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All the right switches

Korry Electronics developed a system for testing the switches, indicators, and potentiometers the company builds for the new Boeing 787 airliner.

By Martin Rowe, Senior Technical Editor. -- Test & Measurement World, August 1, 2006

Project Description

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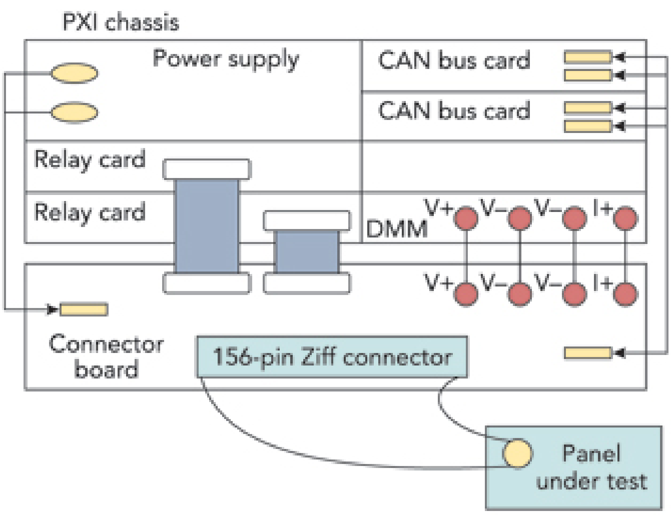
Korry Electronics (Seattle, WA, www.korry.com) manufactures control panels for the Boeing 787 aircraft. With the 787, Boeing is incorporating a new generation of panels. Traditional control panels consist of switches and indicators, each with its own set of wires that come out to a connector. The 787 control panels reduce wiring by incorporating a controller area network (CAN) bus for switch control and indicator status.

The test station's PXI chassis (**figure**) supplies power for testing a panel's switches, potentiometers, and indicators. Two relay cards route power from the DC power supply to the panel, and they connect a digital multimeter (DMM) card when applicable. Software sets the power supply to 28 V, the voltage used in many aircraft systems. Two dual CAN-bus interface cards connect bus channels from the PXI chassis to the individual switch panels.

Test engineer Allen Cutler designed an interface board that routes power to a panel's components. He used a single 156-pin Ziff connector in his custom interface panel so a test operator can connect any of several cable harnesses to the board. Circular military-style connectors bring the signals to the panel. Each type of panel has a unique cable assembly.



A PXI chassis provides power, relays, a CAN-bus interface, and a DMM for testing avionics control panels. Courtesy of Korry Electronics.

Before applying power to the panel, the system verifies integrity of the switch panel power circuitry. After applying power to the panel, the system measures the current it draws. If the current is within limits, the system tests switches by connecting the power supply to each switch. The discrete switches are hard wired, and the digital switches are monitored by the CAN bus. The DMM, connected between the switch under test and ground, verifies switch closure when it senses the power-supply voltage. For manually controlled switches, the system informs a test operator to close the appropriate switch, after which the system verifies switch closure.

To test a potentiometer, the system connects the power supply across the part, then connects the DMM's voltage input from the wiper to ground and measures the wiper voltage. The system instructs the test operator to adjust the potentiometer from end to end, which should produce a voltage from 0 V to 5 V. "We prefer to measure voltage instead of resistance," said Cutler. "It's more accurate."

For an indicator test, the system sends a command over the CAN bus to illuminate each indicator. The system applies power to an indicator and instructs the test operator to verify that the light is on. A set of check boxes appears on a PC monitor, and an operator checks the boxes for passed indicators.

Lessons Learned

During this project, Cutler learned the value of preparation. "Do a good evaluation of your test needs so you'll have the right resources," he said, "and use common connectors whenever possible."

"Use modular code as much as possible," he added. "I use many subroutines across multiple panels. Each relay has its own routine that the software calls as needed, regardless of which panel is under test." He also reuses code written for applying power and measuring power-supply current in each panel.

Device Under Test
Avionics control panels used in the Boeing 787. The panels consist of switches, potentiometers, and indicators that control and monitor various aircraft functions in the cockpit and main cabin. Panels range in complexity from two to 22 switches, one to eight indicators, and one to 12 potentiometers.
The Challenge
Develop a system that functionally tests the panels for switch closures, indicator light illumination, and potentiometer settings. Design an interface board that provides a single connector for use with numerous cable harnesses. Develop an easy-to-use user interface for test operators.
The Tools

- Geotest: PXI 3U/6U mainframe; controller; two-channel, 0–30-VDC power-supply card; 75-channel relay cards. **www.geotestinc.com**.
- National Instruments: PXI CAN bus controller cards; graphical programming language; test executive. **www.ni.com**.
- Signametrics: 6½-digit PXI DMM card. **www.signametrics.com**.

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