FLUKE®

Harrah's stakes its customer satisfaction on Fluke ScopeMeter

SDS line testing with the 196C ScopeMeter® Test Tool

Technology at Work

Across the gaming floors of Harrah's Atlantic City casino, the clatter of falling coins is fading.

The slots machines are still busy, and players fill the floors. But instead of lugging heavy buckets of coins, today's slots players use Harrah's new Fast Cash™ payment system. They simply withdraw their Fast Cash ticket from the machine they're playing, insert it in the next machine and continue to play. Harrah's mainframe computer keeps track of their play and winnings. At day's end they can redeem their balance for rewards credits, food, refreshments or cash.

Because of its secure encryption process, the ticketing data requires absolutely clean data lines for transmission. With each pull of the handle, 4000 slot machines must infallibly communicate across 96 data lines, swimming upstream to the mainframe and back against the electronic noise generated by casino life.

To keep its data flowing, Harrah's uses the Fluke 196C ScopeMeter® test tool to monitor data line voltage, spot interference, and trace the source before the line goes down. This predictive maintenance-style program works so well it's become a best practice across Harrah's Entertainment, the world's largest gaming company.

Show me the money

"It's all about customer satisfaction," says Ike Denafo, Director of Slot Product Strategy for Harrah's Atlantic City and Showboat casinos. Customers like the new level of convenience, choice, and speed of payment brought by Fast Cash.

Fast Cash is based on the SDS Slot Accounting System from Bally Gaming and Systems. The system continually monitors the casino's slot machines and customer activity through game monitoring units (GMUs) within each slot machine. The GMUs are in constant real-time communication with the system's gateway server and networked host computer that acquires, archives, and distributes critical slot data to PCs or data terminals through a dedicated and secure local-area network (LAN).

Each CAT 5 LAN wire that leaves the mainframe may serve up to 50 slot machines. The wire will be connected to a "six-point

board," where it splits into five lines, each of which are split again at another six-point board.

When a slot machine — or an entire bank of machines — won't redeem a ticket, then customers can't get their money and Harrah's must dispatch an employee onto the floor to handle payouts and appeasements. Most problems come from electronic noise (harmonics and other non-sinusoidal waveforms) from lighting controls and customer electronics and failed components or wiring.

Preventive maintenance, scope-style

Thanks in large part to technician George DiTomasso, Harrah's has found a way to spot most problems before they happen.

Every day, Harrah's technicians run computer-based network performance reports on the entire system. Every week, DiTomasso analyzes the voltage signals on all 96 data lines and feeder circuits with his Fluke ScopeMeter 196C digital oscilloscope.

From Harrah's computer room, where the lines are terminated on patch panels, DiTomasso taps directly into each line using a data jumper cable. He hooks up two probes for dual trace action and simultaneously monitors the polling signals and game side signals transmitted over each line.*

When a waveform comes up wrong, DiTomasso works to isolate the cause–is it a problem with a jumper wire, a six-point board or the GMU located at the slot machine itself?

"Sometimes I can look at a signal and if it's incorrect, I can come pretty close to anticipating what the problem is," he says. "The number one problem is bad six-point boards, generally from a loss in voltage. The voltage reading should be on the order of six to eight volts, and I've seen anywhere from three to five. And then you're getting a lot of noise, too."

Applied consistently, the Harrah's testing program has enabled DiTomasso to reduce the frequency of problems. "In the beginning, several times a week we were going down to the floor to make repairs," DiTomasso says. "The problems have lessened as time's gone on, because we've fixed them. And now we're more conscious of what the problems are, so we fix them ahead of time."

Case in point**

Figures 1 and 2 are sample readings of good system polling signals using an oscilloscope. The scope settings used for this were 2 Vdc per division, (500 ms per division for figure 1, 5 ms for Figure 2), and the trigger was adjusted as required to display the waveform.

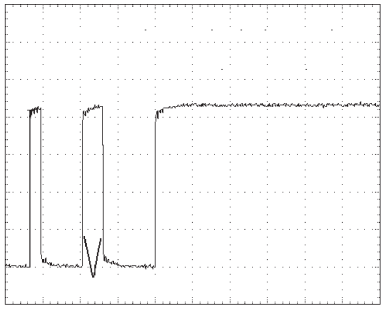

Figure 1.

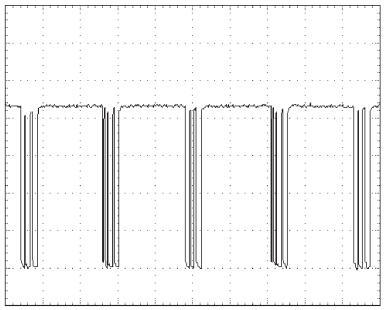

Figure 2.

Figure 3 is a sample reading of a bad game data poll. The figure indicates a poor grounding problem causing 60-cycle interference. The scope settings used for this were 2 Vdc per division, 2.5 ms per division.

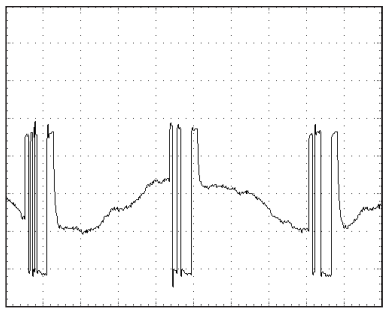

Figure 3.

Figure 4 shows the 196C ScopeMeter screen with both the game data and system polling signal on display. The lower trace indicates a voltage drop of approximately 2 volts on channel (B) of the ScopeMeter test tool. This could indicate a possible bad GMU. The voltage drop could eventually pull down or short out the line, causing it to go down.

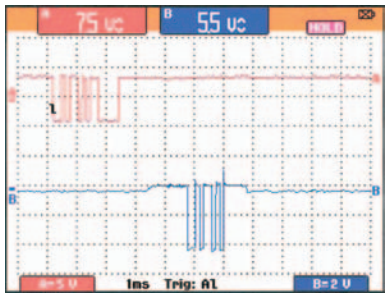

Figure 4. Bad Line 38B low + Game Voltage.

***Note:** Slot lines are a balanced RS422/485 standard and do not support a grounded device. Connecting a grounded device to the slot lines can cause an imbalance. Verify the scope has an isolated ground, like the Fluke 196C does.

****Case description provided by George DiTomasso and by Gaming and Leisure Magazine, Fall 2004 edition.

Technicians used an SDS line chart of the casino floor to trace the line and then tapped the ScopeMeter to the six point board at that location to see the waveform. The signal matched the reading at the patch panel, which meant the line itself was not the cause. They then worked backwards, disconnecting jumpers until they isolated the problem to a GMU short in the cabinet of the game. Figure 5 shows the repaired unit. Typically a good game side voltage should be between 6.5 Vdc and 8 Vdc peak to peak.

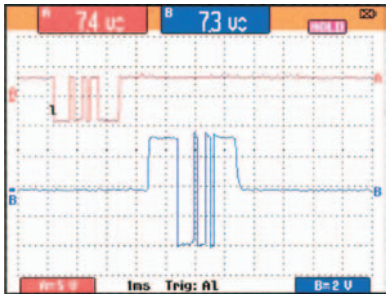

Figure 5. Repaired Line 38B GMU shorting on game cabinet.

Tip: To speed things up, one technician monitors the scope and the other starts the troubleshooting process by eliminating each physical line.

Best practice — and a reference library

"George started the whole process," says Denafo. "He found a lot of value in it. We transferred that knowledge to our sister property at Showboat, and communicated it (to the Harrah's Entertainment organization) as a best demonstrated practice."

"What stands out for me is how easy it is to find the problems," DiTomasso says. "Without a scope it would be nearly impossible. Some people use a meter, but that's not foolproof. You won't see any noise."

The ScopeMeter test tool also enables DiTomasso to take snapshots of any unusual waveforms and share them with others. He has collected a library of waveforms using the Fluke ScopeMeter 196C, which he and Denafo use as reference documents when new problems arise. He has even consulted with Bally Gaming headquarters on some issues, sharing ScopeMeter waveform screen shots by e-mail.

"We've found the benefits in it," Denafo says of the Harrah's maintenance program. "It's good, proactive, preventative maintenance."

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Fluke Corporation
PO Box 9090, Everett, WA USA 98206

Fluke Europe B.V.
PO Box 1186, 5602 BD
Eindhoven, The Netherlands

For more information call:
In the U.S.A. (800) 443-5853 or
Fax (425) 446-5116
In Europe/M-East/Africa (31 40) 2 675 200 or
Fax (31 40) 2 675 222
In Canada (800) 36-FLUKE or
Fax (905) 890-6866
From other countries +1 (425) 446-5500 or
Fax +1 (425) 446-5116
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