
Detecting Relay Chatter in Rocket Launch Vehicles

DATAQ Instruments

Imagine the vibrations you'd encounter as you were launched into space by a rocket. Now imagine how these vibrations can affect on-board control circuits. Since the failure of even one such component during launch can be both costly and tragic, engineers strive to simulate as much of the mission as possible on the ground. One area of particular concern was relay chatter caused by the tremendous vibrations of flight.

A simulation was carried out to determine whether on-board relay assemblies remained closed when subjected to a 70g, 100 Hz to 3 kHz random vibration. Engineers had defined a minimum sample interval of 5 μ s with a total data acquisition time of 3 minutes. This translated to a 200,000 Hz sample rate and a data file size of about 72 megabytes. It also precluded use of an older data acquisition product that had a top sample rate of 50,000 Hz. Instead, a small DC current was injected into the relay circuit and connected to a DATAQ Instruments model DI-400 data acquisition card running under WinDaq/Pro real-time recording software. This combination is capable of sample rates to 500,000 Hz. Any break in the relay circuit caused by vibration would immediately show as a spike on WinDaq's real time display, thus allowing relay performance to be judged on-the-fly. After the test, data files created by WinDaq/Pro were further interpreted using WinDaq Waveform Browser playback and analysis software. The disk streaming capabilities of both software packages allows data acquisition and analysis independent of data file size, which was very large in this example.