WINEMAN TECHNOLOGY INCORPORATED

EFFECTIVE SOLUTIONS FOR CONTROL SYSTEMS AND AUTOMATED TEST EQUIPMENT

Automatic End-of-Assembly Line Functional Testing of Automotive Air Conditioning Modules

Category:
Production Test

Products Used:
LabVIEW™ Software
12 slot SCXI chassis
PCI-MIO-16E-4 card
4 SCXI 1120 modules
PC-DIO-96 card

The Challenge: Performing functional tests on automotive air conditioning (AAC) modules at the end of an assembly line with future model and increased testing capacity built into the software and hardware.

The Solution: A safe, user-friendly AAC module testing system was developed using LabVIEW™ software for data acquisition and system configuration while utilizing a National Instruments' SCXI and digital I/O board for the hardware.

Abstract

The customer requested a system that would be efficient to use by operators and engineers and allow for future expansion. The new test system provides a means to indicate pass or fail of each part without the operator leaving their station. Three indicator lights on the testing bench, among other items, are used to signal "Part Under Test", "Part Passed", and "Part Failed". While the engineers can check the monitor for more in depth information, the system insures the safe operation of the test through the use of safety shields and a low-pressure pneumatic parts handler. In addition, the system will easily accommodate expansion in its software and hardware.

Design Considerations

A major consideration in any system is the way the operator will interact with it. This system provides three operator interaction challenges. First, the system will be in a manufacturing environment. However, dust and particulate infiltration were not a concern, as particulate counts are already well managed. Ruggedness also needed to be designed into the system because load transports such as, hi-lows and handcarts may be in the area and could collide with the system. Second, specific information needed to be displayed on the screen for the line manager and engineers. Making this information readable consumed the majority of the screen; therefore, an alternative to displaying a pass/fail status on the screen was required. Third, the operator would b loading test units into a parts handler. The moving components of the handler offered a potential safety hazard that needed to be minimized or eliminated.

A second major consideration was how to collect and store data. The system is to analyze the data and enter information into a networked database. The tester needed to operate independently of other network and system components, so a method of storing the data was necessary in the event of a network failure.

A third major consideration was the future use of the test system. The possibility existed that the test system might be expanded to accommodate increased AAC electronic module production and testing capacity. The system would also need to accommodate a variety of modules. Consideration was given to providing flexibility in the test sequence and hardware to cover variations in different models' designs. With this in mind, the software would be developed to allow for efficient future modification.

System Design

The system was designed around an IBM compatible PC with a 400 MHz Pentium II® processor, 64 MB RAM and 17" monitor. Window NT™ 4.0 was chosen as the operating system. A National Instrument's twelve slot SCXI chassis, four SCXI-1120 modules, a PCI-MIO-16E-4 data acquisition card, and a PC-DIO-96 card provided the data acquisition hardware. A variable power supply that accepts a voltage input was selected to change the voltages supplied to the unit-under-test (UUT). The majority of the system was enclosed in a 19-inch rack cabinet with the parts handler and test fixture on an industrial six-foot steel bench.

For the primary user interface, three lights, two switches, and an audible alarm were selected. The lights indicate Part Under Test, Part Passed, and Part Failed. The two switches are a Start Test and acknowledge alarm; both switches are proximity type. The audible alarm sounds to alert the operator of a part failure or system error. The computer monitor was reserved to display Daily Part Yield, test Results, and other information of interest to line managers and engineers.

System safety is maintained through safety shields and a low-pressure pneumatic parts handler. The safety shields were installed to prevent the operator form encountering moving parts. The low-pressure pneumatic parts handler (Figure 1) was installed in the unlikely event that an operator would get caught in the parts handler; therefore, the operating pressure is sufficiently low to avoid damage.

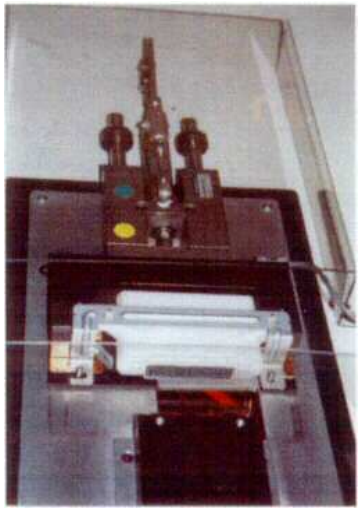

Figure 1: Low pressure pneumatic parts handler

A local database was created to store the required information to ensure data storage independent of the network. This was put in place should the network database become unavailable. National Instruments' SQL toolkit provided the functionality to access both the network and the local database. ODBC was setup to allow the database to be readily altered if necessary.

The twelve slot SCXI was selected to allow for future increased capacity. Eight slots remain open for additional SCXI 1120 (8 channel voltage/thermocouple) modules. The six-foot bench is only half utilized at this time, allowing for an additional station to be placed on the remaining half.

All tests were created programmatically to provide upgrade test capabilities for future models. The channels measured, the checks performed and the time delay between tests are setup in the administrative section of the program. Flags are set to allow for special occurrences during a test or special procedure. The administrative section is password protected to prevent casual or accidental changes to the test setup.

Conclusion

The use of LabVIEW™ and National Instruments' SCXI hardware allowed an expandable and flexible system to be created with rapid development time. The use of a fully configurable test setup will allow for additional models to be added with relative ease.