Fuel Metering Pump Test Stand Upgrade

Industry:

Aeronautics & Defense

Design Task:

The US Marine Corps' Fleet Readiness Center contracted KDY to upgrade the software and data acquisition & control system in their Rolls Royce F402-RR-408 A/B Fuel Metering Unit Test Stand. The stand was required to:

- Accurately monitor & control applied pressure, pump speed, flow rates & valve positions throughout the steady state & simulated flight operation of the installed unit.
- Perform frequency response analysis of the unit's signaling system versus fuel flow

The client was experiencing several problems with their existing design:

- Frequent test failure due to inconsistent in-test flow rates
- No ability to store or access completed test data

The upgrade would encompass both the stand's control system & user-end software while addressing any underlying issues with the current system. The existing design featured no automated testing capabilities.

The Solution:

Reliable Hardware. Automated Software.

KDY completed software redesign that enabled automated testing and operator-friendly calibration, tested & analyzed the client's previous design for underlying issues, & redesigned hardware components to drastically increase the reliability, accuracy, and efficiency of the Fuel Metering Unit Test Stand.

To improve stand performance, KDY provided:

- Kollmorgen MX11 Series Step Motor & P7000 Series MicroStepping Drive; high resolution for pressure control to an accuracy of +/- .3 PSIG
- Custom Dynic Labs 3-Phase Stepper Drive; specific to military aerospace applications
- PCB Intrinsically Safe Piezoelectric Pressure Sensors & GE PTX Series Transducers & Dataforth 5B Series ICP Signal Conditioners ICP conditioning
- National Instruments PCI6363 Multi-function I/O module & PCI6602 Counter Input Module

KDY designed a LabVIEW-based control system & user interface that in conjunction with the provided hardware provided precise, reliable test conditions & a suite of automated testing routines. The software packaged featured:

Servo-Controlled Valve Positioning: Custom control software scaled the user selected valve position setpoint to a corresponding servo position & programmatically set valve position during automated test procedures.

Open-Loop or Closed-Loop Step Control: Dual algorithms enabled the user to select either sensor feedback control or lookup table scaling to determine control values for the system's pressure regulators & servos based on user input.

Custom Sensor Reading & Unit Scaling: Scaling logic for individual sensor readings & built-in unit conversion to increase operator efficiency.

Automated Testing Suite & Calibration Software: A full range of automated test & calibration routines increased ease of operation. KDY included automated routines for troubleshooting for issues exhibited by the client's current hardware.

Transfer Function & Frequency Response Analysis: Fully automated transfer function & frequency response testing.

Data Storage & Export Capabilities: The update enabled test data to be exported as an XML file or exported as a text file or a LaTeX generated PDF report.

KDY delivered these feature & more while utilizing the majority of the test stand's existing hardware & electronic system, drastically increasing the tester's utility at a low cost.