

Case Study: F-15 AMAD Test Stand

Industry:

Aeronautics

Design Task:

The Hill Air Force Base contracted KDY to design, build, and program two test stands equipped with custom software to fulfill all operational testing requirements of the F-15 Eagle's Airframe Mounted Accessory Drive (AMAD) gearboxes. The stand was required to drive units under test (UUTs) of two different form factors at speeds ranging from 1000 to 9000 RPMs.

The system required a reservoir & heat exchanger to service the AMAD system with pressurized oil & cool the return oil via the chilled water supply on site.

Throughout testing several acceptance criterion would be monitored:

- UUT Case Pressure
- PTO Input Shaft Speed
- Oil Pressure; Oil Input & Output Temperature; Oil Flowrate;
- UUT Vibration

And multiple additional alerts regarding the UUTs electrical system & the test stand operational constraints.

Historically, vibration levels were measured manually & the many acceptance criterion were recorded by hand from analog sensors. This required operator attendance throughout the time-intensive testing.



Figure 1: F-15 AMAD Test Stand, as delivered

The Solution:

Fully Automated Testing, Custom Alert Management

KDY designed & fabricated an operator-friendly test stand equipped with custom DAQ hardware enabling fully automated testing procedures, computer generated testing reports, and real-time alarms for parameters of interest.

The mechanical design featured:

- **Direct Drive Motor:** A High-Speed Parker MGV Series Motor to eliminate the need for a speed increasing gearbox, lowering maintenance & system costs.
- **Calibration Friendly Design & Instrumentation:**
 - Quick disconnect plumbing elements for easy introduction of flow or pressure standard
 - Thermowell mounted temperature probes for easy removal
- **3-Color Visual Alert System:** State of acceptance parameters clearly indicated by mounted red/yellow/green light add-on; Eliminates need to continuously check sensors

- **Noise- Reducing Enclosure:** Sound insulation & damping features to ensure noise reduction despite high vibration application

For the electrical system & software design, KDY utilized its experience as a UL Listed Panel Shop to build both a Motor Drive & Instrumentation panel with user-friendly features:

- Two Hoffman UL Type 4/12 enclosures with penetrations for a disconnect operator
- Drive panel isolation to electrically insulate motor drive from sensitive instrumentation
- Power/feed-through convenience port for easy calibration
- NI-based digital and analog I/O
- Test stand mounted enclosures for sensor proximity reducing EMI noise

KDY delivered custom software that dramatically increased ease of testing:

- **Frequency Domain Vibration Analysis:** NI 9234 Analog Input Module and LabVIEW's Sound & Vibration Module to automate vibration measurement and analysis
- **Intuitive Calibration Software:** Multi-point calibration for all sensors with remote laptop capabilities.
- **Alert Management:** Alarm logger & visual alert system reduced operator attendance throughout testing
- **Windows Installer:** And executable for easy installation and software management

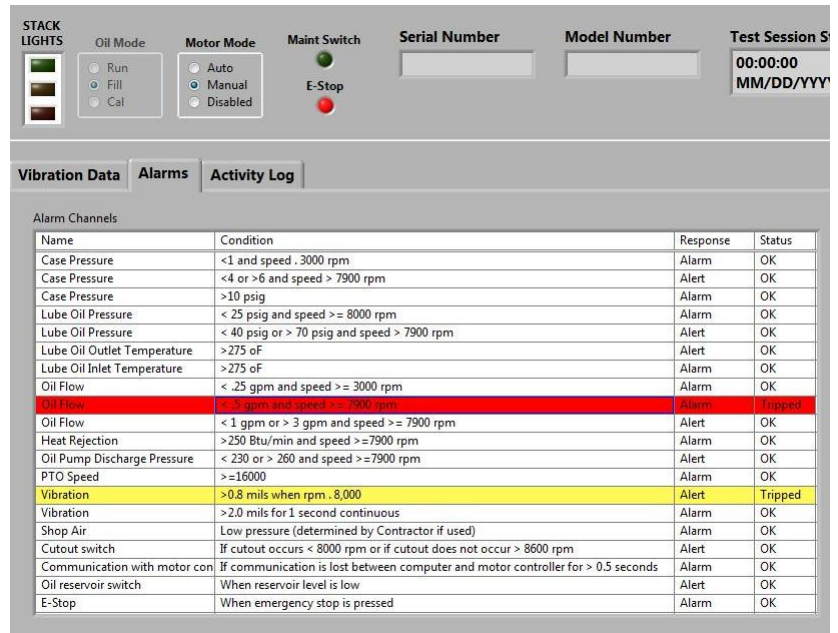


Figure 2: Alert Management Software