VXI Test System Helps Ensure Elevator Function, Safety

Electronic Control Test Case Study

Customer:  
An Asian elevator manufacturer.

Introduction:  
Elevators are used in virtually every modern office building in the world. Each day, hundreds of thousands of passengers depend on them for speed, comfort, and safety. If elevators malfunction, it can cause anything from minor delays to physical discomfort to actual threats to safety. It is imperative that the electronic controls used in elevators function safely and reliably on a continual basis.

Situation:  
The elevator manufacturer, which employs some 400 people, had to conduct functional tests of its high-voltage printed circuit boards (PCBs) – the control units which operate the elevator's drive motors. The tests were designed to ensure quality and reliability, to sort good units from bad, and to comply with relevant regulatory requirements.

Problem:  
The manufacturer was using an analog voltmeter and analog power supplies to calibrate the elevator controller printed circuit board, which limited the accuracy of the test. Because of lack of automation and throughput limitations, it took 20 operators a total of 10 hours per day to test each controller board. The rejection rate was 25%, creating an unacceptable level of time, personnel, and financial drain.
Implications:
If the elevator control boards are not tested properly, they cannot pass quality specifications or regulatory requirements. In addition, if defective units are used in elevator operation, they could create threats to passenger comfort and safety. This would have obvious legal, as well as competitive, implications for the company.

Solution:
An HP VXI-based system was chosen to replace the old test system. This B-size system was low in cost. HP engineers worked closely with the manufacturer to analyze how the elevator PCBs function, which parameters must be tested (voltage, current, resistance, etc.), the acceptable range of each parameter, and the kinds of test equipment required. Because the entire system is under the control of a PC, testing time is now more accurate and efficient. This means that a larger number of controller boards can be tested in a given period of time, which increases throughput.

In this system, an HP E1301A B-size VXI mainframe houses an HP E1339A 72-channel open-collector relay driver. The driver in turn is used to control a high-voltage relay that switches the power supplies in the test system. An HP 34401A digital voltmeter is used to make the measurements.

HP VEE was chosen as the test development software because of its ease of use, especially when it comes to creating a user interface.

Description of Test:
The printed circuit boards that control the elevators have four variable resistors that need calibration. Before HP built the test system, the customer had to adjust these resistors using an analog voltmeter. When the adjustments were made, a large number of them were inaccurate, so the PCBs failed final integration into the elevator controls. HP built the new, more accurate system using highly accurate, digitally-programmed power supplies and a digital voltmeter. With this system, adjustment of the four variable resistors was extremely precise. This prevented PCB failures and thereby increased test throughput.

Results:
With the new system, each controller can now be tested in about 30 minutes. The test requires only four operators for 10 hours per day, compared to 20 operators for 10 hours per day, and the rejection rate dropped from 25% to 1%! The tests were more accurate because of the higher precision of the digital voltmeter and power supplies.

Programmable power supplies used with a multiplexer also reduced the number of power supplies needed by a factor of four to one.

Using HP VEE, the company reduced its test development time from several months to 100 hours. HP VEE software also contributed to ease of use and faster testing.

In the future, the company plans to test five new controller boards, and has asked HP to design and integrate a test system for these.