

Cab/Dash Electrical System Test Station

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The Challenge

Provide a user-friendly, multi-configurable test system for quickly testing electrical components and connections from the cab/dash of a vehicle to firewall connectors. Problem circuits must be identified immediately so the technician can repair and test while the cab/dash progresses down a fast paced assembly line.

The NTS Solution

Create a multi-channel test system using LabVIEW and Field Point.

Introduction

Vehicle producers worldwide run assembly lines at full speed whenever possible. At this fast pace of production, any system that can provide a faster test station on the assembly line while maintaining or increasing quality will directly effect the quality and quantity of the plants production.

The cab/dash types as well as the electrical configurations of these vehicles vary greatly from plant to plant. Though each plant produces a unique type of vehicle, the general method of production is similar from plant to plant.

The cab/dash portion of each vehicle is assembled separately from the chassis portion. Both main parts of the vehicle are tested independently, and then the two are brought together to complete the vehicle. Once a complete vehicle is produced, inspection and functionality tests are performed on the vehicle to ensure the high quality of the vehicle before it is released to the customer.

The Cab/dash Electrical System Test Station is utilized for testing all electrical connections and components from the cab/dash at the firewall before the cab/dash is attached to the chassis. These components include all switches that have corresponding firewall connections such as the headlight switch, turn signals, ignition switch, etc... As well as being capable of testing switches in the cab/dash, the Cab/dash Electrical System Test Station can test the connections to, and the functionality of, all of the gauges in the cab/dash. Using the Cab/dash Electrical System Test Station while the Cab/dash is still separated from the chassis simplifies the final troubleshooting of the vehicle because all of the in-cab/dash problems are resolved before the marriage of the cab/dash and chassis.

System Design

The environment and the purpose of the systems drove both hardware and software design. Hardware had to be ruggedized to ensure reliable functionality in a harsh assembly line environment. Ten analog input Field Point Modules, two relay modules and one pulse width modulator module are safely enclosed together and are kept within close proximity to the cab/dash via an overhead moving framework. This framework structure moves with the cab/dash as the line progresses automatically. A flat panel monitor is also contained in the framework and easily repositioned by the operator. The computer and power supplies required for the system are located in a cabinet that can be kept well away from the main activity of the assembly line. The cabinet is linked to the field point enclosure with an overhead cable.

The software challenge for this application was to make every aspect of the application dynamically configurable. To achieve this flexibility, a mapping algorithm was used to determine the field point channel that drives each of the indicators on the test panels. This algorithm also accounts for how many switch test screens are required as well as how many gauge test screens are needed. Test parameters, and therefore the appearance of each test screen, can be changed between tests in a matter of moments and several different configurations can be saved and recalled instantly during testing. This flexibility allows the test system to be configured to conform to each technician's testing style to produce maximum efficiency for each operator.

Utilizing Field Point created quite an advantage in both hardware and software for making a test station easily reconfigured for any type of cab/dash. The selection of three different Field Point module types (FP-AI-100, FP-RLY-420, and FP-PWM-520) encompassed the required functionality for testing even the most complicated cab/dash being produced. The Field Point Configuration for each of the Test Stations is the same, allowing for maximum channel count

use. The advantage of Field Point Explorer 1.7 is that each channel's input value can be verified even before Cab/dash Electrical System Test Station software is executed. Once connections are verified, the configuration of the test station software is quick to perform and the test station ready for full speed testing of cabs/dashes.

Once the system is in operation, a four-button control wand is used to drive the user through the test sequence. The test sequence is simple and can be learned by the operator within the first couple of tests performed. The test dynamically notifies the user of switches that make proper contacts when operated, and individually drives gauges allowing the user to determine if they are working properly and wired properly. When the test is complete, the user can print a report that shows which of the gauges and switches have passed and which have not been tested. This report is kept with the vehicle for final testing when the vehicle is completely assembled.

Results

The system is installed and operating on several assembly lines. The installation time for each system currently depends upon how quickly each signal can be mapped and connected to the Field Point Enclosure. Typically, custom interface cables are required between the cab/dash and the enclosure (with several types of cabs/dashes being tested, this customization for each system is unavoidable). Once interface cables are created, the remaining configuration can be completed within hours.

As a result of this test system, the time required for testing entire cabs/dashes (which includes connecting all interface cables before testing, and disconnecting after) averages about two minutes. The reliability of the system has gained the confidence of the technicians and any switches or gauges reported as faulty are quickly replaced and re-tested before the cab/dash is permitted to continue down the line. The Cab/dash Electrical System Test Station is helping various automotive plants produce better quality vehicles and saving time for these lines as well!

Products used in this Program

National Instruments Products

- FP-1000 RS-232 Network Module
- FP-AI-100 Analog Input Module (6)
- FP-RLY-420 SPST Relay Module (2)
- FP-PWM-520 PWM Output Module
- FP-TB-1 Universal Terminal Base (8)
- FieldPoint Bus Extender Cable
- DIN Rail 26 inch (3)
- Data Acquisition Interface Box
- Service Cart
- Hardened Flat Panel Monitor
- Dolch NotePac II
- Hewlett Packard DeskJet 882C
- Operator Console
- Rack

About NTS Test Systems Engineering

NTS TSE, located in Albuquerque, NM, designs and integrates test, measurement, automation, data acquisition and control systems utilizing diverse hardware platforms, operating systems, and instrumentation standards. Our expertise involves projects ranging from LabVIEW instrument drivers to full-blown automated turnkey systems. The dedicated staff of electrical and mechanical engineers, project managers and technicians of NTS are well versed in designing, integrating and programming real world solutions for industrial applications for a diverse set of operating systems and standards.

Test & Automation Services Include

- Requirements Analysis & Development
- Hardware Design
- Software Design & Architecture
- Instrument Drivers
- Test System Management (TestStand)
- Software Development (LabVIEW)
- Data Management & Analysis (DIAdem)
- Enterprise Solutions
- Fabrication
- Integration
- Installation & Training
- Maintenance & Support

Contact

To discuss how NTS can help you solve your next test system engineering challenge, contact Tim Brooks at 505-345-9499 or email tim.brooks@ntscorp.com.

