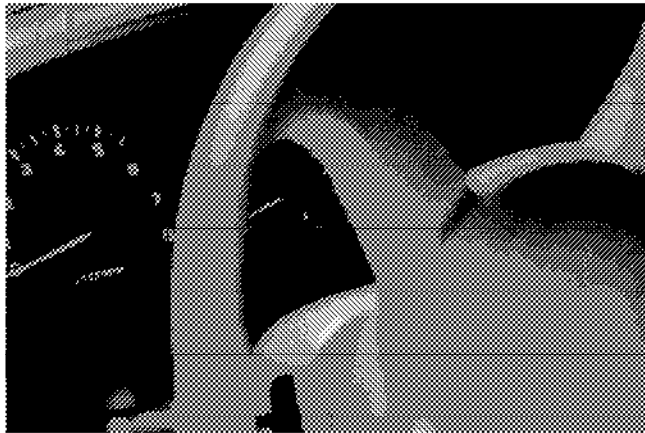

Environmental Test of Automotive Radios and Engine Controllers

Application Note 1270-11



Applications

Electronics
Automotive
Aerospace
Defense Electronics

Departments

Production Test
Quality Assurance
Test Engineering
Reliability
Environmental Test
Research and Development

Description

Automotive manufacturers must insure that all electronic components in a car can withstand temperature extremes normally found in year-round use. Because of the limited number of environmental chambers available, different devices such as radios and engine control modules are often tested in the same chamber and production area.

Problem

Although the radio and engine control modules are dissimilar products, they must share the same environmental chambers and, hence, the same test system. Not only is the throughput of the system important, but the changeover between the two test setups also must be swift. The radios are tested between -40

and +85 degrees C, and engine control units up to +105 degrees C, with the temperature varying during the test sequence. The environmental chamber must be controlled over this range and the test system must handle up to 30 engine controllers or radios at one time.

Solution

The ideal solution combines two, 13 Slot Mainframes, with an adequate number of switch multiplexer modules controlled by an Embedded VXI Controller. A signal generator stimulates the DUTs. The DUTs' output signals are routed through the switches to other system instruments such as distortion analyzer, counter, and integrating DVM for the acquisition of the desired data which is stored on the disc

and displayed on the System's Monitor. The temperature profile of the environmental chamber is also driven and recorded by the system. The system allows total automated testing and quick changes in test configuration and programming for various types of radios and engine control modules.

Implementation

Product Measurements: Radio Test

Car radio tests include audio distortion, local oscillator frequency, and input level sensitivity. Tuning the car radio and adjusting the volume is handled by the digital I/O modules. The signal generator simulates the incoming signal to the antenna. A VHF relay multiplexer card is necessary to carry the RF signals from the stereo signal generator to the radios and the local oscillator signal back to a frequency counter. Outputs from each radio consists of four speaker lines and a local oscillator output.

Instrumentation: Digital I/O, Integrating DVM, Distortion Analyzer, Signal Generator, Counter

Product Measurements: Engine Control Modules

The engine control modules receive a variety of signals fed back from transducers located throughout the car. Most of the transducers produce dc voltages that represent ambient and engine temperature, barometric, oil and manifold pressure, the oxygen content of the exhaust and road speed. A 400Hz signal from a tachometer feeds back engine rpm. Additionally, two binary inputs - the air-conditioning clutch engagement and the transmission gear ratio, feed into the control unit. The primary output from the engine control unit is a current pulse to the car's fuel injector solenoid, which has a 3 A peak current and a duration of 100ms at a repetition rate of 10 Hz. Also, 20 other binary outputs actuate a variety of vacuum solenoids.

Instrumentation: Digital I/O, Counter

Chamber Control

The most common type of chamber control is on/off. Chamber temperature can be changed by turning a heater or cooler on or off. Chamber pressure can be changed with a pressure or vacuum pump and one or more valves. Humidity in the chamber is also controlled by opening or closing valves.

Instrumentation: Digital Outputs, Form C Actuators

Humidity

The products are tested during variations in humidity levels in the environmental chamber. This to simulate the products' operation in high humidity environments as in the tropics and dry climates as in deserts. Some humidity transducers utilize wet and dry thermocouples (mV outputs), others use LVDT-like devices that output a 0 to 10 Vdc signal.

Instrumentation: Integrating DVM,
Relay Multiplexer

Temperature

Thermocouples and thermistors are commonly used to measure the temperature of environmental chambers. Sometimes these temperature sensing devices are mounted inside the test products to detect the effect of environment temperature on the products' operating temperature. Accuracy is important in these tests.

Instrumentation: Integrating DVM,
Relay Multiplexer
with Thermocouple
Compensation

Quick Interconnect

In order to achieve rapid changeover in test configurations from radios to engine control units a quick interconnect scheme must be implemented. The plug-in cards in the switch/test unit must be arranged to accommodate both applications. All wiring from the products must connect with terminal blocks positioned in the quick interconnect fixture to link with the appropriate plug-in card. This test system can be easily changed as product test requirements change. Plug-in cards can be moved or added and capacity can be increased by adding mainframes.

Instrumentation: Quick Interconnect
Fixture

Key System Features

Thermocouple Compensation
Data Storage
Quick Interconnect
Modular Capability

Typical System Configuration

Switch/Test Unit	Qty
13 Slot Mainframe	2-4
Quick Interconnect	2-4
Integrating DVM	1
RF Multiplexer Channels	20-60
Relay Multiplexer Channels	20-100
Digital I/O Channels	100-600
Form C Actuators	4-12

Computer/Software

Embedded VXI Controller
Keyboard, Monitor and Mouse
Disc Drive, Printer
Software - HP-UX and HP VEE

Other Equipment

Distortion Analyzer
Counter
Signal generator
D/A Converter