WINEMAN TECHNOLOGY INCORPORATED

EFFECTIVE SOLUTIONS FOR CONTROL SYSTEMS AND AUTOMATED TEST EQUIPMENT

LabVIEW™ Software Based Vision System for Determining Valve Train Viability

Category:
Automotive

Products Used:
LabVIEW™ Software
MIO Series data acquisition card

The Challenge: Providing an automated high-speed system to accurately measure the movements of valves in racecar engines in relation to the crankshaft, keeping in mind that the valve train is the limiting durability factor in an engine.

The Solution: The solution utilized National Instruments' LabVIEW™ software, a MIO series data acquisition card, an encoder, and an optical displacement camera to watch the valve motion and then display the data on a computer screen as a waveform.

Abstract

The previous system consisted of feeding the waveform information to an oscilloscope and then the customer had to take a picture of the oscilloscope at just the right moment.

The solution utilized National Instruments' LabVIEW™ software, MIO series data acquisition card, an encoder, and an optical displacement camera to watch the valve motion and then display the data on a computer screen as a waveform. The data was then also downloaded to a spreadsheet program.

Introduction

The previous system consisted of feeding the waveform information to an oscilloscope and then the customer had to take a picture of the oscilloscope at just the right moment. This system also had a tedious alignment procedure for centering the acquired waveform on the display. In fact, the encoder had to be manually rotated to shift the display.

The solution utilized National Instruments' LabVIEW™ software, MIO series data acquisition card, an encoder, and an optical displacement camera to watch the valve motion and then display the data on a computer screen as a waveform. The data was then also downloaded to a spreadsheet program. The camera views the valve movement through a machined part in the block and translates the movement into a voltage output. The system is capable of translating valve motions at a rate of 90 times per second, at a lift of three-quarters of an inch.

An encoder with dual outputs was used, one provided 720 pulses per revolution, and the other provided on pulse per revolution. The 720-pulse signal was used as an external scan clock to synchronize the data acquisition with the valve motion. The single pulse served as the data acquisition trigger. This scenario allowed us to achieve precise displacement versus position plots of the valve motion.

System Design

In order to get an accurate picture of the valve, a light was shone on the valve and then the camera took a video of the reflection. There was also an optical encoder on the engine that let the National Instruments' LabVIEW™ software based program know where the crankshaft position was in relation to the valve position. See Figure 1. This encoder was hardwired to a data acquisition board in the computer.

A software package was provided that reduced test time, increased accuracy, and provided repeatability by using the encoder signals as the scan clock and trigger. The software program allows the operator to shift the waveform without re-positioning the encoder. The operator is able to acquire several valve movements in succession. All data is stored in tab CR delimited data files, which is accessible from spreadsheet packages such as Microsoft Excel.

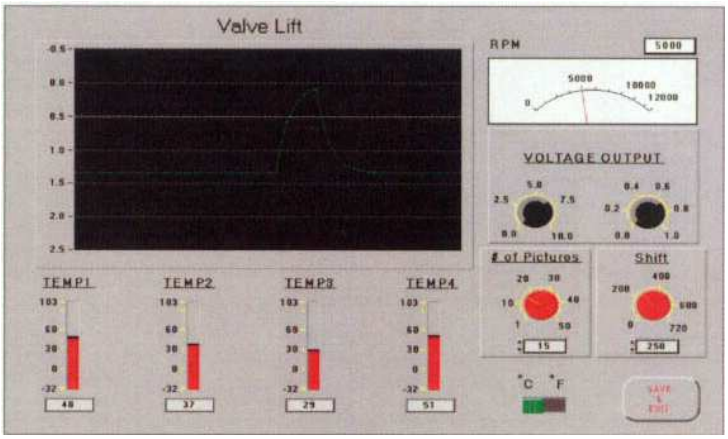

Figure 1: Plot of Valve Lift

Benefits to the Customer

One of the biggest gains for the customer is accuracy. They can tell from the displayed waveform if the valves are bouncing or lofting and if they need to change any of the valve train components. Another advantage is they are now able to re-run and re-evaluate the test data. An added benefit of the system is that durability tests as well as valve characteristics can be done on the engine because they can simulate a race on an engine dynamometer, and they can know if the choice of parts will actually work over the long haul. This data acquisition system saves a lot of trial and error and a lot of broken parts on the track and during a race.

This system and the data collected from it also provides valuable information to the racecar drivers. See Figure 2. It tells the racing team and the driver what the limiting speed of the valve train. It allows the racing team to put a rpm limiter on the ignition system that cuts off the spark to the spark plugs to keep the rpms at a safe level. An accurate system to determine the rpm limit reduces the risk of blowing an engine yet gives them the few additional rpms that could spell victory.

Figure 2: Typical data plot

1668 CHAMPAGNE DRIVE • SAGINAW, MI 48604
(PH) 989-771-3000 • (FX) 989-771-3010 • WWW.WINEMANTECH.COM