starts conducting we develop a voltage across R1. This AC voltage is rectified by D1 and feeds to the Sense for the driver in the TL494 for that side. The TL494 adjusts drive time as needed to keep the

lamp at the correct brightness.

FAILURE POINT: As the tube ages, it takes more drive current to keep the lamp lit. This requires more drive current from the TL494, which drains more current from the +12 Volt supply and can cause our fuse to blow. Realize that the fuse blowing is a sign of a problem in development, not the problem itself. The tubes are aging and/or the caps are going bad. A popular Urban Bench Legend is to just replace the 3 Amp fuse with a 5 Amp fuse, or even (shuddering as I type it at the keyboard) A PIECE OF WIRE. Yes, this gets the board back into service until the lamps finally give out or the board self-destructs from the excessive current.

Between the Sense resistor and the TL494 are two more possible variations in the circuit. We will have either D8, C25 and Q12, or we will have D5 and R13. I confess I never have made notes on when either circuit is used, but I would not expect to see both circuits on the board at the same time. We don't spend much time on these boards either. We just solder a piece of 30-gauge wire across F1 and put the board back into the game. :-)

Differences

All Inverter boards are not created equal. The same basic board is used with variations for use with 12", 15", 17" and 18" LCD displays. As mentioned earlier, the main changes to the board are made when the

board is used for 18" LCD displays. There are three tubes used in each side on 18" displays. This requires a slightly higher voltage output at a much higher current. T1 is changed to the "-0003" part number, from the "-0200" part number. Q1 and Q2 (Q8 and Q9) are changed to a 2SC5103, from a 2SC1624. F1 is changed to a 5 Amp. L1 is changed to a 100 μ H. The Blocking caps are changed to a 22 pF.

Both sides of the TL494 are not driven at the same time. One side is driven then the other. This is done so fast the lamp does not flicker. The tube does not stop glowing once it is ionized and glowing, and the eye reacts even slower. The lamp may be flashing but not at a speed the eye can detect. If your

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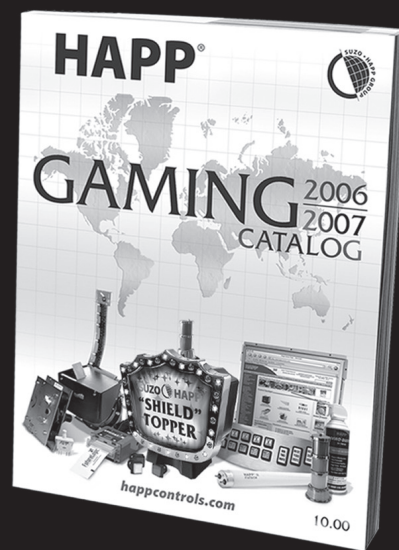
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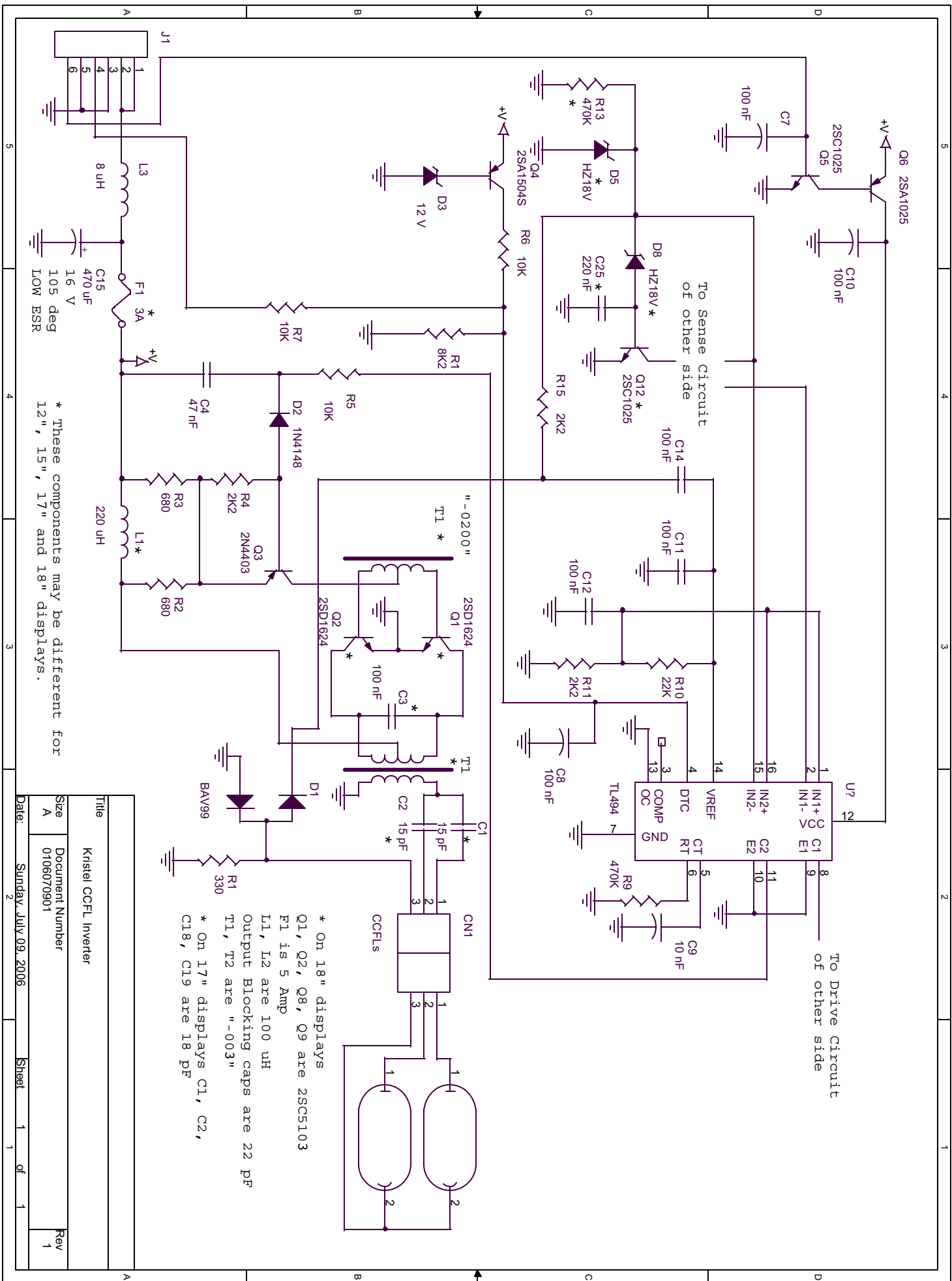


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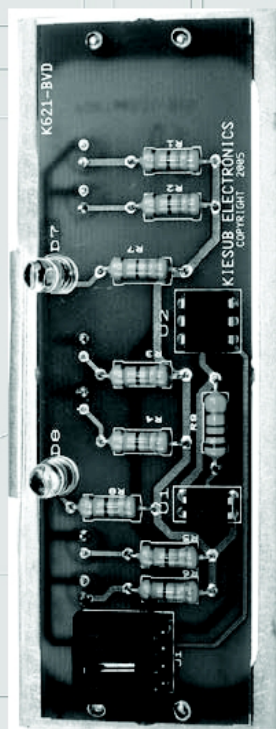


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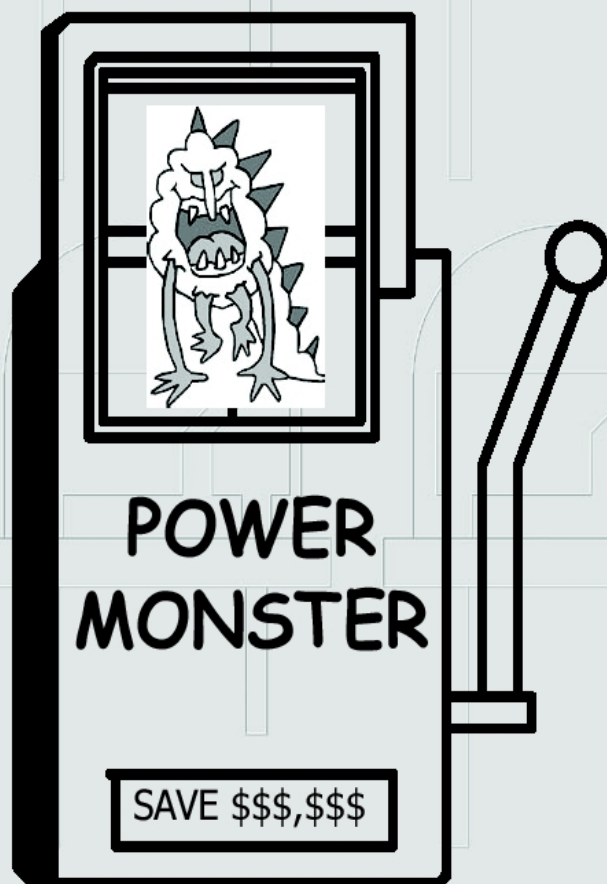
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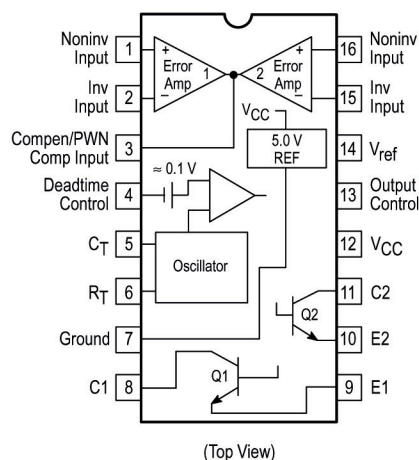


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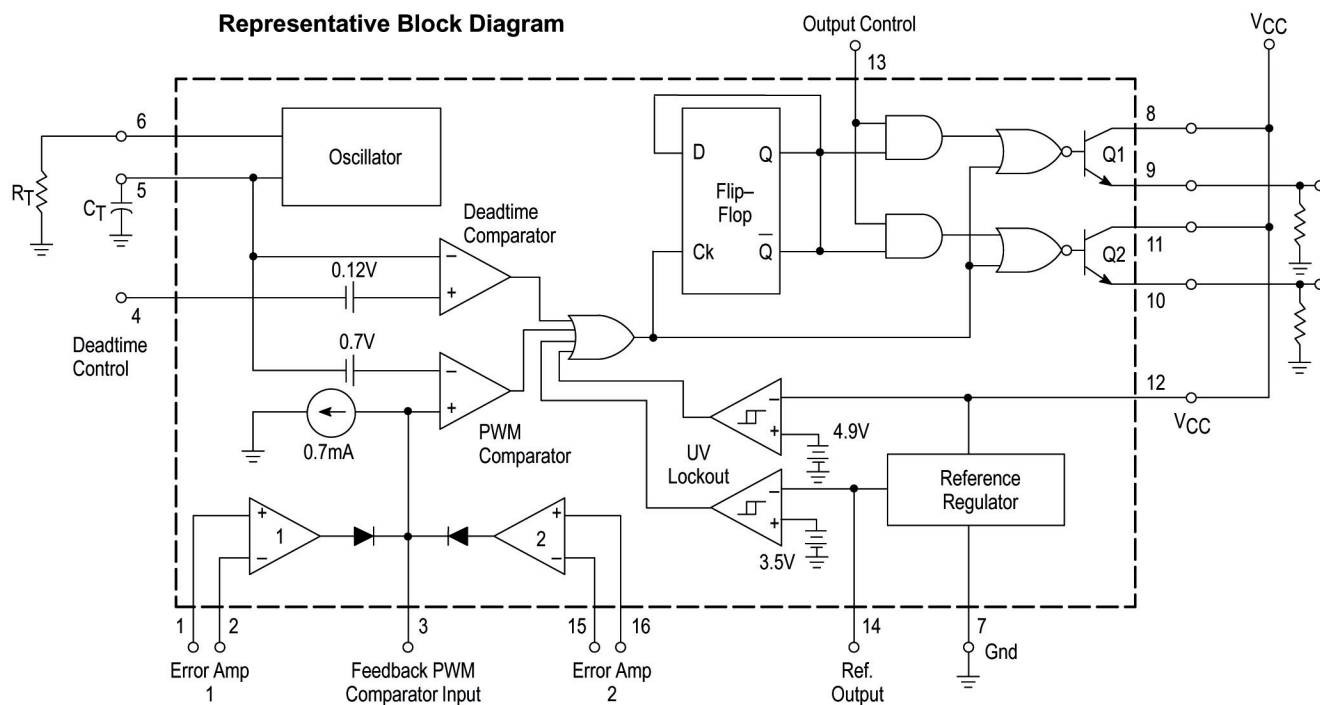
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PIN CONNECTIONS

**TL494**

Representative Block Diagram



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board uses the Q11 and Q12 circuits, it may be worth noting for troubleshooting purposes that the Sense signal is what drives these circuits and the Sense of one circuit turns on the transistor which goes over and kills the Sense on the other circuit. A shorted transistor in one side would prevent the tube on the other side from working.

Circuits Common to Both Sides

If only one set of lamps is malfunctioning, you can limit your troubleshooting to the circuits that only relate to that one side. If both sides are out, you can start looking at circuits that are common to both sides. Power is an obvious place to start. Are you getting +12 V to, and through, the fuse? If you are getting that, is the power getting to the TL494? +V on the TL494 comes in on pin 12. You should find about +12 V there. If you don't, your problem is in the neighborhood of Q5 and Q6.

The LCD Controller board turns on the Inverter board through two transistors, Q5 and Q6. To bring the Inverter board up outside the LCD display we need to do more than just supply +12 Volts. We need to apply +V through a resistor to pin 6. Don't hook this straight to pin 6. Q5's base is directly tied to the pin

6 input and you will blow Q5. Use a resistor to +V of some thousands of Ohms, depending on the +V you apply. Figure about 1 mA of current (1,000 ohms for every Volt applied).

We also have a brightness control on pin 4. I think a ground in gave us maximum brightness. If the Brightness input has no function your problem is in the area of Q4.

Other Things to Check When Troubleshooting

The TL494 has an output Reference Voltage of +5 Volts. We should have +5 Volts at pin 14 of the TL494. This voltage is divided down by a voltage divider made of R10 and R11, and filtered by C12. This should give us about 0.5 Volts at the "+" side of our Sense inputs to the TL494. The Sense signal from the tube goes to the "-" side. Inside the TL474 at these inputs is a Voltage Comparator that compares "+" to "-". "If "+" is lower than "-" we drive the output hard. We drive it until "+" gets higher than "-". "

TROUBLESHOOTING TIP. If the TL494 is working properly we should be able to ground pins 1 or 16 of the TL494 and turn off both lamps since they use this same Reference Voltage.

The TL494 oscillation frequency is set by C9 and R9. $F = 1.1 / R \times C$. With a 10 nF cap and a 470K resistor we should get an oscillating frequency of 234 Hz, or pulse rates of about 4.3 ms at the "C1" and "C2" outputs of the TL494 at about +10 Volts peak. The Sense "+" inputs should have the same 4 ms rate and be about 1V or less. The "-" side of the sense lines should be a steady voltage of around 500 mV.

Across R1 and at the Collectors of Q1 and Q2 we should see groups of pulses at a higher frequency. I would not suggest trying to scope the high voltage side of the transformer.

When bench testing the CCFL Inverter boards, we need a load when we power up the board. We can use either a set of lamps or we can use resistors. See www.slotnotes.net for more information. Here, Robert Sult suggests a string of 50K Ohm, 10-Watt resistors, giving taps at 100K, 150K, 200K and 250K Ohms. The boards should not come up and operate without a load on the outputs.

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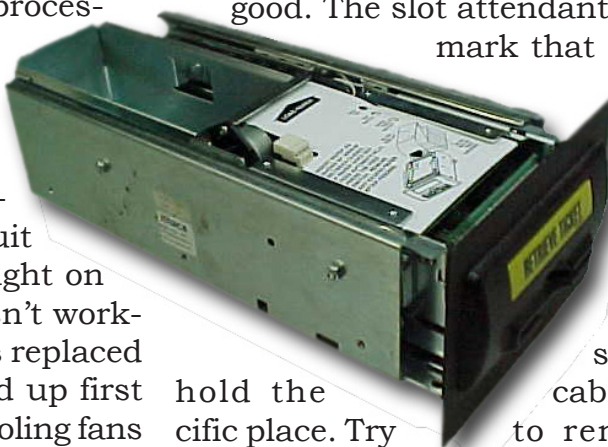
WMS Slant Top Printer

If a situation occurs such that the ticket printer isn't working properly, check the ribbon cable. It is well known that on the Ithaca 850 printer, to install the cable with the plastic cover. What about the Ithaca 750? These cables have problems too. On the gaming floor where I work, we have these older type printers in a bank of WMS slant top games and a few Aristocrats. The trouble with the slant tops are, you can't really see the condition of the cable unless you lay on the floor. There are, quite commonly, some wisecracks made by someone nearby such as "Taking a nap on the job?" Umm no. I happen to be checking the tower light fluid. : -)

Once into a position where I could see the small white printer cable, the problem was obvious. From paper being loaded numerous times as well as from paper jams and what not, the insulation on the cable had worn down and bare wires were showing. Not good. The slot attendant had made a re-

mark that there was some arcing going on; now I knew why. Simply replace the cable. There are small square clips that

hold the cable in a very specific place. Try to remember where these were located when putting in the new one. With the new cable installed and the clips in the wrong spot, your time has been wasted. Once complete, slide the printer



IGT AVP Won't Boot Up

During a routine walk of the gaming floor, I happened to notice one of the Star Wars AVP games didn't have a picture on the screen. "Some kind" of power was there because the machine lights were lit up. Once in a great while, one of the power supplies would come loose and simply need reseated but not this time. Well, let's try the good old reboot. No luck. Maybe a complete power down would help? I disconnected the incoming 120 VAC line from the game and, after a few seconds, plugged it back in and it was rebooted once again. No luck though. Something was noticed though. It was trying to boot up but it wouldn't go all the way. The game would get to a point and then start again from the beginning. I guessed that the main processor board was bad. I was close but wrong once again. The following day the game was worked on once again and the tech knew what the problem was right away. The cooling fan on the processor board quit working. Some games will show right on the monitor that the cooling fan isn't working, but not this time. The part was replaced and sure enough, the game booted up first try. We had a slight problem with cooling fans on a few Aristocrat Mark 6 games. The main processor board was pulled, the fan replaced (only four screws and one connector) and the game was back online.

into its home position very slowly. Pay careful attention on how the cable bends. If it is pinched even once, the cable may be bad. Always power down when replacing printer cables. The Ithaca 750 and 850 do not like hot swapping. On the upright Aristocrats that have the 750, the printer cable is very easy to see. If it is acting unusual, the cable may be loose. Power down the game and make sure the connector is nice and snug. I've seen where the cable end is at a slight angle and obviously there would be a poor connection. Once hooked up properly the game will work fine, the majority of the time anyway.

Tech + Pocket PC

I ran into a cool situation not long ago and would like to pass it along. My Pocket PC came in VERY handy. Some of the neon on our signs weren't working so the sign techs came in from the gaming capital of the world, and were checking them out. Connections were checked, transformers, etc. Then I was asked a question, "Who does neon around here?"

I told him of our local company... low and behold... I had their phone number right at my fingertips. I gave him the number from my pocket PC, he put it on his cell (you have to love modern technology) and he called right away. Later that day, our neon was working great. Think of the time that was saved. Running back to the

office, looking for the phone book, then looking up the number, so much time was saved. That's the way things are SUPPOSED to work. UBA and PDA? Sure...bill acceptor and pocket PC. With the pocket PC that we have (Dell Axim X51 with an Intel PXA270 processor at 520 MHZ) and a compact flash card with the new ten-dollar bill program, it only takes 54 seconds to download. Simply put in the flash card into the pocket PC, hook up the cable and select download. The LEDs on the UBA will show

how it responds. There isn't even a comparison to the old way of upgrading bill acceptors. The slot tech (sometimes the attendants would help too) would remove the units from a select bank of machines and bring them to the shop, if they were the "flash" type. The flash type of bill acceptor has a soldered in EPROM that is downloadable. Once hooked up to the "JCM Download Tool" (most of us are very familiar with that) press the download button and the new program is installed into

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the bill head. It takes a couple minutes to do one. Not counting the time it takes to remove the unit from the game. The JCM WBA with a removable chip is easy, but it takes up time. Each unit still has to be removed from the game. "BEAM ME UP SCOTTY"- This is a really cool feature I like about the pocket PC. "Beaming"- Talk about new millennium technology! Simply line up the wireless transmitter/receiver, select the material that you want to "beam" then select "beam." Just like Star Trek...off the material goes into the air, and then onto the other person's pocket PC. This can be very handy when game options need to be set. If the floor is busy, you can't check the game next to it. Once the data is in the pocket PC, open up the file, and there it is. I also put in tips on game repair. You know when there is a problem and you don't run into it again for another six months? Well, it will be on the pocket PC if the info was put into it. Here is an example. A tech beams the game options for a Konami stepper game to their pocket PC, you are on a vacation day and the game needs a full RAM clear. The tech can grab their handy tool, and option the game. Game back online.

Konami Stepper Game Options

The vast majority of the options are common sense such as turning the coin acceptor off, the hopper off, (because it is a coinless game) and turn the printer on. Even the game

address is pretty easy for me to remember. It is the standard SAS address 1. The ones that I tend to forget are the COM port settings. The printer and game have to be set at PORT 2. Of course the machine number has to be entered in and the asset number needs to be selected to zero. During setup, the player buttons need to be optioned too. If this isn't done properly, a customer will be upset. If they want to bet only ten credits and the button says ten, but the game ACTUALLY bets 20...ouch. There will be one upset customer. Nowadays with technical tracking systems, promotional cash, which can be downloaded onto a game, player points, all of the game options have to be perfect. If the wrong machine number is optioned and a customer hits a taxable jackpot, the surveillance department will ask questions. Not good. ALL of the game options have to be perfect. I won't even get into when a progressive game option was set wrong and the sign amount reset right away. It was not fun tracking what the amount was. (This wasn't on a Konami game though) In a nutshell, make sure the game is optioned properly, no shortcuts.

More Funny Stories From the Floor

I received a call from a slot attendant that a customer put in a ticket for \$8.20 and didn't get any credits. Thus far I don't recall any games "eating" a ticket. The "all

events log" was checked on the game. The last ticket recall was also checked but nothing showed anything that had to do with \$8.20. She was playing nickels, so it is a fair amount of credits. Luckily she was extremely polite; she stated that she was almost positive that she had put it in the game. I even checked the stacker box. The last item put in was a bill. She was told that there was no ticket to be seen in the game at all. I showed her the bill acceptor assembly (that it was empty) and that the cashbox had a bill on top. While trying to figure out what had happened, the security guard noticed a ticket in her coin cup. Take a wild guess what the amount was? \$8.20. Wow a miracle has happened before my eyes. She didn't even put it in the game in the first place. The woman said she was very sorry numerous times but it's all in a day's work. At least this situation didn't go down in the "Unsolved Mysteries" file.

Recently a woman was playing a nickel video game and stated she had put in a \$10.00 bill in it and no credits were given. She also said that this was her "first drink." Umm OK (this could get interesting). There were credits on the game (somewhere around 520) so why you would put in a ten-dollar bill, I'm not sure. Game recall, events, and last bill in were checked out and the last denomination that was inserted was a \$20. It is quite rare

with this particular game, but it may have “ate” it and she was pretty sure she had put in a ten. I told her what I had seen with the game recall and I was told, “Don’t worry about it. It is only \$10.”

This customer was very polite too, and I didn’t want her to think that we don’t care about the minor things, so I got the stacker box key and checked it out. Sure as the sun comes up in the morning, a \$20.00 bill was on top. The woman apologized again and again. I told her that this kind of thing happens every day, no big deal at all. Point being...she was happy with the end result. The sawbuck was never inserted and it had been proven to her.

In yet another bill situation (I wish half of the calls were THIS easy) a call came over the radio that a customer put in a five-dollar bill and didn’t get any credit. I responded that I’ll be over there shortly. Not thirty seconds later this call actually came over: “Never mind, the customer didn’t put the bill into the machine in the first place.” Had to laugh at that one. My response was “Umm ok.....disregarded.”

Funny but true...no coin acceptor but the game has a “coin in error” on it. I like this one. This also applies to hopper tilts when there isn’t even a hopper (try explaining it to a new slot tech). A slot attendant will call that he or she can’t seem to clear the error, and there isn’t even a coin

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mech in it. Sometimes I'll joke about it. "What's the deal? How can there be a tilt when there isn't one even there?" It stumps the newer slot attendants almost every time. It is actually quite elementary. The I/O (input/output) card or cards on an IGT slot door come loose every so often. The game doesn't see that there isn't a component disconnected or not even there, so it "looks" for it. Power down the game, make sure the cards are snug, and the game is good to go. It is funny though, coin in or hop-

per error, and there isn't even one in the game to give a tilt.

IGT Multi-Game Bar Tops

Ever run into a game where you try darn near everything and it still won't work right? On the newer IGT bar games, once in a great while, the main power supply comes loose. The monitor is reseated on it, and no go. Fuses are checked and they are all ok. On the lower left side of the game, is a rectangular metal box with lots of

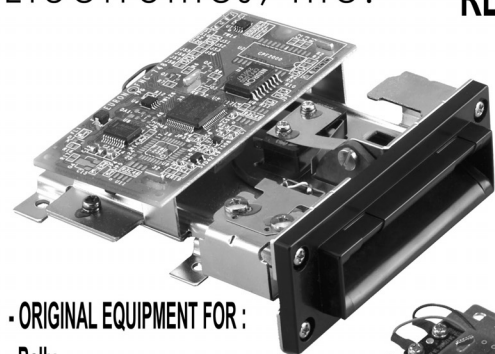
holes in it. This is the power supply. Power off the game and make sure it is snug. Power up the game and it should work. If not, the power supply needs a rebuild. Much of the time, new caps will do the trick. It is a good idea to have a spare or two on hand so there isn't a rush to repair the original. Install the freshly rebuilt supply, check the game options, and the game will be online.

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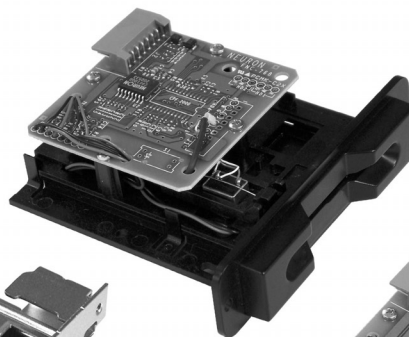
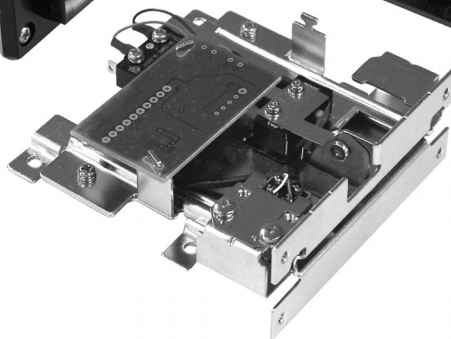
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With a history dating back to 1932, Las Vegas-based Bally Technologies designs, manufactures, operates and distributes advanced gaming devices, systems and technology solutions worldwide. Bally's product line includes reel-spinning slot machines, video slots, wide-area progressives and Class II, lottery and central determination games and platforms. As the world's No. 1 gaming systems company, Bally also offers an array of casino management, slot accounting, bonusing, cashless and table management solutions. The Company also owns and operates Rainbow Casino in Vicksburg, Miss. Additional information on the Company can be found at www.BallyTech.com.

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For information: Jean-Pierre Roy
Media Relations, Loto-Québec
Tel.: (514) 499-5151

Marcus Prater
Senior VP of Marketing, Bally
Technologies
Tel : (702) 584-7828



Yes, another build your own article!

By Ted Befus

Don't get me wrong, the thought of using the PSP program definitely crossed my mind. However, when I tried to configure the security access for the users, I found a problem. You either have read only access or complete read/write access. Unfortunately for us, the shift managers CANNOT have write access to jackpot levels, increment rates, etc. Our technicians can access PSP to set things up but not unless we have the watchful eye of our auditors and surveillance to keep things on the up and up.

For those of you using the CON2 who may be unfamiliar with it, I'll expound on the intricacies of the CON2 (I'm still trying to break in my new dictionary).

The CON2 receives machine pulses from either its Machine Scan Port (labeled J1 pins 9-40) or its serial input (J3). These pulses are then converted into increment value and added to the current jackpot value you would see on a MIKOHN overhead sign or in machine display. In the case of a mystery jackpot, the coin pulse that increments the current jackpot value to the random value chosen by the controller will trigger the sign to display the winning machine. In the event of a progressive, the winning machine sends a signal to the controller and the controller then displays the win on the signage.

That's a pretty simple description of what's happening but it's easy to understand that way. After the jackpot has been hit and the

This time stemming from another dilemma Casino Regina ran into because of our system changeover. Our previous slot system had the capability of connecting directly with all our MIKOHN Supercontrollers serially. This allowed us to reset all pending progressive and mystery jackpots remotely from a terminal. I'd tell you what our old system was but I'm certain that very few people in North America would even know what I'm talking about.

Prior to our SDS installation, I posed the question as to whether or not our new SDS system would also have this functionality. Of course the answer was no. How unfortunate. Fortunate for you the reader of Slot Tech magazine though, because today I'll explain just how we conquered this problem. Those of you who think I'm just going to explain the use of the MIKOHN PSP program had better think again!

patron has been paid their winnings, the sign needs to be reset to the starting jackpot value.

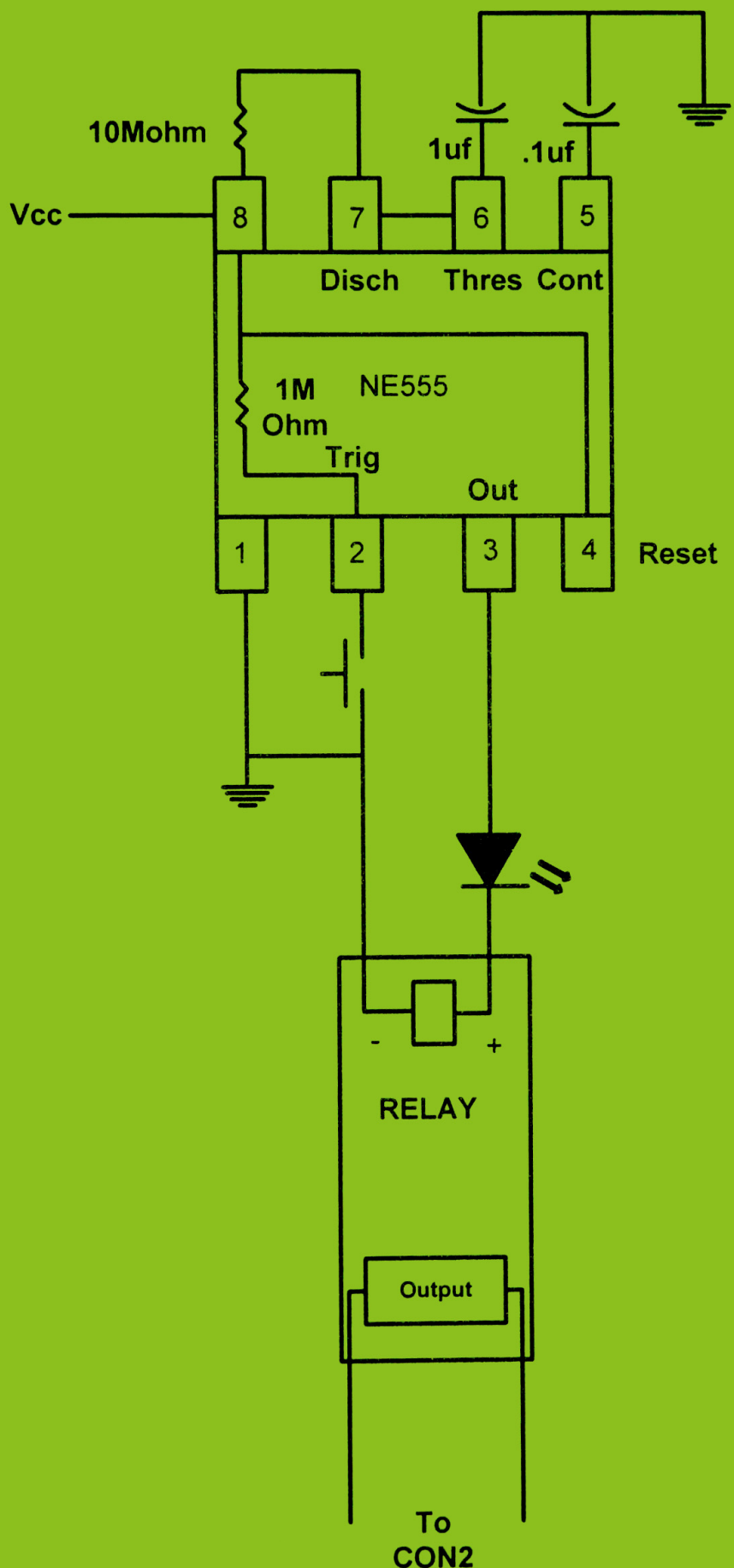
As I previously mentioned, we can't use the MIKOHN interface program to reset it due to security concerns. There is also a feature in the CON2 to reset the display on the next coin pulse from the machine that triggered it, but this option was also ruled out.

So what do we do now?

We need something easy to use with little chance for error.

For those of you familiar with the CON2 supercontroller, you might already have thought of the answer we came up with. You build a controller to reset the CON2 for you!

The CON2 has the capability to use lines on its Machine Scan Port to reset pending jackpots. This is available on all CON2 models (CON2A, CON2i, CON2AF and CON2iF). For those of you who might not be familiar with the differences between these controllers, the CON2i is used specifically for IGT progressives with a serial return line. The CON2A can be used for other progressives and random jackpotting. The letter "F" at the end shows that the CON2 has fibre op-



Here's the wiring diagram for one of the timer circuits. It's a pretty simple 555 timer, but it works perfectly for the application at hand.

tic capability installed (for master/slave relationships).

Now we need a Bill of Materials (BOM). This BOM will only show enough parts for one controller. I built ours to support 10.

Bill of Materials

555 Timer Integrated Circuit
1 MΩ resistor
10 MΩ resistor
1 μf Electrolytic Capacitor
.1 μf Electrolytic Capacitor
12mm LED
SPST (toggle switch)
OMRON G6A-2-H relay (or equivalent of your choice)
Enclosure

I bought the enclosure locally through an electronics supply store, sorry but I don't

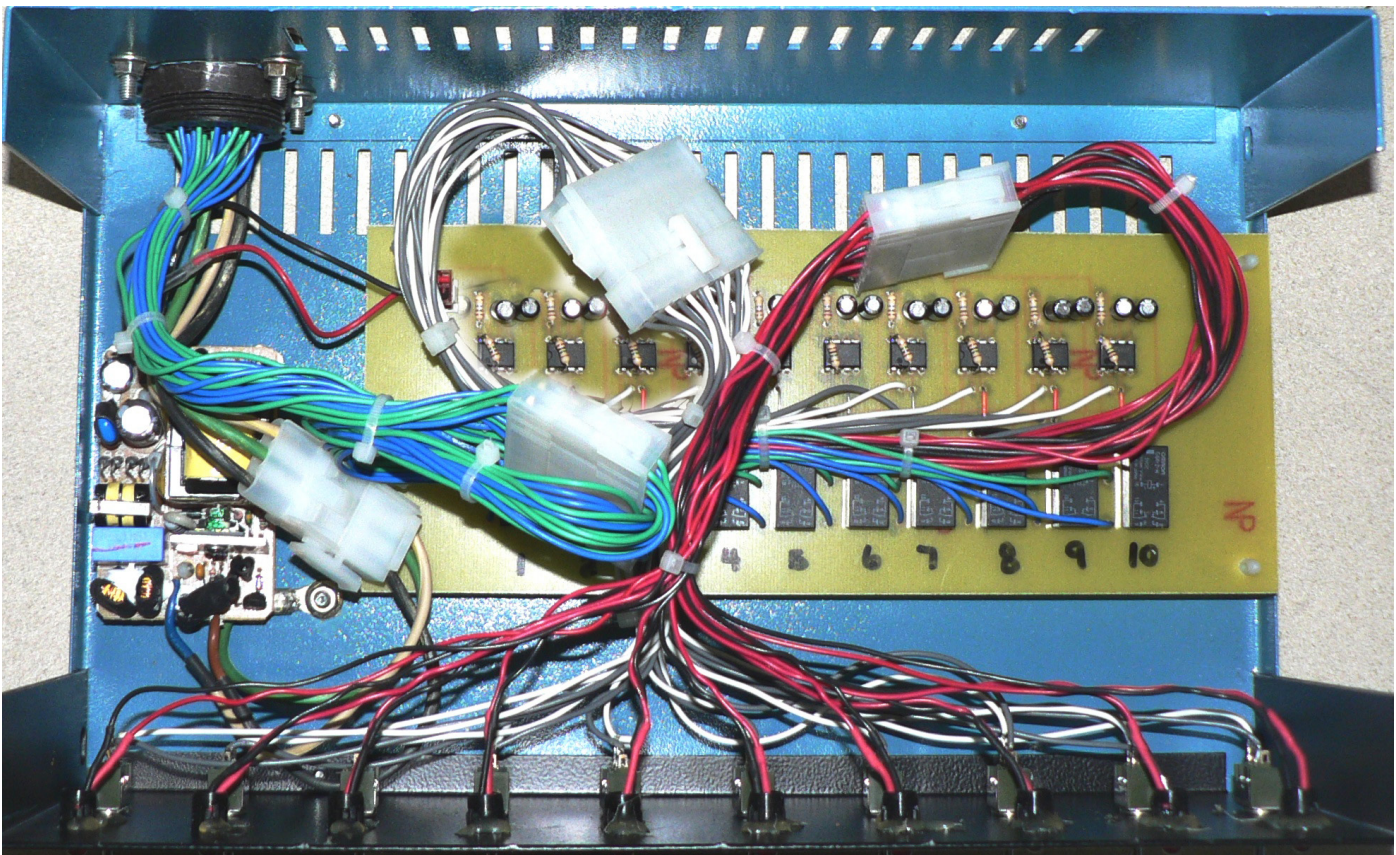
have the info on the manufacturer.

The premise is very simple. The CON2 controller needs a minimum of five seconds of closure on its reset leads to reset the pending jackpot. During my testing phase, I found that five seconds was not enough time to reset the jackpot. My test results showed it needed a ten second closure.

So we set out to build a timer circuit that would activate a relay for a ten second time period so we could reset any controllers we needed to (okay, for those of you who are going to take the schematic and figure out the time frame it's actually 11 seconds).

Obviously after establishing a BOM we needed to breadboard the circuit we "designed" to make certain that it was working correctly. I love that word "designed" like it's something special to rig up a 555 timer! It worked great as one circuit. When all ten were hooked together in the finished board, there were problems. It turns out that I had neglected to isolate the toggle switches between each of the timers. Adding a resistor fixed this glitch.

To make the board, we first made the board layout with Ultiboard from Electronics Workbench. We then used the MG Chemicals photofabrication PCB making kit to etch my layout onto the



photoresistive PCB.

Here's the finished controller (see Figures 2 and 3). Notice that we have installed a 12VDC power supply to run the control board. Also, all the peripherals (LEDs and switches) are on MiniFit Jr® connectors so we can remove bits and pieces without tearing the whole assembly apart. All of our controllers are connected to the box using an AMP CPC® connector.

Ok, now that we've built the controller and tested it, let's discuss where we're going to hook this new toy up. The output of each relay has to be connected to J1 of each supercontroller. Before you get too antsy and start hooking up wires, we've gotta be sure of where to hook up. Don't look into your manual for the CON2. You won't find it in there. However, MIKOHN did have a technical bulletin regarding this. It's Bulletin number 950-210-02 (IGT/CON2 Supercontroller interface -

Jackpot Reset Switch Inputs for CON2I Unmodified

Maximum: 30 machines

Usable groups: JP0 and JP4

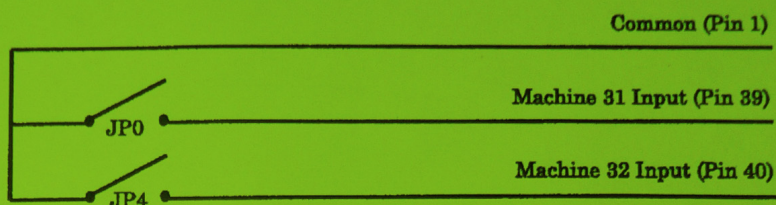
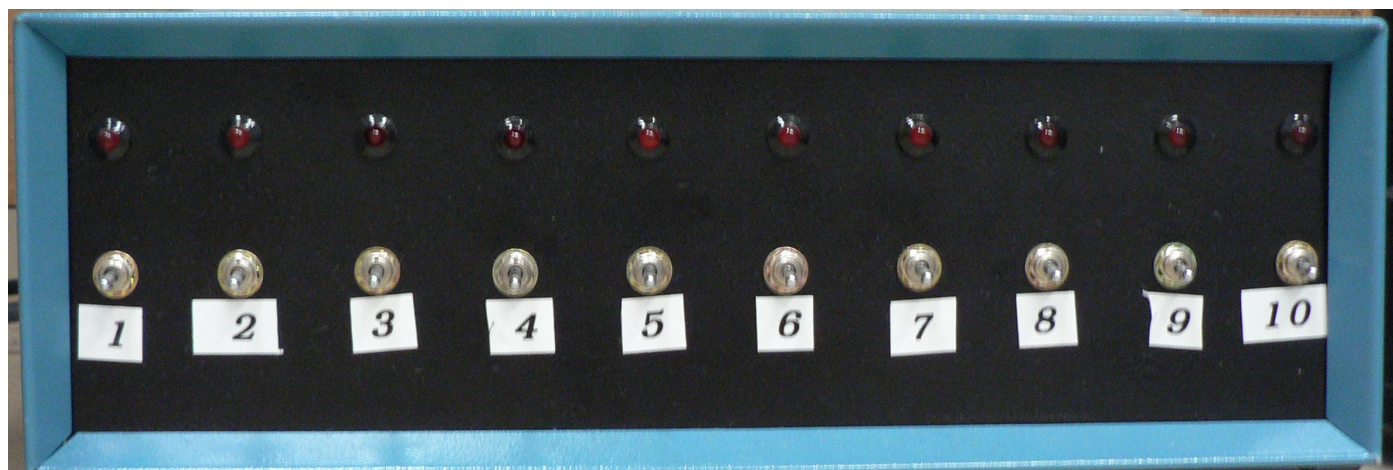
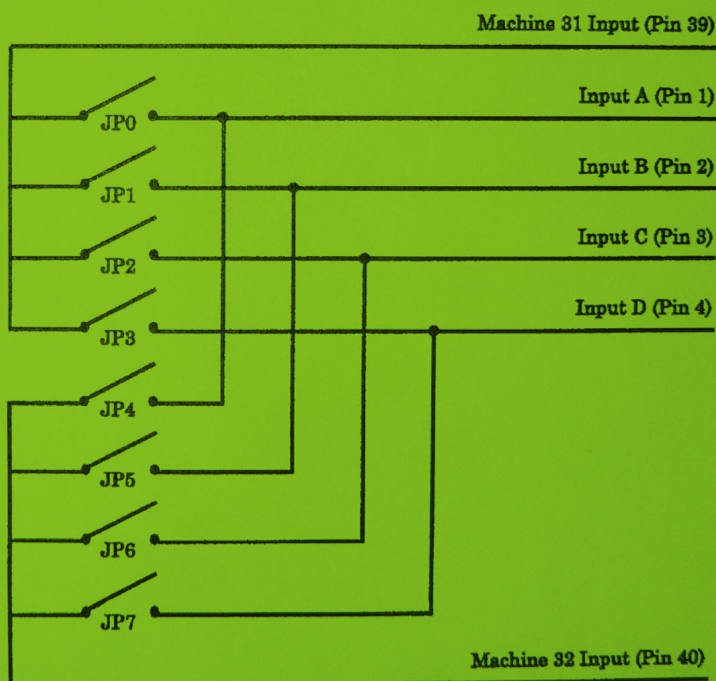


Figure 2 Jackpot reset switch inputs for CON2I unmodified

Jackpot Reset Switch Inputs for CON2A

Maximum: 30 machines

All groups, JP0 through JP7, are usable



Mystery Jackpot configurations).

The Machine Scan Port (J1) on the CON2A uses pins 39 and pin 40 for jackpot resets. Pin 39 controls jackpot groups JP0 – JP3 while pin 40 controls JP4 – JP7. By connecting either of these pins with the 4 input lines on J1 (pins 1-4) you can reset any of the 8 jackpot groups. See figure 4 for a list of connections.

The CON2i is a little different, depending on the model you have. You can either have a CON2i modified OR unmodified. It's easy to tell which you have. Remove the PCB from the housing and turn it over. If you see wire mods on the bottom of your

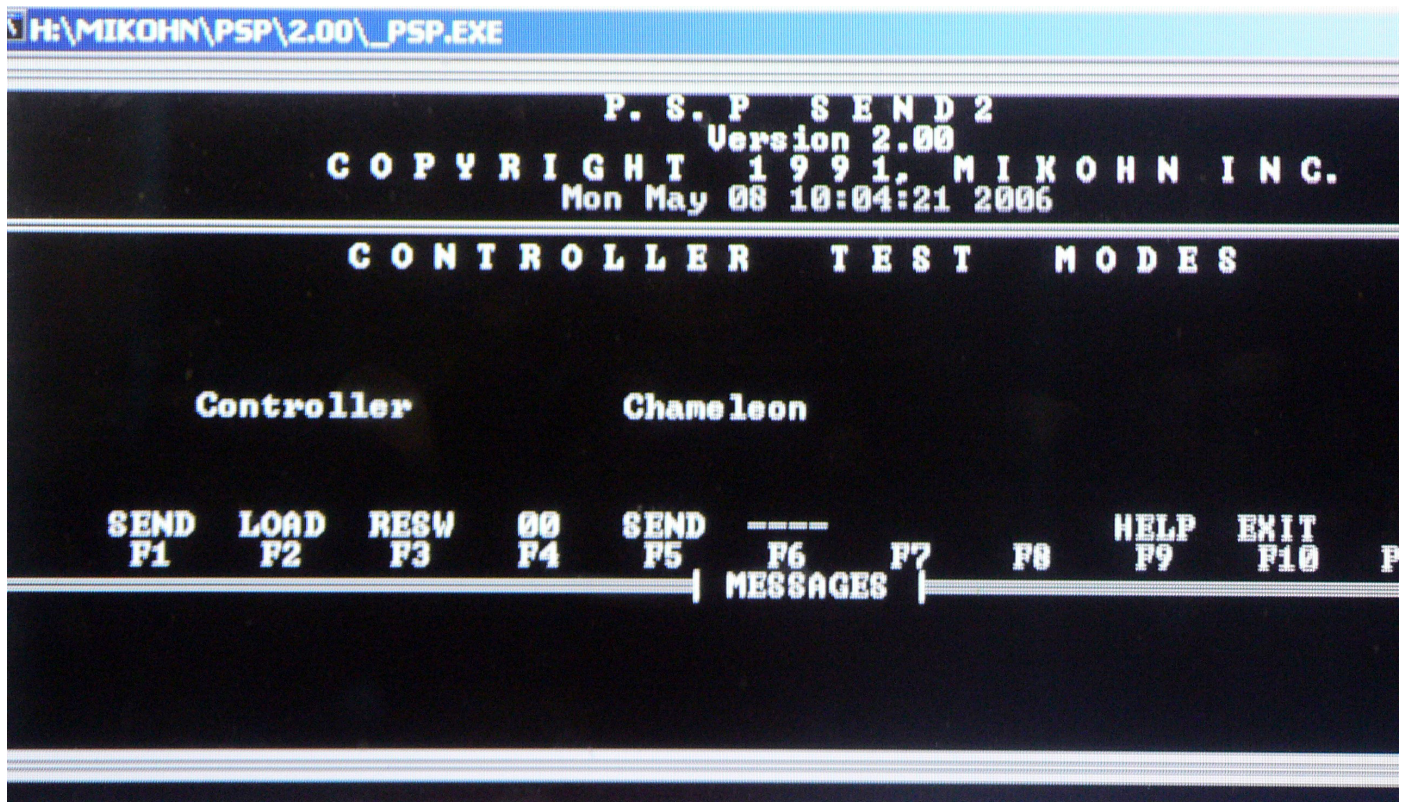
CON2 it is MODIFIED. I'm only covering the Unmodified CON2i here. The CON2i can only support 2 jackpot groups JP0 and JP4. Their resets are located at either pins 39 (JP0) or 40 (JP4). These are tied to Pin 1 (I/O GRND) to reset the jackpot.

That's not quite all there is to it. There is an option in PSP that needs to be checked. You have to go to PSP and from the main screen go to page eight (Controller Test Mode). Do you remember me mentioning that you can use coin in to reset jackpots? This page is where you disable this feature. If you look towards the bottom of the screen, you should see a list of function (F) keys with a command

listed above them. The F3 key will let you configure for the use of a reset switch. Press the F3 key until the command above reads RESW. This means that unless you use the reset inputs found on J1 or PSP page 7 (Clear/Reset Current Jackpots) the jackpot will not be reset. The page should look something like this. (See figure 5). Don't forget to send your changes to the CON2.

All that's left is to hook up your wires check for continuity on the reset pins when you're done and sit back and relax, the slot department won't be calling you and your laptop to reset jackpots for them anymore.

- Ted Befus
tbefus@slot-techs.com



RoHS and HEBER PRODUCTS

Heber Limited, designers and manufacturers of electronic control systems for the Gaming and Amusement industry, is pleased to announce that it is able to supply gaming control systems that fully meet RoHS legislation that became law within the European Union (EU) on 1st July 2006. Any product sold within the EU after 1st July must comply with RoHS legislation.

Over the last 18 months, Heber has been sourcing replacement components for its gaming control systems. Any component that contained a banned substance such as lead or cadmium has had to be replaced in order to meet the RoHS legislation. For Heber this has meant amending bills of materials and sourcing new and replacement components from its suppliers. Many components have become obsolete which has meant finding suitable replacement components from alternative suppliers.

"It's been a challenging few months for the Heber Purchasing Department," said Tania Bailey, Purchasing Manager. "Heber is fully prepared for RoHS legislation that has come into effect. With careful planning, stock control management and working closing with our suppliers we have been able to ensure that we can supply product that fully complies with the RoHS legislation."

The law is very clear as far as Heber is concerned. Any new control system sold within the EC must be RoHS compliant. Heber has made sure that all new products that were in development before the RoHS Directive became law use RoHS compliant components. Any control systems that were sold before the RoHS Directive became law can be repaired or replaced with control systems that were non-RoHS compliant when new. Heber can also supply non-compliant products to

customers outside the EC but there is an expectation that all product, whether sold outside of Europe or not, will eventually be RoHS compliant.



Further information about RoHS is available from the UK Government DTI website:

<http://tinyurl.com/oz63z>

For further information about Heber Limited visit www.heber.co.uk

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World of Games turned out to be SmartWorld



June World of Games truly is an event of international scale.

Nevertheless even an accidental visitor (if there were any) could see right a way who exactly among the exhibitors really took advantage of this event that gathered together more than a hundred of famous gaming companies. Total of 850 square meters were occupied by SmartGames Group. Four booths were welcoming the visitors to see what SmartGames Group has to show. SmartGames at World of Games was really hard to miss.

The company mainly counted on a wide assortment: a wide range of products offered by the largest Russian manufacturer of gaming equipment meets the requirements of different levels. That was again underlined by the SmartGames management team in the press conference on the first day of the show. Valery Klesov, a general director, said that machinery – a generalized name for the industry where gaming manufacturers work – opens good opportunities to diversify production in different directions: besides EGM's, there are also pay terminals, ATM's, entertaining machines, et cetera can be manufactured. These are the tactics chosen by SmartGames in a tight corner of problemacy of Russian gaming legislation. Lubov Loginova, a commercial director of SmartGames Group sounded even more adventurous in her comments on main competitors of SmartGames: «I do not observe competitors among Russian companies. We are the only company to offer equipment, software and service support of any price category. We now compete with the world brands».

The last solemnly launched colorful confetti was still elegantly showering over Crocus-Expo Convention Centre at the official opening of World of Games 2006 when the exhibition was already in full swing. From the first minutes participants and visitors set its pace and all three days long this intensive rhythm was maintained keeping the show bright and festive.

Even two huge halls in Crocus-Expo of 15000 square meters in total could hardly house all the World of Games exhibitors, the largest gaming companies from all over the world. And there is nothing to be surprised at as many participants of gaming and entertaining markets were very well prepared for this major international show of achievements, new trends and innovations. Held in Moscow on 7th to 9th of

Isn't it a daring statement? Yes, it is. And all World of Games visitors could see with their own eyes all the variety of products, all the innovations presented by SmartGames as a proof to the aforesaid. Always popular and trustworthy among its customers, a traditional production range of SmartGames was overshadowed by the new elaborations of SmartGames, its new machines and gaming platforms. Eleven new

games were presented and among them there were games that have already proven their performance such as Robin Hood's Silver Arrow, Bust da Safe, Surf Riders, Knyaz Vovan and others.

The newest slot machines of SmartGames deserved the closest attention. Slim 19" meets all international standards. It is compact and it has got a wide monitor and a fascinating sound. SG-Novo resulted from a joint project of SmartGames and Austrian Novomatic. And Leonardo was the true sensation of the show. As SmartGames representatives say this unique slot machine was created according to designs of great Leonardo da Vinci. Aurora, another subdivision of SmartGames Group and an exclusive distributor of Aristocrat Technologies gaming equipment in Russia, used the World of Games show to demonstrate prototypes of the exclusive Russian AX Machine. The AX Machine is a joint achievement between the Russian-Australian companies, it combines Aristocrat Technologies advanced gaming platform with SmartGames-unique cabinet design. The result is a high quality and cost effective product.

All kinds of spare parts and components for slot machines were presented at the booth of SmartGames-Trading where company's representatives and their visitors with fortitude fought a smoke coming from the stand across the aisle and the cold air coming from an air



conditioner right to the freezing SG-Trading people.

The most far-seeing entrepreneurs paid very close attention to SmartBoss, a high tech solution for casinos and slot halls, an on-line management and control system. At the booth of SmartBoss there was presented jackpot "Crazy Squirrels" based on this system. This product is

considered to be one of very important tools in financial and marketing policies of casinos and slot halls.

All over Crocus-Expo there were placed SG-Pay Newton and SG-Pay Pascal, the first modifications of SmartGames pay terminals. And that was more than a strong evidence of production diversification started in the company.



Showgoers compare notes at World of Games

Red Rock & South Coast Casinos Select FutureLogic's GEN2 Printer for TITO Slot and Video Poker Machines

FutureLogic, Inc., manufacturer of thermal ticket printers for cashless gaming, announced today that Red Rock Casino, Resort and Spa in Las Vegas has selected FutureLogic's GEN2™ printer as the standard gaming printer for all of the casino's TITO (ticket-in/ticket-out) slot machines and gaming platforms.

Red Rock Casino, Resort and Spa, located in the master-planned community of Summerlin, Las Vegas opened in April 2006. The casino features more than 3000 gaming machines equipped with IGT's EZ-Pay system and FutureLogic GEN2 printers.

Red Rock Casino, Resort, and Spa is Las Vegas' newest locals' entertainment destination. It is located on 70 acres of land close to the majestic Red Rock Canyon in Summerlin and is approximately 10 miles west of the Las Vegas Strip. Red Rock Casino, Resort, and Spa is Station Casinos' fifteenth property in Southern Nevada.

Approximately 1700 GEN2 Universal printers are being used with IGT's new Trimline™ AVP® games at Red Rock Casino. Designed to provide the ease of integration required for the next generation of electronic games, the FutureLogic USB-compatible printers anticipate new GSA standards for downloadable games.

Designed to support all current and emerging game types, The GEN2 Universal printers in-

clude three game ports – USB, NetPlex and RS232 – as well as a dedicated promotional printing port to connect with the promotional server. With jurisdictional approvals the printer can be used to implement promotional couponing to recruit, retain and reward customers. "Thermal printers are a critical component in today's gaming business," said David Frankhouser, director of slot operations at Red Rock Casino. "FutureLogic's GEN2 printers help us streamline operations, contribute to our initiatives of making play faster, easier and more convenient for our customers, and provide a clear migration path for new gaming technology."

South Coast Casino Too!

Likewise, FutureLogic, Inc. has announced that South Coast Casino in Las Vegas has also selected FutureLogic's GEN2™ printer.

South Coast Casino has incorporated FutureLogic's GEN2 printer with more than 2400 slot and video poker machines in its new 80,000 square foot casino. Coast Casinos has been in the vanguard of TITO since its inception and has helped set the standards for cashless gaming.

"We selected the GEN2 printer because of its excellence in design and FutureLogic's outstanding technical support," said Marcus Suan, Corporate Vice President of Slot Marketing for Coast Resorts. "The

printer has an impressive track record of reliability and technological innovation, and was developed by people who understand and are committed to the gaming industry."

The South Coast Hotel & Casino is the newest property of Coast Casinos a wholly owned subsidiary of Boyd Gaming. Along with the gaming and entertainment amenities that made Coast Casinos sister properties Barbary Coast, Gold Coast, The Orleans and Suncoast famous, the South Coast features a complete Equestrian Complex set to open in 2006 and 150,000 sq. ft. of Convention, Exhibit and Banquet Space with the capacity to cater to groups of any size.

The multi-function printer satisfies South Coast Casino's quality and performance requirements with reliability features such as ITH™ (Intelligent Ticket Handling) technology to eliminate torn, smeared, or crumpled tickets, 50% more paper capacity than other printers, and a dedicated port for firmware upgrades.

For further information, contact:

FutureLogic, Inc.
Nick Micalizzi, VP-Sales & Marketing
949.487.4829
nick.micalizzi@futurelogic-inc.com
www.futurelogic-inc.com

or 702.597.5355 for technical service.



Does your casino have problems such as buzzing or humming on P.A. or sound systems, monitors that look like they wave or computers halting for no apparent reason? These could be signs of Harmonic Distortion in the casino power distribution system. The slot machines may not see the effect of the harmonics directly, but they may be the direct cause of the harmonic distortion.

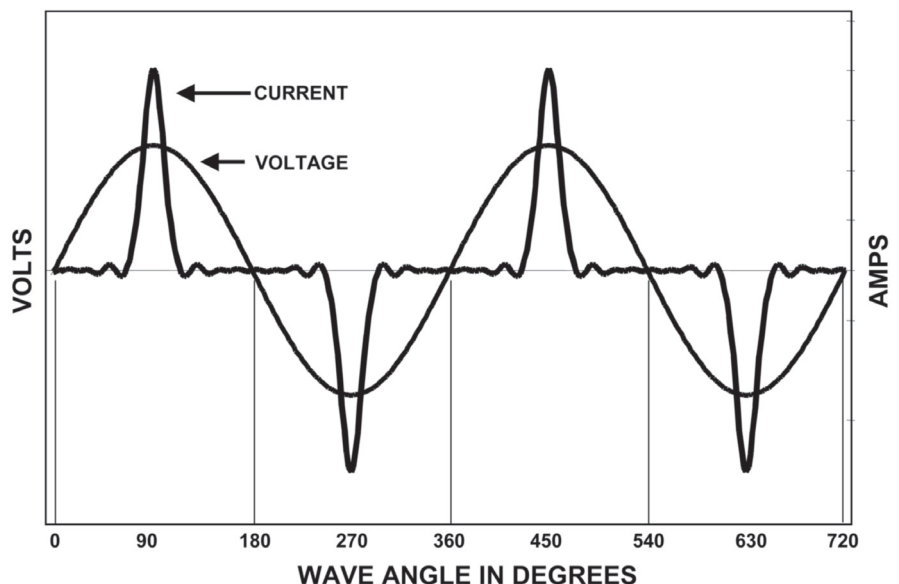
Harmonic Distortion is distortion of the 60 Hz 120-volt sine wave that provides power through the casino. In the ideal world of AC power, the power company will provide a perfect sinusoidal waveform at 60 Hertz. With typical linear loads such as resistive heating and incandescent lights, current is in phase with the voltage of the AC sine wave. However, electronics is anything but perfect. Inside slot machines,

we operate one or more (likely WAY more) of the worst causes of harmonic distortion, switched-mode power supplies. The switching power supplies that run the electronics in our slot machines cause harmonic distortion in the 60 Hz, 120 VAC power throughout the casino.

The cause of harmonic distortion is a load that draws a non-sinusoidal current. The non-sinusoidal current causes a non-linear relationship between the voltage and current thus giving the harmonic distortion usually in the 180-hertz or third harmonics of

the AC voltage. The use of diodes and filtering capacitors cause current to spike near the peak voltages, both positive and negative.

A simple way to have circuits (branches) tested for harmonics distortion is to make two separate current measurements. Make the first measurement on a branch using an average responding current clamp meter. Make the second measurement on the same branch using a true RMS current clamp meter. Divide the first measurement (average) by the second measure-



Although the slot machine is powered by a sine wave, the filter capacitor in the power supply is actually "topped off" by a current spike. This drawing illustrates a single phase system.

ment (RMS). This will give you a ratio between 1 and about 0.5. A ratio of 1.0 would be little or no harmonic distortion. A ratio of 0.5 would be a high 50% harmonics distortion. If you believe you have a Harmonic Distortion problem, it is recommended to contact your power provider. The power provider has experts who can completely test for harmonics and check for symptoms of harmonic damages.

Most casino-related products are connected to unbalanced power, with two wires connected to the 120 Volts AC and a ground for safety and noise. If you measure between the load (black) and neutral (white) you will measure around 120 VAC. If you measure between load and ground (green) you will measure around 120 VAC. These two measurements should be the same. If you measure between neutral and ground you should measure 0 VAC. Because electronics cause noise and nonlinear currents, there will be some voltage between neutral and ground. There are ways to reduce noise and current between neutral and ground.

One other area of concern for the power on the gaming floor is not having the power panels balanced between phases. The power panel is feed by two hot and one neutral. If you measured between the two hot sides, you would read 240 VAC. Each hot when measured to the neutral is 120 VAC. With the gaming floor always changing, it is not hard to have one phase loaded higher than the others. Some power panels may experience 33 amps

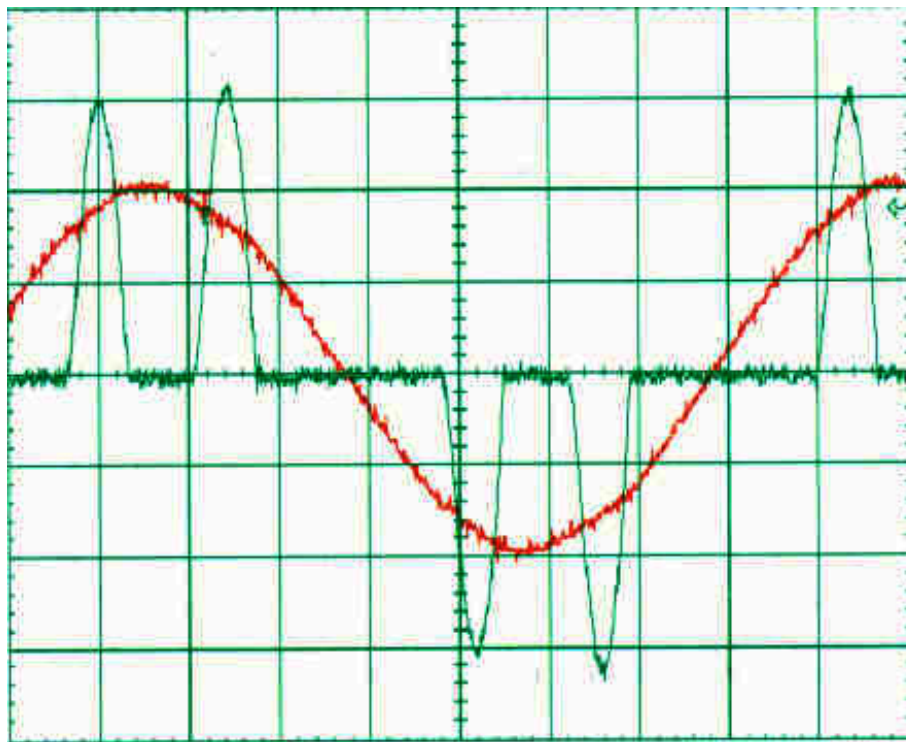
imbalance between the neutral and ground inside a power panel.

A certified electrical engineering company should do harmonics testing with the proper harmonic testing equipment. The testing will include testing at the main feeds into the casino, the step-down transformers, the power panels and the individual loads on the power panels.

Testing at our casino resulted in a 9.0%, 9.2% and 9.8% THID (Total Harmonic Current Distortion) on the 480 feed transformer branches. Circuits on the power panel showed as high as 47.9% THID and as low as 6.44% THID. Testing of slot machines showed two manufacturers with the highest distortion: manufacturer (a) with 36.90% THID and manufacturer (b) 54.90% THID (We were asked not to disclose

any identification of slot machine manufactures tested). Since casinos normally install machines in groups by manufacturer's models and styles, you can see how the THID can be really high on some panels and not on others. If somehow the (a) phase had 20 machines of manufacture (b) and (c) phase had 20 machines of manufacture (a) this would cause a serious imbalance of the phases. This will cause overheating in the transformer, grounding heating of the switch panels off the transformer and possible heating the panel itself.

There are ways to have the electricians help to reduce some of the unbalanced and harmonics distortion. Install conductors for the neutral two times the size of the load conductors. Ground conductors should be one size



This illustrates the non-linear relationship between voltage and current in a three-phase system. Notice that there are now two spikes per half-cycle where we saw just one in a single-phase system.



"On behalf of Table Mountain Casino I just wanted to express our thanks to you and your team. I couldn't have asked for anything better."

Brian Rankin - Slot Technical Manager

On-Site Slot Tech Training Customized Classes Available

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

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

Students learn how to work with:



THE DIGITAL MULTIMETER

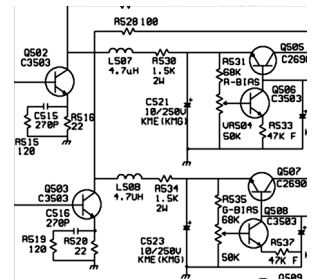
This relatively inexpensive piece of test equipment is easy to operate. Casino School students learn to use the digital multimeter to perform tests and measurements that will pinpoint the cause of a failure down to a single component.

ELECTRONIC COMPONENTS

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

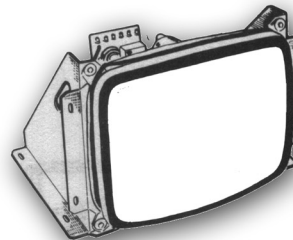
SCHEMATIC DIAGRAMS

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



POWER SUPPLIES

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



MONITOR REPAIR

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

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

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tel.619.593.6131 fax.619.593.6132 e-mail CasinoSchool@slot-techs.com
For a complete brochure, visit the website at: slot-techs.com

larger than the load conductors. Sometimes the electricians will share the neutral and ground between circuits that are run in the same conduits. In the gaming industry, this practice should not be done. Each circuit should have individual hot, neutral and ground even if they are in the same conduit. Then, harmonic filtration should be installed at the load of each circuit.

A recommended type of filter is a "3rd Harmonic Blocking Filter." This type of filter is connected in series with the loads (slot machines). The filter presents a very high impedance to the odd harmonics (the especially bad 3rd harmonic as well as the 5th, 7th, and 9th harmonics) but presents a very low impedance to the fundamental 60 Hz frequency. This allows the 60Hz current to pass easily with little voltage drop. This product significantly reduces harmonics at the load.

Filters are available from:
MTE CORPORATION
W147 N9525 Held Drive
P.O. Box 9013
Menomonee Falls, WI 53052
USA Toll Free: 1-800-455-4MTE
Tel: 1-262-253-8200
Fax: 1-262-253-8222

Additional assistance in tackling your pesky 3rd harmonic problems can be obtained from:
Dr. Michael Z. Lowenstein
Harmonics Limited
50 Pocono Road
Brookfield, CT 06804
tel.(877) 437-3688
fax (203) 740-3083

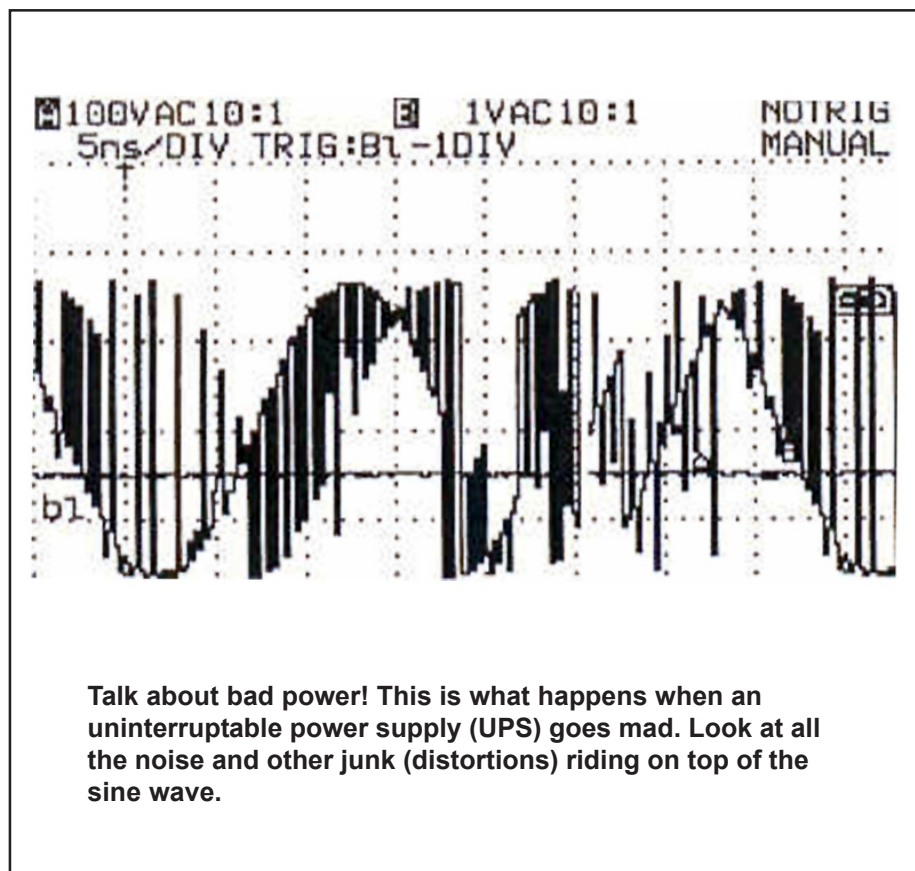
There are many other ways of reducing and removing harmonics. Active filters are placed at the transformers prior to the power switchgear. They are expensive and do not remove problems inside the casino, rather removes harmonics from entering the power company transition lines. Phase Shifting Transformers; remove harmonics to the primary circuits. Tuned 3rd Harmonic Filters; are placed on the 3 phase rectified power supplies like large UPS (Uninterrupted Power Supplies)

With all the low voltage processors, plasma screens, LCDs, monitors and other gear used in the newer slot machines, we see more and more harmonic distortion being applied to the power

circuits of the casinos. Low voltage communications like T-Base, RS-485 and RS-232 will possibly be effected by the harmonic distortion produced by the slot machines and other switching power supplies. Casino Managers along with the Facilities Managers need to be pro-active in reducing and preventing harmonic distortion damage to the casino power distribution system and any problems that may be transmitted to the power company.

For even more information about Harmonic Distortion, see Slot Tech Magazine, August 2004. Pages 18-25.

- Robert Jewell
- rjewell@slot-techs.com





MultiMax

High Speed Stand-alone Device Programming System

EE Tools introduces the most cost effective high-performance Programming System to program leading high-density Flash memory and other programmable devices (such as Samsung's NAND parts) at near theoretical minimum programming times. MultiMax is a complete, stand-alone programming system, featuring a fully embedded operating system, a simple operator interface, and an ergonomic user-friendly design that minimizes process steps and maximizes performance. The MultiMax is designed to program even faster, so when Flash memories get bigger and faster, so will the MultiMax.

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- Intelligent PC remote operation with powerful GUI software
- Stand-alone or PC operation via USB 2.0 interface for high-speed data transmission
- Supports Windows 98/Me/2000/NT/XP

MultiMax-8G	\$5,950
MultiMax-16G	\$9,950
TopMaxII	\$995
ChipMa2	\$475



ProMax

Concurrent Programming System

ProMax is the state-of-art universal programmer offers you the most advanced programming facilities for high-speed USB 2.0 PC-interface. It programs a 64Mbit flash memory in 42 seconds. ProMax supports the latest device technologies, regardless of package type.

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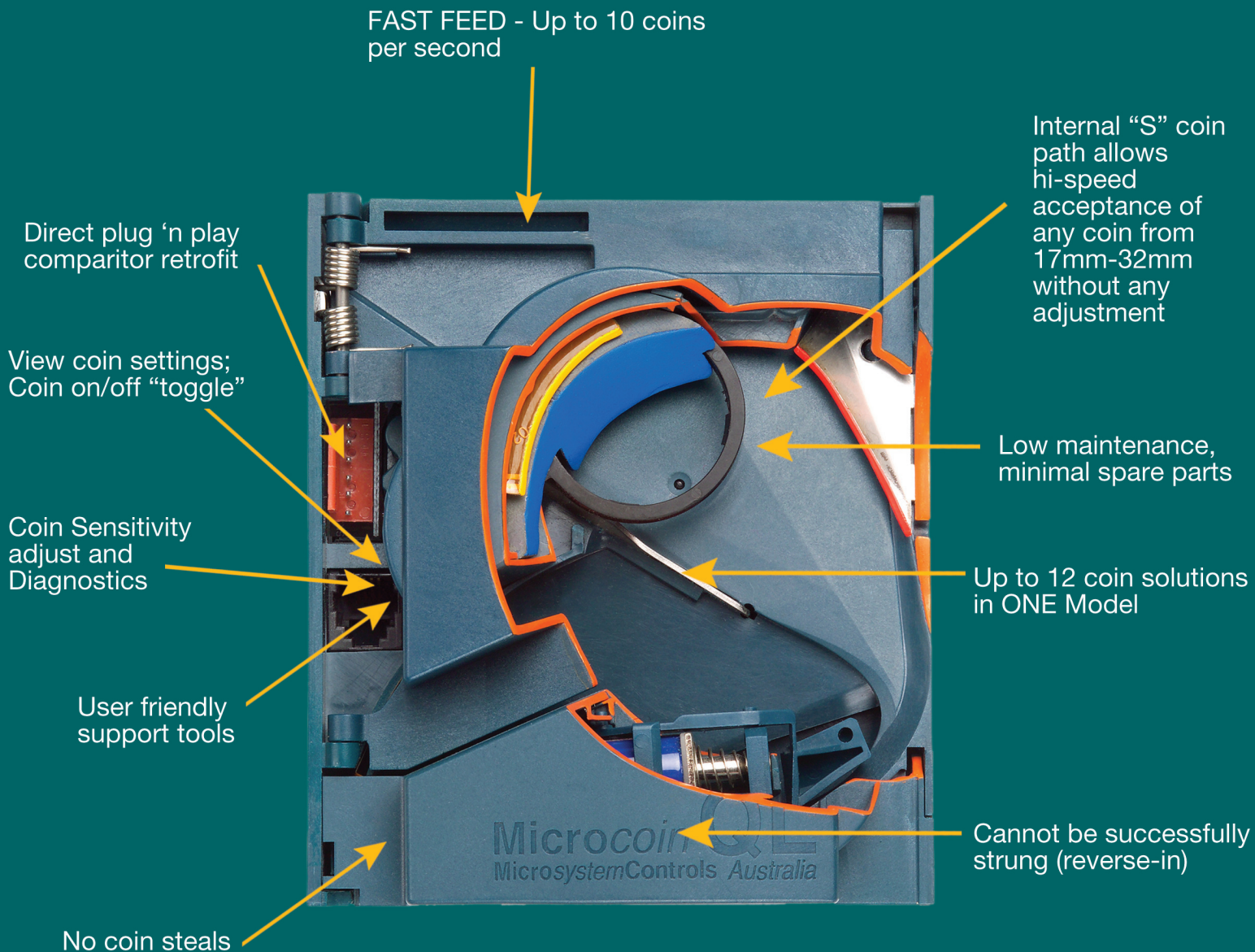
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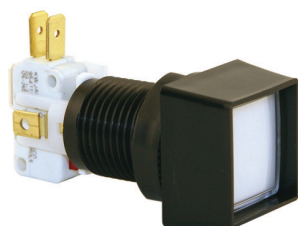
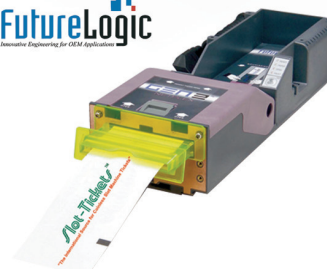
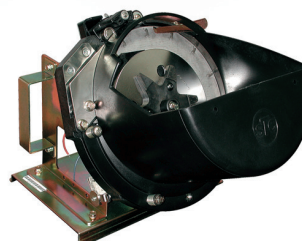
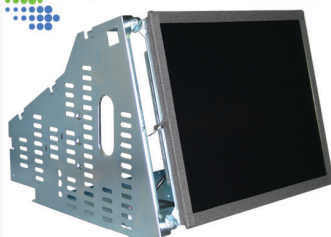
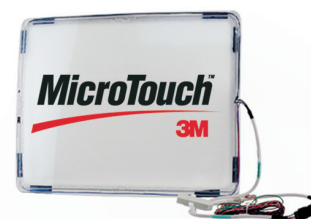
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