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# On Road Vehicle Testing

## Application Note 1270-6



### Applications

Automobiles  
Trucks  
Railroad Engines

### Departments

Research and Development  
Product Test

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### Description

Automobiles, trucks and railroad engines require on-road testing to verify their design. Characterizing a variety of parameters can lead to better and more efficient vehicles. Often the electronic circuitry used to control the engine can be improved for better economy.

### Problem

A mobile system with high reliability is needed to withstand road test conditions and still provide accurate measurements. Electronic noise introduced by the operating vehicle must not adversely affect measurements. Large amounts of data must be stored for subsequent analysis in the lab.

### Solution

Hewlett-Packard VXI Data Acquisition equipment can withstand less than ideal conditions and still make accurate measurements. By using integrating voltmeters, low level (millivolt and microvolt) measurements can be made in the presence of electronic noise. High reliability is an important attribute of HP data acquisition and control systems. When coupled with an HP computer and disc drive, the system can make measurements, perform some real time analysis, and store large quantities of data for later in-depth analysis.

## Implementation

### Temperature

A variety of temperature measurements are made during on-road vehicle testing. Temperature data on inside and outside air, engine, brakes, gears and fuel is used in characterizing vehicle performance. Temperature can also indicate wear in mechanical parts. Generally thermocouples or thermistors are used to make these measurements.

Instrumentation: Integrating DVM,  
Relay Multiplexer  
with Thermocouple  
Compensation

### Vehicle Speed

The speed in the vehicle can be easily measured using a shaft encoder and a quadrature counter. The frequency of the pulses from the shaft encoder are proportional to the speed of the vehicle.

Instrumentation: Counter

### Fuel Flow

Vehicle efficiency is determined by measuring the amount of fuel used during a test. By monitoring fuel flow, fuel consumption can be correlated with road conditions and engine control settings to optimize the fuel delivery system. Some flow meters put out microvolt signals and others output a series of pulses.

Instrumentation: Integrating DVM, Relay  
Multiplexer, Counter

### Braking Pressure

The frequency and intensity of brake application is a measure of typical driving conditions encountered by the vehicle. Heavy braking pressures may require design modifications in the braking system. In railroad tests, characterizing the entire route helps the engineer in determining when to apply the brakes to slow the train to an optimum speed with minimum brake pressure, thus saving time and energy.

Instrumentation: Integrating DVM,  
Relay Multiplexer

### Body/Suspension Vibration

Strain and vibration on both the vehicle body and the suspension system can be measured with the data acquisition system. Strain measurements of dynamic conditions can be used to calculate high stress points. The strain on gears and bearings can be used to predict their useful life.

Instrumentation: Integrating DVM,  
Strain Gage  
Multiplexer,  
High-Speed DVM,  
Dynamic Signal  
Analyzer

## Key System Features

- Strain Gage Linearization
- Temperature Linearization
- Data Storage
- Noise Immunity

## Typical System Configuration

Data Acquisition System	Qty
13 Slot Mainframe	1
Integrating DVM	1
High-Speed DVM	1
Relay Multiplexer Channels	10-30
FET Multiplexer Channels	10-20
Counter Channels	3-10
Strain Gage Channels	5-20

## Computer/Software

- PC Embedded Controller
- Keyboard, Monitor and Mouse
- Disc Drive, Printer
- Software - Windows and HP VEE

## Other Equipment

- Dynamic Signal Analyzer