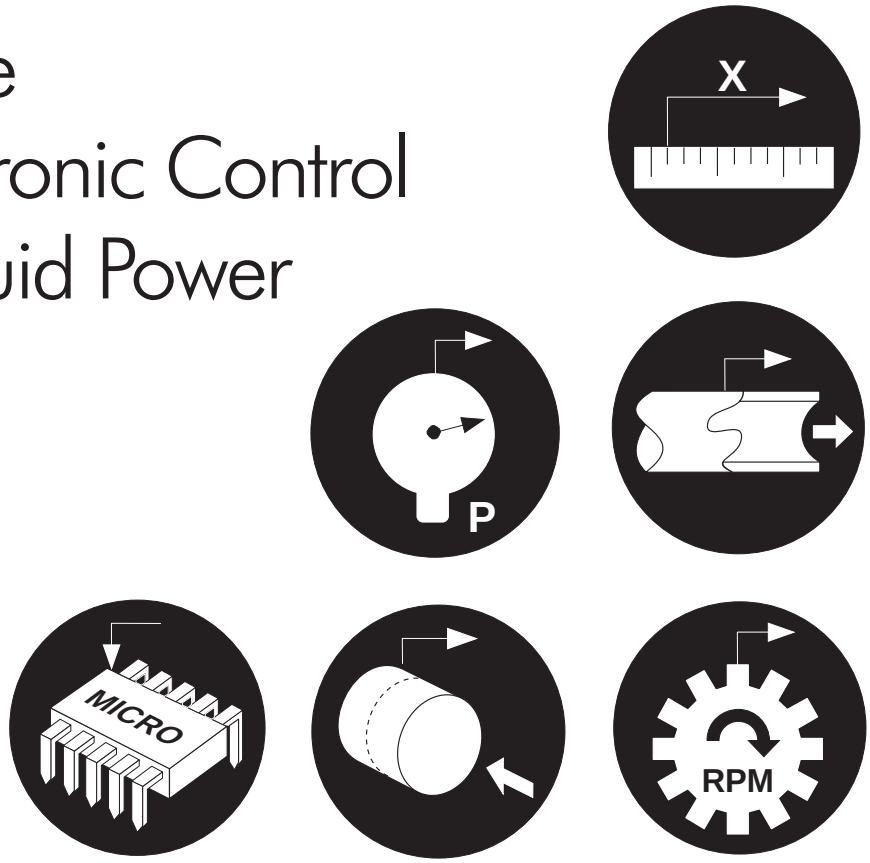
Your Guide to the Electronic Control of Fluid Power



The members of the National Fluid Power Association (NFPA) have prepared this application as an introduction to the electronic control of fluid power. The application and components described here are representative — electrohydraulics and electropneumatics can be effectively utilized in countless processes, and components are available in many different sizes and configurations.

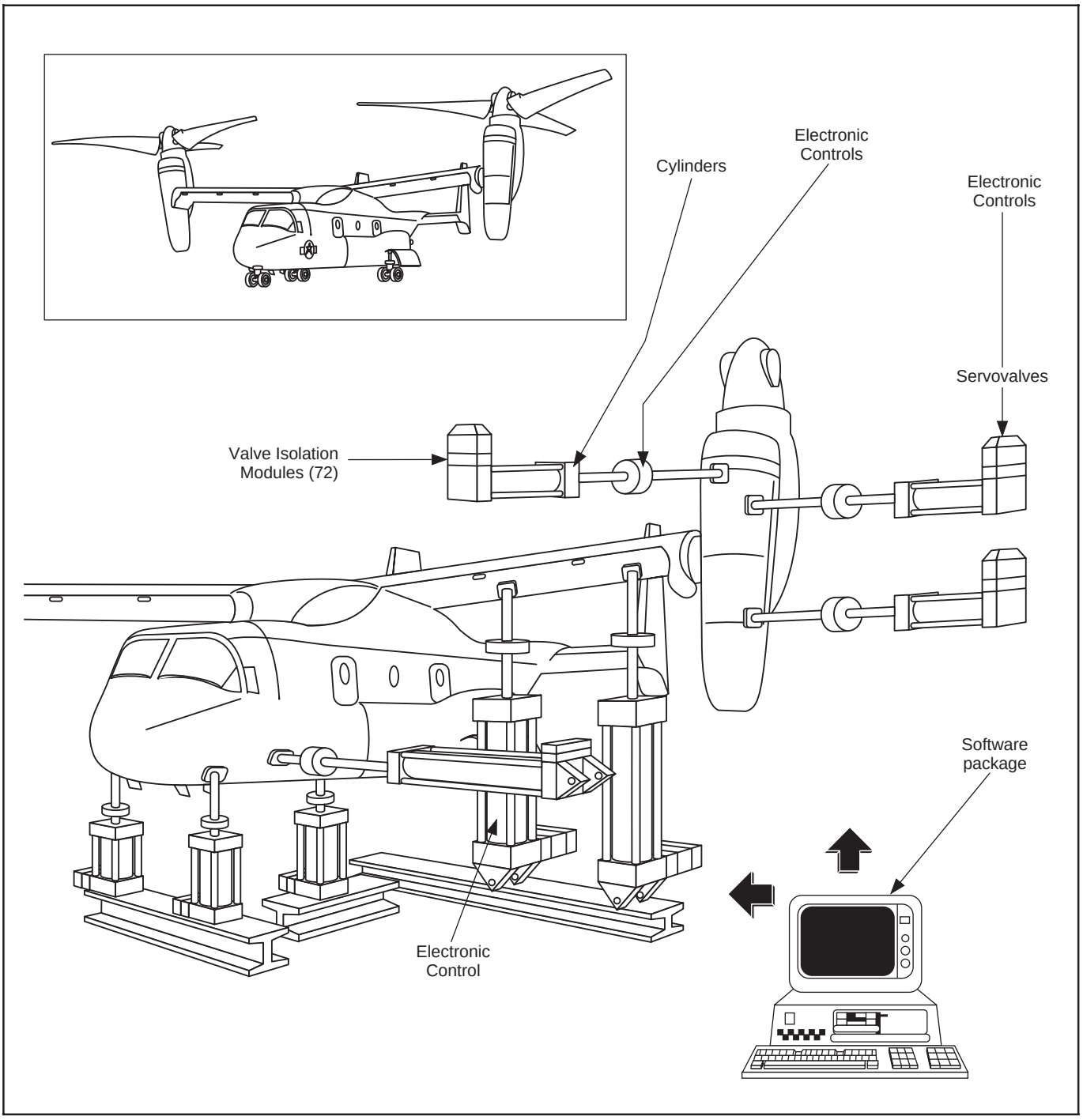
NFPA's manufacturers invite you to contact them for additional information.

National FLUID POWER Association®

ISBN 0-942220-28-5

Electrohydraulics at Work

Airframe Tester



The Problem

Recent advances in composite laminates for airframe construction have increased their strength and stiffness thereby allowing for direct attachment of critical high force components such as engines. But these new composite materials must be proved by realistic lab tests long before pilots take the planes into the air for final proofs. Thousands of hours of ground-based testing and observation for cracking, delamination, adhesive-joint or fastener failure must be performed.

Its Solution

One aircraft maker attacked the problem by creating a testbed, with 72 force-applying electrohydraulic actuators placed strategically around the actual airframe. (The illustration is conceptual only.) Every force and deflection is monitored so that the effect of a force at point *A* is known at points *A* through *Z* and beyond.

Orchestrating the complex stress and strain is the job of the host computer and its sophisticated software programs. However, not even a computer can monitor and control the myriad of complex motions and forces created by 72 powerful actuators in real time. Therefore, separate microprocessor controls are distributed throughout the system, integrated into the electrohydraulic devices themselves. Each microprocessor has the capability to monitor and control the local actuators, and to report back to the host computer. Over a thousand sensors and a myriad of electrohydraulic valves and actuators dot the testbed. A special data acquisition system ties them all together.

The result: Creation of a harsh dynamic environment for the plane prototype under test, with accompanying intelligence, strength and speed to discover in weeks or months what would have taken years of actual flying to achieve.*

During actual testing, each actuator is called upon to move into position, apply force, stabilize, allow readings to be taken, and then repeat the process for various levels and duration of force. The testing duplicates, as much as possible, the expected forces generated during sustained flight.

Typically, forces from 1000 to 150,000 pounds are applied, and then increased and decreased at different rates, creating load changes of 10% to 20% of full force within time periods ranging from 3 to 300 seconds.

Force sensors on the cylinder rods give direct load information which is monitored by the host computer via the data acquisition system.

*Performing the hard work are electrohydraulic actuators with integral position and load sensors, powered by electrohydraulic servovalves and instructed by integral microprocessor controls. Each local actuator system is complex in itself, and will not be described here.

Related Applications

Similar technology is used in the destructive and non-destructive testing of automobiles, trucks and many other vehicles, giving long-range performance data on key components such as engines, suspensions, drive trains, structural members and body parts. Operating conditions are simulated over various types of terrain.

How Electronics Improved This Application

- Speed
- Accuracy
- Automation
- Adjustable sequence and timing
- Monitoring and diagnostics
- Standard components
- Upgradability

Components Used in Industrial Hydraulic Systems*

Accumulators
Controls (electronic) and Software
Cylinders
Filters
Fittings
Flanges
Fluids
Gauges
Heat Exchangers
Hose
Hydrostatic Drives
Manifolds
Motors
Power Units
Pumps
Pump Drives
Reservoirs
Rotary Actuators
Seals
Shaft Coupling
Shock Absorbers
Switches
Tubing
Valves

***Click here to access the NFPA Fluid Power Product Locator, which includes information about and links to NFPA member companies.**

From *Your Guide to the Electronic Control of Fluid Power*, a publication of the National Fluid Power Association.